Investigate Your Plate: A Five Day Agri-Science Curriculum

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Abstract

A team of 4-H youth development educators and state specialists at the University of Wisconsin - Extension organized a one-week, residential STEM summer camp titled "*Investigate Your Plate*" for

youth. The focus of the camp was to introduce students to the different aspects of the agricultural system and promote understanding of the connections among the system components. A mixed-methods design was used to evaluate the program. Two qualitative methods namely *group mapping* and *participant-observation* were used in addition to an end-of-session quantitative survey. On all five days of the camp, students drew their understanding of how the different components (plants, animals, humans, soils, water, technology and energy) worked as a system on the farm. The visual observation of changes in the maps from Day 1 to 5 showed a drastic improvement in students' understanding of systems concept. Student maps were quantitatively evaluated using an evaluation form, which revealed that the mean scores were significantly higher on Day 5 compared to Day 1 for all the student groups, validating the visual observations. Participant-observation results indicated a few areas for improvement, which were discussed with the camp educators, and this is likely to improve future camps.

Program Description

A team of 4-H youth development educators and state specialists from the University of Wisconsin- Extension collaborated with University of Wisconsin Pioneer Farm's research facility to organize a STEM summer camp for youth. This camp was conducted as a part of a larger USDA NIFA grant titled "*Production Agriculture Systems: Closing the Gap in Monitoring and On Farm Learning Opportunities*". The one-week, residential summer camp named "*Investigate Your Plate*" engaged 28 middle school aged youth from 11 counties in the state of Wisconsin. The focus of the camp was to introduce youth to the different aspects of the agricultural system and promote understanding of the connections among the system components. The anticipated outcomes from the program were for the students to:

1. Understand how the different components on a farm (plants, animals, humans, soils, water, technology and energy) worked together as a system

2. Gain basic knowledge and skills related to various aspects related to agriculture
3. Become aware of the various career options available in the field of agriculture
4. Improve leadership and team skills

The camp covered various topics within animal science, hydrology, soil science, plant science, technology and energy. The team used a variety of teaching and learning methods like brief lectures, discussions, small group hands-on activities, mapping exercises for students and various field visits. These included visits to swine, poultry and dairy facilities on the Pioneer Farm, horticulture gardens, food sections of grocery stores, sunflower fields and a Civil Engineering irrigation and drainage water laboratory. The teaching-learning process and each day's agenda were designed to provide experiential learning opportunities for students. The Evaluation Unit at the University of Wisconsin designed and implemented the camp evaluation.

Demographic profile of the students: The average age of the students was 12 years and about 75% of them were 6th and 7th graders. A majority of the students (54%) were female and lived on a farm or visited one at least once a month. Nearly one-quarter (*n*= 6) of students said this camp experience was their first time on a farm. Students were from a mix of rural and urban counties.

Research Base

The program design including the evaluation component was based on peer reviewed literature and tailored to fit the grant and project goals. A unique evaluation plan was created to maximize meaning and use. Agriculture and allied industries contribute about $789 billion to the country's Gross Domestic Product (4.7% share), with jobs from these industries constituting 9.3% of nation's total employment (Economic Research Service, USDA, 2015). Understanding the significance and realizing that an average American's agricultural and environmental awareness and literacy are low (Glassman, Elliot, & Knight, 2006; Cassell & Nelson, 2010), and acknowledging that people tend to solidify their perceptions at a young age (Holz-Clause & Jost, 1994), this one-week residential 4-H camp for middle

school students focused on increasing the understanding of the agriculture system and the various career opportunities. In addition, the camp aimed to increase environmental literacy given low

The teaching-learning process was designed on the basic 4-H educational philosophy of "learn by doing" (National 4-H History Preservation Program, 2016). Torock (2009) stated that Cooperative Extension System in all states and program areas educates clients predominantly through experience. Edgar Dale's Cone of Experience validates this educational philosophy, highlighting that people remember 90% of what they say and do [e.g.: doing a dramatic presentation, doing the real thing etc.] (Dale, 1969). Researchers have confirmed over time that both extension educators and learners reported experiential educational processes to be effective (Ford, 1995; Jayaratne & Martin, 2003; Kwaw-Mensah, 2008; Koundinya & Martin, 2011). The teaching-learning process of the camp was designed based on this educational philosophy.

A mixed methods (a combination of quantitative and qualitative) design was adopted to evaluate the program. There is an increasing agreement among evaluators and researchers that a mixed-methods design measures program outcomes in the most meaningful way. Mixed methods design provides a more comprehensive account than either method used alone, offers better explanation of the results and enhances the integrity of findings (Bryman, 2006 as cited by Tucker-Brown, 2012). Fetters (2016) stated that pioneer evaluation researchers identified and accelerated the use of combining quantitative and qualitative methods, which the modern day innovators explored further. Our experience with evaluating and offering 4-H extension educational programs tells us that most 4-H camp evaluations focus mostly on quantitative surveys with little efforts on innovative qualitative methods. Patton (2015) stated that understanding of the programs is enhanced when observant evaluators attend the programs and pay attention to all details and systematically document what they observe. Also, if program participants are engaged in innovative ways (like our *group mapping* exercise), program evaluation can be more valid and meaningful. This proposal presents two qualitative

methods 'group mapping' and 'participant-observation' that were used to evaluate the camp, and one of the outcomes measured by using these methods.

Program Evaluation

Two qualitative methods namely *group mapping* and *participant-observation* were used in addition to an end-of-session quantitative survey to evaluate the camp.

Group mapping:

An evaluation form with 11 evaluation criteria was developed to rate students on the mapping exercise (Appendix 1). The criteria were rated on a scale from "*0= Not at all…….10= Completely*". Students were divided into five cooperative learning groups, who drew their understanding of how the different components (plants, animals, humans, soils, water, technology and energy) worked together as a system on farm. Two half hour sessions were provided on all days of the camp towards this mapping exercise. Student groups used the same chart paper on all days of the camp and kept improving or changing the visual depiction of their understanding as the days progressed. In order to have a baseline of individual student levels, all students drew individual maps on the first morning of the camp before participating in the educational experience. One professional evaluator and the camp lead educator evaluated the group maps at the end of each day. To ensure inter rater reliability, Cohen's Kappa Coefficient was computed to the rating scores from the first day (Table 1).

Table 1. Inter Rater Reliability Scores from First Day of the Camp

	Value	Asymptotic Standardized Error	*Z*	*p*
Measure of Agreement	0.417	0.078	5.510	0.000*
No. of valid cases	55			

A positive Kappa value of 0.417 indicated that the two evaluators agreed more on the scores than can be expected by chance. However, this value can be considered only a "fair" strength of association, and should be treated as a matter of concern (Bakeman & Gottman, 1986 as cited by Catrambone, 2015). The evaluators compared their first day ratings and discussed where they differed, and agreed upon criteria they would use to rate the maps from the remaining four days. Students were also involved in the evaluation process on Day 5 of the camp. This participatory approach gave them a clear understanding of what their learning was a result of this educational experience.

The visual observation of changes in the maps from Day 1 to 5 showed a drastic improvement in students' understanding of systems concepts (Fig 1). ANOVA analysis indicated that the mean scores were significantly higher at 0.01 level of significance on Day 5 compared to Day 1 for all the student groups, validating the visual observations.

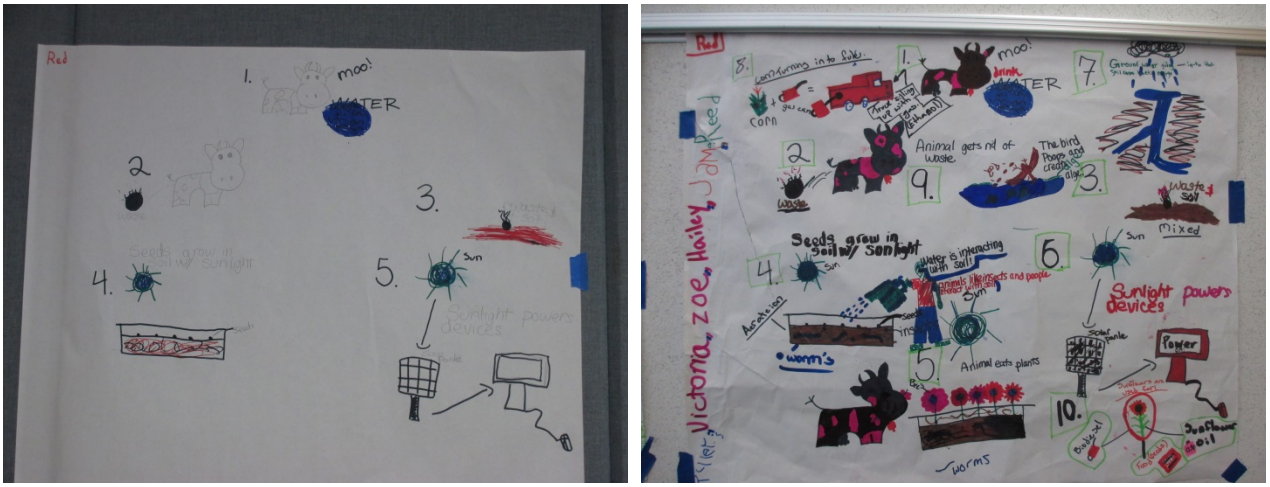

Fig 1. Visual depiction of improvement from Day 1 to 5 by one of the cooperative learning student groups in understanding how different components work as a system on the farm

Table 2. Improvement in Map Scores from Day 1 To 5 of the Camp

Cooperative learning student group	Difference in mean scores	*p*
Orange	+6.30	p=.000**
Blue	+4.65	p=.000**
Green	+4.50	p=.000**

Red	+4.11	p=.001**
Yellow	+3.65	p=.006**

Participant-observation:

One of the project evaluators actively participated and observed the entire camp experience, which included group presentations by students on Day 5 of the camp. The team developed a structured observation guide (Appendix 2) which allowed for focused and systematic observation of the camp. Observation results indicated that student engagement in learning was good, and that students were forming new connections. It was also observed that the staff members were friendly with students and the entire atmosphere was conducive for learning. Enough opportunities and time were provided to reflect on what was being offered through the various teaching sessions, which is an essential component of the experiential learning cycle. The educators engaged students in question-answer sessions that furthered the reflection process. However, it was observed that time management during certain site visits was not very efficient. All the observation results were shared with the team.

Targeted Outcomes for Participants

The anticipated outcomes for the participants of this program seminar session are:

1. Participants will develop better understanding of group mapping and participant-observation evaluation methods.
2. Participants will understand the importance of combining qualitative evaluation methods with quantitative methods.

Instructional Techniques

The presenters will deliver a brief lecture using PowerPoint as a teaching tool. After the brief lecture, the evaluation form (Appendix 1) used for group mapping and the observation guide (Appendix 2) utilized in participant-observation will be shared with the team. Participants can adapt these forms in

their program evaluations. Also, the students' group and individual maps will be displayed via PowerPoint so the participants can clearly see the improvement in students' understanding of how different components on the farm work together as a system, which was the primary anticipated program outcome. Digital copies of students' maps will be shared with interested participants. Adequate discussion and Question-Answer time will be included throughout the seminar to make it interactive.

Program Replication Requirements

There are some costs associated with buying supplies (charts, marker pens, pencils, tapes, pins etc.) for the mapping exercise. If participants are not familiar with qualitative methods, training on qualitative data collection and analysis will be required.

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Appendix 1

Group Mapping Evaluation Form

Question/Evaluation Criterion	Scale (0 – Not at all … 10 – Completely)	Reasons for the score
Do the maps show how rainfall might relate to crop output?		
Do the maps show how water interacts with soil?		
Do the maps show how different components on a farm work together as a system?		
Do the maps show sunlight as a major component in the health of plants?		
Do the maps contain different types of plants?		
How do humans impact the farming research that takes place on the farm?		
Do the maps reflect changes in season of the year on the farm? How so?		
Do the maps show different types of animals and reflect animals that we have discussed in the camp?		
Do the maps show products produced by the farm that can be used by humans or other animals?		
Do the maps show how technology might be used on a farm?		
Do the maps show surface water and groundwater?		

Appendix 2

Observation Guide

Observation Prompts	Actions You See or Comments You Hear
1) Engagement/Delivery a. How are students engaging in the activities? b. What is their body language?	
2) Learning a. Are students expressing what they are learning? b. Is the environment conducive to learning?	
3) New connections a. Are students forming new connections? Why? How? b. Are the interactions positive or negative? Why or why not?	
4) Staff friendliness & circulation a. Staff use a warm tone of voice and respectful language with students b. When students approach, staff are attentive and responsive c. Staff interact one-on-one at least once with every student during each activity	
5) Emotional safety a. Staff show respect to all students and insist that students show mutual respect to each other b. Staff address any incidents in which student(s) are made fun of or where there are misunderstandings	
6) High expectations & good challenge a. All students are encouraged to try out new(er) skills b. Staff provide intentional opportunities for development of new(er) skills c. Students seem challenged (in a good way) by the activities	
7) Active, cooperative and experiential learning a. Activities include both hands-on and cognitive processes (problem-solving, practicing skills, manipulation of ideas, creatively expressing ideas and building with materials exercises)	
8) Planning and Reflection a. Students have multiple opportunities to make individual or group plans for projects and activities	
Other observations a. Anything stand out from a positive or negative perspective? b. Any other observations?	

University of Wisconsin-Extension

4-H STEM SUMMER CAMP EVALUATION

Please take a few minutes to complete this survey. This will help us improve future 4-H summer camps and help us talk about the camp with other people. *Please be honest as you respond and don't tell us what you think we want to hear, but what you truly feel.* We do not ask for your name, and your responses will be combined with all the other responses when we take a look at the data. If you feel uncomfortable with any questions, you do not have to answer them. **Please ask an adult if you have any questions about how to complete the survey or are unclear what certain questions are asking.** Thank you!

1. **What are the two most interesting things you learned from this summer camp?**

   1. _____
   2. _____

2. **How would you describe this one-- week summer camp to your close friend?**

   _____

   _____

3. **Did the camp make you more interested in any careers/jobs related to agriculture or science?** ☐ **Yes** ☐ **No**

   If you answered "yes" to Question 3, please explain. What career/job interests you and why? _____

   _____

4. **Was the camp too long, too short, or just right?** ☐ **Too long** ☐ **Too short** ☐ **Just right**

5. **Was the camp too easy, too hard, or just right?** ☐ **Too easy** ☐ **Too hard** ☐ **Just right**

6. **Did the camp have too many hands-on experiences, not enough, or just the right amount?** ☐ **Too many** ☐ **Not enough** ☐ **Just the right amount**

For Questions 7-- 8, please read each statement and then think about how you would answer based on how you feel now that you've completed the camp, and also think back to how you would rate yourself a week ago (before starting this camp). Then for each statement, check one box for your "now / after the camp" rating in the left column and another box for your "before the camp" rating in the right column.

How to choose a number for Question 7:

Now / After the camp					Before the camp				
1 = No idea	2 = Sounds a little familiar	3 = Heard of it but don't really understand it	4 = I have a basic understanding of this	5 = Yes, I know a lot about this!	1 = No idea	2 = Sounds a little familiar	3 = Heard of it but didn't really understand it	4 = I had a basic understanding of this	5 = Yes, I knew a lot about this!

7. How would you rate yourself, both now/after camp (left column) and thinking back to before camp (right column)?

Now / After the camp					STATEMENT	Before the camp				
1	2	3	4	5		1	2	3	4	5
					Know how sunlight can affect plants					
					Understand how the three soil types allow water to flow through soil					
					Understand how soil type can impact plant growth					
					Understand how plants look at different growth stages					
					Understand how rainfall can increase soil erosion					
					Understand how water can affect plants and how they grow					
					Understand that producing animals and plants for food costs money					

Now / After the camp					STATEMENT	Before the camp				
1	2	3	4	5		1	2	3	4	5
					Know at what depth groundwater is located					
					Understand the risks of chemicals in water to animals, plants and people					
					Understand how animals, plants, soils, water and people work as a system					
					Understand how technology used on the farm affects the health/well-- being of animals					
					Understand the various foods that production animals can eat (depending on their digestive system)					
					Understand what products animals produce that are used by humans					

These next tables are more related to your abilities or skills than your knowledge or understanding. How to choose a number for Question 8:

Now / After the camp					Before the camp				
1 = No idea	2 = Sounds a little familiar	3 = Heard of it but can't really do it	4 = I am basically able to do this	5 = Yes, I can definitely do this!	1 = No idea	2 = Sounds a little familiar	3 = Heard of it but couldn't really do it	4 = I was basically able to do this	5 = Yes, I could definitely do this!

8. How would you rate yourself, both now/after camp (left column) and thinking back to before camp (right column)?

Now / After the camp					STATEMENT	Before the camp				
1	2	3	4	5		1	2	3	4	5
					Identify common plants used in agricultural food production					
					Identify the process of creating food and/or feed					
					Identify the three basic soil types					
					Identify major chemicals that pollute groundwater in agriculture					
					Develop ideas on how to minimize impact of agricultural practices on groundwater resources					
					Identify how technology is used at Pioneer Farm					
					Identify various steps in developing a hypothesis					
					Explain how farm animals' digestive systems differ					

Now / After the camp					STATEMENT	Before the camp				
1	2	3	4	5		1	2	3	4	5
					Create and test a hypothesis (identify what you want to know and then test it)					
					Use technology to make observations about the environment					
					Record observations					
					Draw conclusions from data					
					Communicate conclusions with others					
					Confidently speak in front of groups					
					Explain my decisions to others					
					Work well with other youth					
					Treat everyone fairly and equally when I am part of a group					

9. Are the following statements true for you? Please mark YES, SOMEWHAT, or NO for each.

	Yes	Somewhat	No
I felt safe at camp.	☐	☐	☐
I could talk to camp educators and chaperones about issues affecting me.	☐	☐	☐
Camp educators and chaperones were helpful when needed.	☐	☐	☐
I felt okay being away from home for more than one night.	☐	☐	☐
I felt comfortable meeting new friends.	☐	☐	☐
I felt accepted by others.	☐	☐	☐
I learned from other campers.	☐	☐	☐
I enjoyed learning about people who are different from me.	☐	☐	☐
Camp helped me to see the world beyond my hometown.	☐	☐	☐
I like science, technology, engineering **or** math more now that I did this camp.	☐	☐	☐

10. What, if anything, would you like to learn more about now that you've completed this summer camp?

_____

11. How could we have made the camp better for you personally?

_____

12. Information about you:

a. ***What grade are you in?*** **_____**

b. ***How old are you?*** **_____**

c. ***What is your gender?*** **_____**

d. ***Do you live on a farm or visit one at least once a month?***

☐Yes ☐No

e. ***Was this camp your first time on a farm?*** **☐Yes ☐No**

Comment box:

Thank you for your participation!

INVESTIGATE YOUR PLATE

Animal Science Life Stages

Activity Plan

Project Skills:
Youth will be able to identify ages/stages of production animals

Youth will increase knowledge in differentiating animal feeds and types of digestive systems

Youth identify the relationships between animals, plants, soil, human use and technology "Mapping"

Life Skills:
Problem-solving, communication, critical thinking, cooperating, decision-making

Academic Standard:
Ag, Food & Natural Resources (ANFR):
AS8.b.1.m Identify optimal environmental conditions for animals
AS7.a.2.m Students will select animal facilities and equipment that provide for the safe and efficient production, housing and handling of animals.

Grade Levels:
5-8

Time:
2 hours

BACKGROUND

How do animals differ in their growth stages? The American population is further removed from the farm with each passing generation. This activity will help students identify stages of animals, their feed and housing requirements, and how long it takes for animals to mature.

WHAT TO DO

Break students into small groups of five to seven students and set up rotational stations at various locations at the workshop site. For example:

Station 1 - dairy barn and milking parlor
Station 2 - poultry (live birds in cages)
Station 3 - commodity shed (matching plants-feeds-animals)
Station 4 - beef (trail mix activity to simulate rations)
Station 5 - swine (observe pigs if possible)

Use PowerPoint handout as basis of discussion.

Supplies Needed:
Stations (enough room to have posters or live animals) – Can use AnimalPedia boards – from UW-Extension

Worksheet for Commodity Shed Station (Matching)

PPT for Swine Station
Swine Term Puzzle

Do Ahead:
Create stations and secure speakers for each station

Sources:
Lesson arranged by: Lori Berget, 4-H Youth Development Educator, UW-Extension Lafayette County

The_Life_Cycle_of_a_Pig.ppt, Sonoma Valley High School

Feed Matching Worksheet, Deb Ivey, 4-H Youth Development Educator, UW-Extension Iowa County

AnimalPedia [tri-fold] Ag Literacy Match Game Boards, Bonnie Borden, Dodge County UW-Extension Youth and Livestock Educator

Photo: Investigate Your Plate campers

Students will learn similar information at each station (for each of the animal species listed above).

1. Life cycle of the animal (observe photo board or real animals) and discuss length of time to get there, feed requirements at each stage and housing requirements at each stage.

2. Digestive tract of the various species and how that affects their diets.

3. At the commodity shed station, students will have a matching worksheet with plants, feeds and animals. They will need to match the correct feed with the plant it comes from, and match the feed to the correct type of digestive system and animal.

TALK IT OVER

Reflect:

- *How does the age of the animal affect the type/amount of feed it consumes?*
- *Housing requirements for each species – where does the waste go?*
- *How is it incorporated back into the soil to produce more crops for feed?*
- *What is the major difference in digestive tracts?*

Apply:

At the completion of the station rotations, use the mapping activity to observe how students understand life stages, feed and housing requirements and what common plants are grown to be used for animal feeds.

ENHANCE/SIMPLIFY

Enhance:

Each student creates a journal at each station identifying the major differences in life stages, feeds and housing requirements.

Simplify:

Have a set of worksheets for students to use at each station and fill in the blanks for the exact information that they should know.

INVESTIGATE YOUR PLATE

We All Share The Same Resources

Activity Plan

Project Skills:
Youth will increase understanding of the interconnectedness of soil, animals, plants and human use.

Youth will identify the importance of natural resources to production agriculture and our food supply.

Life Skills:
Problem-solving, communication, critical thinking, cooperating, decision-making

Academic Standard:
Ag, Food & Natural Resources (ANFR):
AS8.a.1.e Identify how the food and fiber system uses natural resources.

Grade Levels:
5-8

Time:
30 minutes

Supplies Needed:
2 large apples (softer apples work better)
paring knife (or heavy plastic knife)
brown and blue construction paper

The Global Apple Activity, YouTube video

BACKGROUND

One of the most important natural resources that covers much of the earth's land surface is soil. All living things depend on it as a source of food, either directly or indirectly. Our food producing land remains the same and yet the world population continues to grow. Consequently, each person's food portion becomes smaller and smaller. It is the responsibility of each generation to use the soil wisely to insure the future.

Using *The Global Apple Activity* worksheet, students are able to visualize the amount of land that is able to be used for production agriculture.

WHAT TO DO

ACTIVITY: How Do Plants Affect Our Lives?

As an introduction to the importance of sharing resources in our lives, have students view the video presentation of The Global Apple Activity www.youtube.com/watch?v=_J9cg7dxD5E

At the conclusion of the video, instruct the students that they will be working in pairs or small groups of 3-4 creating a "model" of the earth's crust, which is used in production agriculture. After each step, have a different student complete the next step.

Procedure:

1. Cut the apple into four equal parts. Three parts represent the oceans of the world. The fourth part represents the land area. Place the three "ocean" parts on paper and the one "land" part on brown paper.
2. Cut the land section in half lengthwise. Now you have two ⅛ pieces.
3. Ask students, can we (man) live anywhere on land on the earth's

3 large posters to hang around room labeled: natural resources, non-renewable natural resources and synthetic resources

Do Ahead:
Gather supplies

Download YouTube video

Sources:
Created by Lori Berget, 4-H Youth Development Educator, UW-Extension Lafayette County

The Global Apple Activity
youtube.com/watch?v=_J9cg7dxD5E

The Global Apple Activity Worksheet, Indiana University-Purdue University Indianapolis
www.iupui.edu

Photo: Investigate Your Plate campers

surface? Is there anywhere that just wouldn't be suitable for us to build a house and live?

4. Explain that one section represents land—deserts, swamps, Antarctic, Arctic, and mountain regions where man cannot live. The other ⅛ section represents land where man can live but may not grow food.
5. Slice this ⅛ section crosswise into four equal parts. Now you have four thirty-second pieces.
6. Ask students, can we grow crops for food or graze cows for meat and milk here around our school? In your neighborhood?
7. Explain that three of these one thirty-second sections represent the areas of the world which are too rocky, too wet, too hot, or where soils are too poor for production, as well as areas developed by man. Only one section is suitable for production.
8. Carefully peel the last thirty-second section. Explain that soil is only on the very top layer of the earth's surface so this small bit of peeling represents the soil of our earth on which mankind depends for food production! Take the other whole apple and put the small peel next to it so students can see the very small part of the earth where soils are suitable for food production.

After the activity, have three signs posted around the room: Natural Resources, Non-Renewable Natural Resources and Synthetic Resources. Show a photo on the projector screen of a resource and have students go to the sign that depicts that photo. At the end, discuss each resource. Examples: leather belt, corn, sun, water, soil, Styrofoam cup, paper.

TALK IT OVER

Reflect:
Discuss the fact that the world's population continues to grow so it is even more important that we take good care of the land we have!

Apply:
Discuss the difference between preservation-conservation-exploitation.
How does sharing natural resources impact production agriculture?

What requirements do animals have of our natural resources (in production agriculture)? Shelter, clean water, waste removal, feed. Complete a marketing circle to demonstrate.

ENHANCE/SIMPLIFY

Enhance:
Have students complete a marketing circle to demonstrate steps in processing animal commodities from raw products to the table.

Simplify:
Do as a large group demonstration while students watch – and discuss each step in depth.

INVESTIGATE YOUR PLATE

Digital Observation Technology Skills (DOTS)

Activity Plan

Project Skills:
Youth will experience and identify various aspects of nature through technology.

Youth will learn and understand tools of technology used to uncover nature's mysteries.

Youth will identify differences in the microclimates of their surroundings.

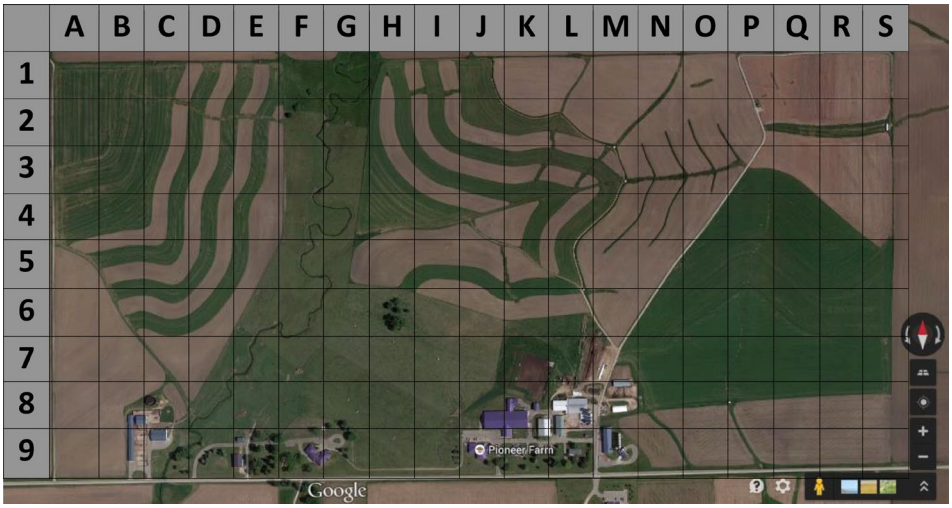
Youth will explore adaptations of flora and fauna in various locations.

Life Skills:
Problem-solving, communication, critical thinking, cooperation, decision-making

Academic Standard:
Decision-making
WI Academic Standards:
Science F.4. Life And Environmental Science

Grade Levels:
5-8

Time:
30 minutes for intro presentation
2 hours for exploration rotations
15 minutes for debrief



BACKGROUND

The Digital Observation Technology Skills (DOTS) program is an innovative Science, Technology, Engineering and Mathematics (STEM) program designed to incorporate mobile digital technologies into experiential environmental education. The program was created to be utilized by learners of all ages to help bridge the gap between technology and their environment. Participants, young and old, are encouraged to make enhanced observations about their surroundings through a unique technological lens, utilizing modern mobile technology tools to connect to the outdoors in new and exciting ways. The inquiry-based curriculum navigates the basics of the scientific method and focuses on the importance of good scientific communication and sharing discoveries with others.

WHAT TO DO

INTRODUCTION: Digital Observation Technology Skills

As an introduction to the importance of making scientific observations, present the introductory DOTS PowerPoint to youth. Participants will be exposed to the tools within the DOTS kit and start to think about questions they have about their surroundings and how the tools within the kit can help answer some of those questions.

ACTIVITY: Investigate Outside

***NOTE**: The activity below will require four separate stations which participants will rotate through for 30 minutes a piece*

After the introductory presentation, ask youth what types of observations they would like to make outside with the tools and how the tools may help make enhanced observations.

Supplies Needed:
3 DOTS kits–tools separated per station

Introductory DOTS PowerPoint, contact Justin.Hougham@ces.uwex.edu for more information

4 investigation stations: 2 to explore living organisms, 2 to explore non-living organisms

1 workbook per participant

Do Ahead:
Ensure all kit components are charged and ready for use

Identify sites to be used for exploration

Prepare observation workbooks

Sources:
Created by Dr. Justin Hougham, State Specialist-Environmental Education, Director – Upham Woods Outdoor Learning Center

UW-Extension – Environmental Education website : fyi.uwex.edu/environmental education/programs/technology-programs/

Hand out workbooks that direct youth to think about the differences between living and non-living organisms through a microscopic perspective, as well as through a thermal perspective. The workbooks can be found following this lesson plan.

Split youth into groups of four to five people. Inform them that they will be staying in these groups for the duration of the activities and they will need to work together as a group to make their observations.

Instruct groups to rotate between all four stations. The stations will focus on making observations in the following areas:

- 1 thermal investigation of living organisms (using the thermal imager and infrared thermometer) – observed cows and their habitat
- 1 thermal investigation of non-living organisms (using the thermal imager and infrared thermometer) – observed compost piles
- 1 microscopic investigation of living organisms (using the wireless microscope and iPad) – observed corn stalks/husks
- 1 microscopic investigation of non-living organisms (using the wireless microscope and iPad) – observed buildings and construction materials

NOTE: The locations for these stations should be pre-determined and strategically chosen for their suitability. One adult should be stationed at each location with the tools ready.

Instruct youth to fill out their workbooks to ensure they remember the data they collected at each station

At the conclusion of the activity, have youth share their observations with the entire group. Use the data the groups share, the information on the observation workbooks and the reflection questions below to start a discussion about the activity.

Finally, have all participants complete a workshop survey. The survey can be found after this lesson plan.

TALK IT OVER

Reflect:

- *What differences did you notice between living and non-living organisms?*
- *Which had a larger temperature difference, living or non-living organisms?*
- *Were there any patterns you noticed throughout your observations?*
- *How can the DOTS tools help us see things we wouldn't otherwise be able to see?*
- *Which tools did you use for each observation?*
- *How did this activity impact how you may view the world around you in the future?*

Apply:

- *What did you learn about making observations and the scientific method?*
- *What was the strangest thing you observed? Why do you think that happened?*
- *What new questions do you have about any organism you observed?*
- *What did you learn in this experiment that will be able to use at school?*
- *At home?*
- *How do living organisms adapt to their surroundings?*
- *How does changing the environment affect living things? Non-living things? Where have you observed this?*
- *What are some other situations where you will need to use skills in making critical scientific observations?*

ENHANCE/SIMPLIFY

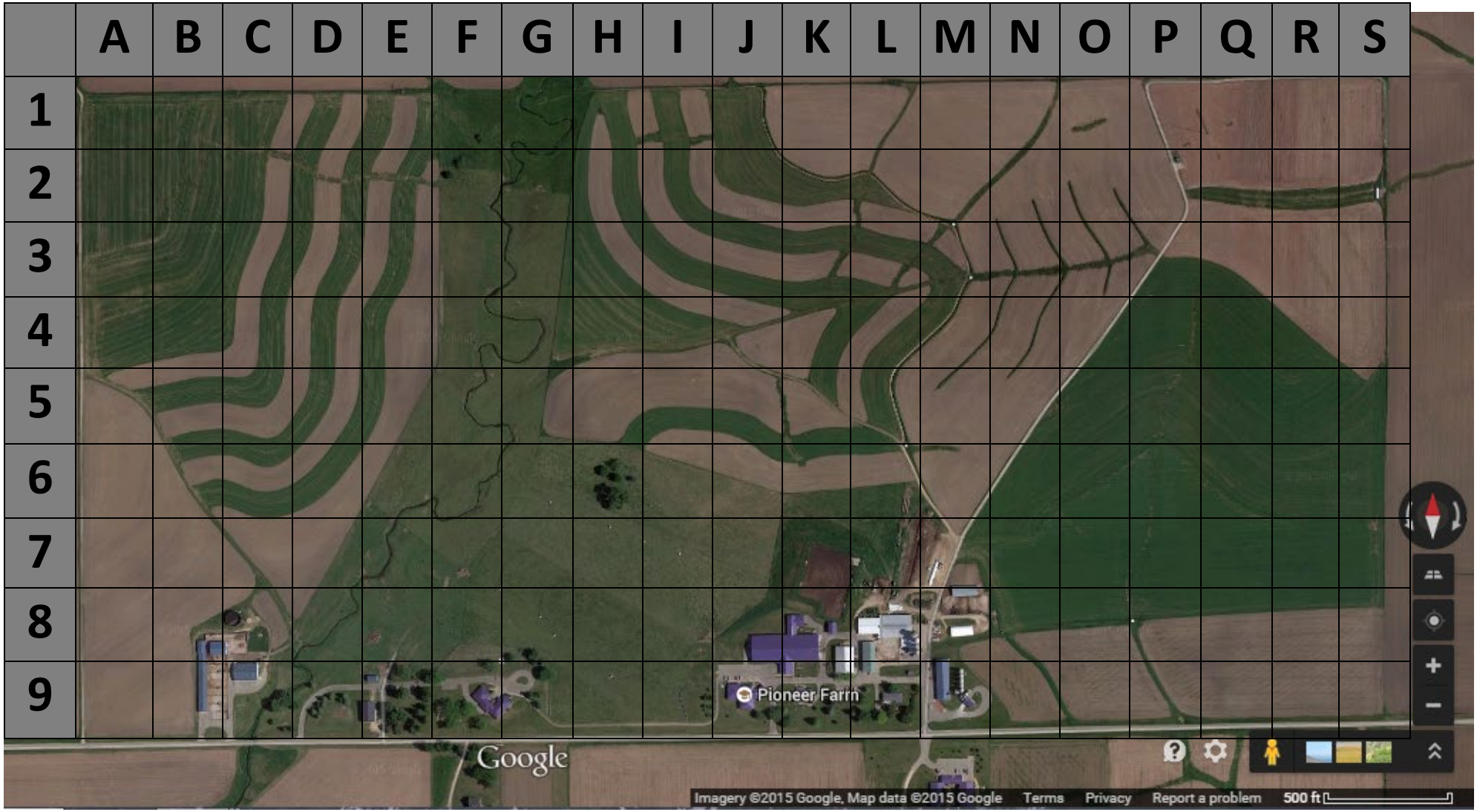
Enhance:

- Extend the number of sites explored.
- Extend the number of days to explore
- Use more of the tools in the DOTS kit and expand the scope of exploration.
- Have students maintain a workbook of observations over a lengthier period of time.
- Make drawings/sketches of their observations

Simplify:

- Lessen the amount of sites.
- Use more tools at less sites to increase intensity, but decrease variability.

Investigate Your Plate with UW-Platteville at Pioneer Farm



Date_____ Group Name_____ Box #_____

Investigate Your Plate!

- Use the map to come up with three distinctive spots that you want to investigate.

- Record the waypoints according to the provided grid. Use more description if necessary.

- Form a hypothesis about each spot for each of the roles and record on the back.

- Fill in the blanks with the information that you have gathered.

Team Member	Waypoint 1 Location _____ Time _____		Waypoint 2 Location _____ Time _____		Waypoint 3 Location _____ Time _____	
Meteorologist	Wind: Temp: Humidity:		Wind: Temp: Humidity:		Wind: Temp: Humidity:	
Thermal Imager Biotic and Abiotic examples	Hottest	Coldest	Hottest	Coldest	Hottest	Coldest
Thermal Investigator Biotic and Abiotic examples	Hottest	Coldest	Hottest	Coldest	Hottest	Coldest
Microbiologist	Object: Adaptation:		Object: Adaptation:		Object: Adaptation:	
Navigator Record the precise location of your observations.	Latitude: Longitude:		Latitude: Longitude:		Latitude: Longitude:	
Media Specialist	Photo of? Video of?		Photo of? Video of?		Photo of? Video of?	

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Date_____ Group Name_____ Box #_____

Hypothesis	Waypoint 1 Coordinate _____	Waypoint 2 Coordinate _____	Waypoint 3 Coordinate _____
Meteorologist Hand-held weather station - Kestrel			
Thermal Imager Infrared thermometer with view screen			
Thermal Investigator Surface temperature gauge			
Microbiologist Mobile microscope that connects to an Ipad			
Navigator What is unique about this spot? – GPS			
Media Specialist What is unique about this spot? – Camera/video camera			

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Appendix 2

Group Mapping Evaluation Form

Question/Evaluation Criterion	Scale (0 – Not at all … 10 – Completely)	Reasons for the score
Do the maps show how rainfall might relate to crop output?		
Do the maps show how water interacts with soil?		
Do the maps show how different components on a farm work together as a system?		
Do the maps show sunlight as a major component in the health of plants?		
Do the maps contain different types of plants?		
How do humans impact the farming research that takes place on the farm?		
Do the maps reflect changes in season of the year on the farm? How so?		
Do the maps show different types of animals and reflect animals that we have discussed in the camp?		
Do the maps show products produced by the farm that can be used by humans or other animals?		
Do the maps show how technology might be used on a farm?		
Do the maps show surface water and groundwater?		

Appendix 3

Observation Guide

Observation Prompts	Actions You See or Comments You Hear
Engagement/Delivery How are students engaging in the activities? What is their body language?	
Learning Are students expressing what they are learning? Is the environment conducive to learning?	
New connections Are students forming new connections? Why? How? Are the interactions positive or negative? Why or why not?	
Staff friendliness and circulation Staff use a warm tone of voice and respectful language with students When students approach, staff are attentive and responsive Staff interact one-on-one at least once with every student during each activity	
Emotional safety Staff show respect to all students and insist that students show mutual respect to each other Staff address any incidents in which student(s) are made fun of or where there are misunderstandings	
High expectations and good challenge All students are encouraged to try out new(er) skills Staff provide intentional opportunities for development of new(er) skills Students seem challenged (in a good way) by the activities	
Active, cooperative and experiential learning Activities include both hands-on and cognitive processes (problem-solving, practicing skills, manipulation of ideas, creatively expressing ideas and building with materials exercises)	
Planning and reflection Students have multiple opportunities to make individual or group plans for projects and activities	
Other observations Anything stand out from a positive or negative perspective? Any other observations?	

Why we chose each particular evaluation method

The focus of the residential youth camp was to introduce students to the different aspects of the agricultural system and promote understanding of the connections among the system components. The anticipated outcomes from the program were for the students to (1) understand how the different components on a farm (plants, animals, humans, soils, water, technology and energy) worked together as a system; (2) gain basic knowledge and skills related to various aspects related to agriculture; (3) become aware of the various career options available in the field of agriculture; and (4) improve leadership and team skills. Since the outcome related to *understanding system concept* can be better evaluated using qualitative methods in addition to the end-of-camp quantitative survey, a mixed-methods design was used to evaluate the program.

Two qualitative methods namely *group mapping* and *participant-observation* were used in addition to an end-of-session quantitative survey. Group mapping method was used to measure the *system understanding* of students, whereas participant-observation was primarily used to assess how the various activities were organized at the camp and how students and instructors were engaging in the learning experience. The Evaluation Unit of the Environmental Resources Center at the University of Wisconsin-Extension designed and implemented the camp evaluation.

How we implemented that method

The evaluation plan was developed in consultation with the team that consisted of 4-H Youth Development educators and state specialists. The questions for the surveys (Appendix 1) and the evaluation form for scoring the student group maps (Appendix 2) were developed in a similar way. Two evaluators developed a structured observation guide (Appendix 3) to standardize the observation process.

For the group mapping exercise, an evaluation form with 11 evaluation criteria was developed to rate students. The criteria were rated on a scale from "*0=Not at all...10=Completely*". Students were divided into five cooperative learning groups, who drew their understanding of how the different components (plants, animals, humans, soils, water, technology and energy) worked together as a system on farm. Two half-hour sessions were provided on all days of the camp towards this mapping exercise. Student groups used the same chart paper on all days of the camp and kept improving or changing the visual depiction of their understanding as the days progressed. In order to have a baseline of individual student levels, all students drew individual maps on the first morning of the camp before participating in the educational experience. One professional evaluator and the camp lead educator evaluated the group maps at the end of each day.

One of the project evaluators actively participated and observed the entire camp experience, which also included group presentations by students on Day 5 of the camp. The team developed a structured observation guide which allowed for focused and systematic observation of the camp. Additionally, an end-of-camp evaluation survey was administered after the last

activity of the camp on Day 5. Along with other variables associated with stated anticipated outcomes from the camp, students' self-assessed knowledge and skill levels on the concepts taught in the camp were measured using a retrospective post-then-pre format.

The evaluation methods used in the camp will be shared with the Extension and evaluation community through a peer-reviewed journal publication and by presenting at various venues.

Any reflections/lessons learned that we'd suggest to someone who would want to replicate this

The group mapping evaluation method used for this evaluation is specific to this project and educators need to consider their program objectives before adopting this method. This method suited these learners who were middle school students very enthusiastic to participate in this fun activity. This method may need to be sufficiently tweaked when working with adults. Similarly, the observation guide has to be adapted to include the prompts that suit program goals. Further, if educators are not familiar with qualitative methods, training on qualitative data collection and analysis will be required.

APPENDIX A: SCAVENGER HUNT

INVESTIGATE YOUR PLATE

A. WEED (Copy this page for each weed that will be reviewed.)

You are assigned this weed_____

Draw a picture of the weed

What are some characteristics of the weed? (color, shape, size, smell, texture, etc,)

What is the scientific name of this weed?

Why is this weed a problem for agricultural producers?

How can this weed be removed?

RESOURCES:
http://weeds.cropsci.illinois.edu/weedid.htm
http://www.garden.org/weedlibrary/
http://www.weedid.wisc.edu/

B. CORN FIELD/STALKS

Measure the heights of a corn stalk _____

Draw a corn stalk here:

How far is it from the soil to the leaves?_____

How many leaves does a corn stalk have?_____

How far apart are the corn plants?_____

How far apart are the rows of corn?_____

Why are the corn rows this far apart?

How many ears are on a corn stalk?_____

How many kernels of corn on each ear of corn?_____

Why is it important that corn, soybeans, sunflowers, etc. are renewable and biodegradable?

C. MACHINERY

What machine plants corn and soybeans?

What machine harvests corn and soybeans?

How far apart are the planter discs? _____

Is this the same or different distance than the distance between rows of corn?

How tall are the tires on the tractor?

Imagine someone is sitting inside the tractor. Where do you need to be standing in order for the driver to see you? (Sketch below or include measurements.)

D. FENCE AND PALLET GARDENS

Farms are measured in acres. An acre is 208.7 feet by 208.7 feet or 43,556 square feet.

Measure the spaces marked on the map on the back of this page and described below.

Space # 1: Length of the white fence from the apple trees to the angle_____

Distance from the fence to the line of light poles_____

Multiple these two distances to get the square feet. Is this space more or less than an acre?

Space # 2:

Length of the white fence near the parking lot to the apple trees_____

Distance from the blacktop from the front of the apple trees to the first corner:_____

Multiple these two distances to get the square feet. Is this space more or less than an acre?

Record the following information about plants growing in the Pallet Garden

Name of two plants:

Color

Stage in the plant life cycle—draw what you see

How are the plants getting water?

Where is the soil?

Who could use pallet gardens? Why?

GROUP EXTRA CREDIT:

Names of at least FIVE different trees that you see

1.

2.

3.

4.

5.

INVESTIGATE YOUR PLATE

Crops Scavenger Hunt

Activity Plan

Project Skills:
Identify the relationships between water, plants, animals, technology soil and people.

Understand how farm crops are impacted by sun, water, technology, soil, nutrients, weeds and people.

Communicate with group members throughout the scavenger hunt.

Life Skills:
Problem-solving, communication, critical thinking, cooperation, decision-making

Academic Standard:
PS3.c.4.m: Identify major local weeds
PS3.d.2.m: Describe sustainable agricultural practices
PST1.m.6.m: Measure and calculate fencing material

Grade Levels:
5-8

Time:
2 hours

Supplies Needed:
APPENDIX A: Scavenger Hunt

Measuring devices

BACKGROUND

Explain that today they are going to participate in a scavenger hunt to explore how various things impact the production of crops on a farm. They will learn about the equipment to produce and/or harvest corn, gauge the size of an acre, identify weeds and how to control them, learn about pallet gardens and get up close and personal with a stalk of corn.

A crop is a plant grown for harvest. Crops help the farmer generate income. Weeds are plants that grow in the field that were not intentionally planted. Weeds reduce crop productivity and the financial success of a farm. Weeds reduce crop productivity by competing for nutrients, light and water and have other negative impacts on the farm.

WHAT TO DO

ACTIVITY: Plants and Crops Scavenger Hunt

Break students into small groups of five to seven youth. Prepare stations at various locations based on weeds, corn, equipment, pallet gardens (or other sustainable option) and "an acre."

At each station, youth will complete the activities on the scavenger hunt guide (Appendix A.) Have sufficient supplies and pages at each station for all youth to be actively involved, i.e., 10 weeds at a station, then each youth will draw and analyze each weed. The most complete description could be used in the weed book. For the measuring activities, supply enough tools for all youth to assist in measuring.

Discuss the observation skills they need to use during rotations. Study the "mystery" weed (looking at details, noticing size/shape/color, leaf structure). Remind them to carefully observe and complete assignments and use their senses (touch, smell, sound, sight but not taste).

corn field and/or plants

weed garden or plants

corn planting and/or harvesting equipment

pallet gardens

Do Ahead:
Prepare Scavenger Hunt locations and answer key

Prepare matching worksheets using common plants/feeds found in the area.

Sources:
http://4h.unl.edu/4hcurriculum/crops

Photo: Investigate Your Plate campers

When each group has completed the hunt, gather for a follow-up discussion and processing. Prizes might be given for specific completed tasks. Completed weed pages might be compiled into a weed booklet.

TALK IT OVER

Reflect:

Weeds

- *Why are weeds a problem for agricultural producers?*
- *How do/might farmers make decisions about weed control?*
- *What do farmers need to know to make good decisions on their farm?*

Pallet Gardening

- *What might be some limitations of a pallet garden?*
- *How do plants in a pallet garden get water?*
- *Who might use pallet gardens for planting?*
- *What makes pallet gardens an appropriate option for some people?*

Why is it important that corn, soybeans, sunflowers, etc. are renewable and biodegradable?

Equipment

- *What is the relationship between the size of a farm, the size of machinery and the crops produced?*
- *What are safety considerations when operating farm machinery?*
- *What equipment would a farmer growing a large crop use to plant several hundred acres (tractors, plows, combines, tillers, sprayers, reapers, etc.)?*
- *What services would he or she need if serious mechanical problems developed with the equipment?*
- *Why might the size of a farm vary by what is produced?*
- *What other factors might impact farm size?*

Apply:

- *Why do farmers produce the crops they do?*
- *What jobs in your community depend on crops?*
- *Is weather important to farmers? Why or why not?*
- *Besides farmers, what other workers help bring food to our homes?*
- *Describe the **agriculture** that you saw at each station.*
- *What is one way that agriculture affects your life?*
- *Why do you think the use of tractors and other modern farm equipment has sharply reduced the need for farm workers?*

ENHANCE/SIMPLIFY

Enhance:

- Dream of a new use for corn or soybeans and discuss its potential.
- Scout a field for weeds, record what you see, determine if they are at an economic threshold. Take pictures of soil profiles at construction sites and roadsides, soil erosion, crops and production operations for a county fair display.

Simplify:

INVESTIGATE YOUR PLATE

Learning About Plant Growth and Development

Activity Plan

Project Skills:
Youth will identify the importance of plants to human and animal life.

Youth will investigate and understand that plants undergo a series of orderly changes as they mature and grow.

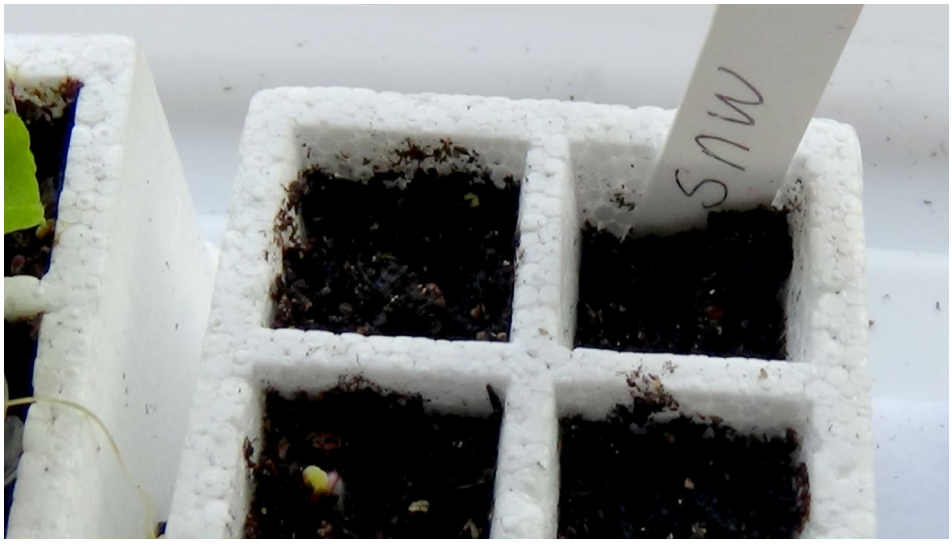
Identify the relationships between water, plants, animals, technology, soil and people.

Understand how farm crops are impacted by sun, water, technology, soil, nutrients, weeds and people.

Life Skills:
Problem-solving, communication, critical thinking, cooperation, decision-making

Academic Standard:
PS2.a: Determine the influence of environmental factors on plant growth
EHS.1.a: Assess the interdependence among natural and human built systems

Grade Levels:
5-8



BACKGROUND

There are many myths about plants and their role in our lives. Understanding facts about plants can be useful in understanding the role of plants in agriculture.

Plant growth and development are the result of an interaction between a plant's genetics and the environment. The amount of light, water, and nutrients plants receive creates differences in how plants grow and develop.

Using Fast Plants® supplies, seeds and kits, youth can grow plants from the mustard family that are easy and fast to grow, and explore the impact of environment on plants.

WHAT TO DO

ACTIVITY: How Do Plants Affect Our Lives?

As an introduction to the importance of plants to our lives, have students decipher myth statements from fact statements about plants. Write "Myth" on one piece of poster paper and "Fact" on the other one. Post these papers on opposite sides of the room.

Divide the class into groups of two to four youth. Give each group two different statements. Groups should discuss the statements and decide if each one is a fact or a myth about plants. Groups will place their cards or Post-its on the Fact or Myth poster paper.
Have each group share a statement explaining why they identified it as a "fact" or "myth." Expand on their explanation as needed. Examples of statements that could be used in this activity:

Time:
30 minutes for Myths/Facts activity

1 week for Plant Growth activity

Supplies Needed:
2 large sheets of poster paper

small note cards or post it notes with plant myths written on them

Wisconsin Fast Plants® Program seeds, supplies and directions for class (2 youth per plant quad)

Plants are Amazing, www.youtube.com/watch?v=Cbf-JetxajI

Do Ahead:
Prepare planting materials

Prepare Myth and Facts posters and note cards

Prepare observation worksheets

Sources:
Created by Deb Ivey, 4-H Youth Development Educator, UW-Extension Iowa County

Grow For IT curriculum, North Carolina State University www.growforit.org/curriculum/detail/www.ces.ncsu.edu

Wisconsin Fast Plants www.fastplants.org/

- Plants provide food, fiber, oxygen and more to living organisms.
- Plants are one of the most valuable natural resources.
- Plants clean the air.
- Without plants, there would be no life on earth.
- Plants help freshen our breath.
- Humans can eat all plants.
- Plants recycle carbon dioxide that we give off and turn it into oxygen for humans and animals to breathe.
- Animals eat plants that humans cannot digest.
- Green manure is a term used to describe plants that are tilled under in a farm field.
- All plants make nitrogen.
- Plants require nutrients to grow, just like animals and humans.
- Agriculture is the science or practice of farming.
- Plants are only used for feed for animals and humans.
- Weeds are plants too.

ACTIVITY: PLANT GROWTH AND DEVELOPMENT

NOTE: The activity below will require 10-15 minute observations daily for about one week to complete. Show the video, Plants are Amazing *as an introduction to the activity.*

Ask, W*hat do plants need to live?* Answers might include food, water, light, and soil.

Ask youth to help conduct an experiment to see the impact of these things on plant growth and development. *How do we set up an experiment to observe the impact of water and light on plants? What will be the control?* Each group might conduct an experiment for each variable.

Follow the planting directions that came with the Fast Plants® materials. Be sure to label the plants with the names of the group members and the variable they are testing. Have them record what they did to set up the experiment and determine how often and when they will make their daily observations. The students might make a hypothesis on the impact of the variable on their plant.

Make plans to conduct daily observations of the plants to observe changes. Youth might use a plant growth worksheet to record daily changes in the plants including tallest, shortest, number of leaves, flower buds, etc.

At the conclusion of the experiment, have youth share their observations with the entire group. Use the data the groups share, the information on the Observation sheet and the reflection questions below to start a discussion about the experiment.

TALK IT OVER

Reflect:

- *How do differences in water and light affect plant growth and development?*
- *How do plants grow if they do not have water or light?*
- *How do plants change as they grow?*
- *How are plants used in agriculture?*
- *How does this experiment impact how you might grow plants in your garden or at your home?*
- *What did you learn about your skills in communication, cooperation, decision-making, and problem-solving?*
- *What was the strangest thing you observed? Why do you think that happened?*
- *What new questions do you have about plant growth?*

Apply:

- *What did you learn in this experiment that will be able to use at school? At home?*
- *How do farmers and gardeners ensure that plants have access to water, light and nutrients?*
- *How does changing the environment affect living things? Where have you observed this?*
- *What are some other situations where you will need to use skills in communication, cooperation, decision-making, and problem-solving?*

ENHANCE/SIMPLIFY

Enhance:

- Extend the number of days that plants are observed.
- Use more variables in the experiment.
- Grow different plants.
- Have students maintain a journal of the growth and development of their plants. They might include drawings, a description of their experiment and their understanding of the science of plant growth and development.

Simplify:

- Use cutouts that show the plant life cycle and have youth put them in order.
- Plant the seeds prior to the class.
- Youth might draw plant to show the impact of the variables.

PLANTS AND FEEDS

TEAM _____

WHAT PLANT IS THIS? Match the correct name to each picture.

Oats

Soybeans

Wheat

Timothy Grass

Sugar Beets

Alfalfa

Corn

Cotton

Barley

1. Match the plant on the left with the feed made from the plant on the right.

Corn	HAY
Soybean	ROLLED OATS
Cotton	GROUND CORN
Oats	CRACKED CORN
Wheat	SOYBEAN MEAL
Barley	COTTON SEED
Sugar beets	CRACKED & ROLLED BARLEY
Alfalfa	CRACKED WHEAT
Timothy Grass	MOLASSES
	BREAD
	SILAGE

2. Which animals eat this feed? (Animal Pictures are on the next page)

Silage	Cotton Seed
Cracked Corn	Molasses
Ground Corn	Cracked Wheat
Soybean Meal	Bread
Hay	Cracked and Rolled Barley
	Rolled Oats

Animal Pictures to use with activity 3 above:

INVESTIGATE YOUR PLATE

Plants Grown For Animal Feeds

Activity Plan

Project Skills:
Youth will identify the importance of plants to human and animal life.

Youth will investigate and understand what plants look like in the field, their seeds, once processed into feeds, and which animals can eat them in their daily diet.

Identify the relationships between water, plants, animals, technology, soil and people.

Life Skills:
Problem-solving, communication, critical thinking, cooperation, decision-making

Academic Standard:
PS2.a: Determine the influence of environmental factors on plant growth
EHS.1.a: Assess the interdependence among natural and human built systems

Grade Levels:
5-8

Time:
15 minutes - 5 minutes for rotation to another station

BACKGROUND

Understanding facts about plants can be useful in understanding the role of plants in agriculture. With the rapid rise of the industrial food animal production system, an increasing number of food animals once raised on pastures are now raised in feedlots. Using plants to feed both animals and humans is an important concept to production agriculture, and that translates to youth investigating their food sources.

Plant growth and development are the result of an interaction between a plant's genetics and the environment. Animal growth and development depends upon the feedstuffs that the animal receives, at various stages of their life cycle.

Engaging students with an activity utilizing photos and real materials to help determine plants used to make feed, feed in its processed form, and animals and posters to denote life cycles of the animals, students will be able to better understand the connection between growing and harvesting plants–processing into feed, and using the correct feeds at the corresponding life cycle of the animal to promote proper growth.

WHAT TO DO

ACTIVITY: Which Plants Are Grown To Feed Animals?

The current world population is more than 7.4 billion and expected to increase to nearly 9 billion within the next two decades. This increase in human population, with resulting pressure on land and changes in composition of the livestock population, will have a major effect on both available natural resources and future demand for commodities which

Supplies Needed:
Worksheets for matching activity

white board/flip chart

samples of feed/ feedstuffs and/or plants (grain)

diagrams of animal digestive tracts *(optional)*

Do Ahead:
Prepare matching worksheets using common plants/feeds found in the area.

Sources:
Created by Deb Ivey, 4-H Youth Development Educator, UW-Extension Iowa County

Photo: Investigate Your Plate Campers

will consequently determine the type of livestock feeding and production systems to be adopted.

This lesson can be used as a stand-alone lesson or with rotations to various stations. We are concentrating on plants grown for their feed values and used locally. Youth will be asked the following questions to introduce the topic:

1. *What are some common plants that are grown for animal feeds*? Create a list on a white board/flip chart.
2. *Are these plants fed in the manner that they are harvested or are they processed?* Go through the list and discuss briefly how each of the plants are used as animal feed.
3. *Do animals use the same feed throughout their entire life or does the feed change as they grow and mature?* Compare to humans–babies to toddlers to teens to adults.

WHAT ARE COMMON FEEDS?

NOTE: The activities below can be personalized to specific locations by using local plants used for feed production.

ACTIVITY: Plants Become Feed For Animals

Ask the youth what animals need to live. Their answers may vary but should include nutrients, water, air and shelter of some sort. These will meet the basic needs.

Do animals eat the same foods when they are a baby or an adult? What are some of the differences in needs at different life stages? Discuss in general terms of tooth production, rumen function and digestibility of feeds.

What are some local plants that are grown here and fed to animals? Generate a list which should be inclusive of all of the plants that students will be identifying in the activity.

Do these plants get processed to feed the animals or do the animals eat them right out of the field? What kinds of things are done to process the plants? Generate a list–grinding, rolling, cooking, mixing with vitamins and minerals, etc.

ACTIVITY: Identify Plant Names

Students will identify plant names and their photos and then identify plant photos and their "feed" component. See worksheets attached.

TALK IT OVER

Reflect:

- *How do differences in the stages of animals reflect the differences in plants fed?*
- *What are the essential elements for plants/animals to grow?*
- *How are plants processed for animal feed?*
- *How are plants used in agriculture?*
- *What was the strangest plant/feed that you observed? Why?*

- *What new questions do you have about plants/feeds/ animal use of plants?*

Apply:

- *How do farmers and gardeners ensure that plants have access to water, light and nutrients?*
- *How do farmers and grain mills ensure that animal feeds meet certain requirements needed for animal growth?*
- *How does changing the environment affect living things (plants/ animals)?*

ENHANCE/SIMPLIFY

Enhance:

- Extend the number of plants observed/feeds fed.
- Have students draw a "map" of the raw plant to the end product (corn plant, harvested, dried, ground, added to mixture of other grains, fed to animals).
- Have students research how much feed a baby calf needs compared to an adult cow (can use other animals also).

Simplify:

- Work in pairs or small teams to complete the matching exercises.

INVESTIGATE YOUR PLATE

Soil Science and Water Percolation

Activity Plan

Project Skills:
Youth will identify the three types of soil.

Youth will investigate the characteristics of soil.

Youth will explore how the soil texture and characteristics affect water transport.

Life Skills:
Problem-solving, communication, critical thinking, cooperation, decision-making

Academic Standard:
WI Academic Standards:
Science C.8 Science Inquiry; Science E.8; Earth and Space Science.
Next Generation Science Standards:
MS – ESS2-1; MS – ESS2-4; MS – ETS1-2.

Grade Levels:
5-8

Time:
30 minutes for Exploration of Soil Types

90 minutes for Water Percolation through Soils

BACKGROUND

Youth will experiment with the three main types of soil: sand, silt and clay. Sand particles are the largest and can be seen with the naked eye. Sand has a coarse feel and allows water to move through very quickly. Silt particles are too small to see with the naked eye. They are often found in places that frequently flood and then dry out. Clay particles are the smallest, fitting together so closely that it is difficult for water to flow through.

The best soil for plants allows water to move through slowly so that some is held in the soil for plants to use. Water moves too quickly through sand, meaning that plant roots can dry out rapidly. Water moves very slowly through clay, but clay can hold water so tightly that plants can't get to it. Soil that is good for plants has a mixture of sand, silt, and clay particles as well as organic matter. Organic matter, also known as humus, acts like a sponge to help the soil capture water. Organic matter is formed by the decomposition of dead plants and animals or plant and animal waste.

Through the following experiments, participants will explore density, weight, texture and water filtration properties of these soils. Through a reflection discussion, youth will understand how the soil composition affects water flow and retention which can directly affect plant growth.

WHAT TO DO

ACTIVITY: EXPLORATION OF SOIL TYPES

Fill three individual zipper plastic bags with five tablespoons of each of the three soil types. Label each soil type: Sample 1 for Sand, Sample 2 for silt, Sample 3 for Clay. Each group of youth (three youth per group) will get one bag of each soil types to explore. Do not tell the youth about the types of soil at this point.

Supplies Needed:
Types by Texture, Utah Ag in the Classroom Handout (background) utah.agclassroom.org/

Soil Texture and Percolation, Utah Ag in the Classroom Handout (background) utah.agclassroom.org/

Fast Plants supplies, seeds and kits, UW-Madison www.fastplants.org/

Utah Ag in the Classroom Soil Samples utah.agclassroom.org/cart/Details.cfm?ProdID=32

plastic zipper bags
pencil
9-oz clear plastic cups
9-oz paper cups (or Styrofoam)
cotton balls
thumb tack
plastic spoons
tap water

Do Ahead:
Prepare observation worksheets for youth to fill out for experiment 1 and 2.

Locate YouTube videos described in activity.

Sources:
Created by Joanna M. Skluzacek, 4-H STEM Specialist, UW-Extension, 2016

Ask the groups to answer the questions on Worksheet A using descriptive words as they compare and contrast the soil samples. The questions on Worksheet A are also provided below:

1. Each bag has approximately the same amount of soil. Compare how much each bag weighs. Be specific. For example: Sample 1 weighs approximately twice as much as Sample 2. Write your observations:

ACTIVITY: WATER PERCOLATION THROUGH SOILS

Ask the groups to answer the questions on Worksheet B individually and then share with the large group. The questions on Worksheet B are also provided below:

1. How might the flow of water through soil impact plants?
2. How might the flow of water through soil impact animals?
3. How might the flow of water through soil impact water supplies (groundwater or surface water)?

Investigation:
Use Worksheet C to enable students to design a water filtration unit. Below is a copy of Worksheet C with a solution to the water filtration design.

a. Each student will draw a prototype for a water filtration unit using two paper cups, one tack, one pencil and two cotton balls. Draw your design here:

Possible solution: use a tack to poke several holes in the bottom on one cup. Use the tip of the pencil to open the holes to a size of about 2 millimeters in diameter. Pull apart the cotton balls and place inside the cup with the holes. Make sure the holes are completely covered by cotton. Fill the cotton lined cup with soil media until the cup is ¾ full. Use the second cup to catch any filtrate that comes through the holes in the soil filled cup.

2. Have the large group review the prototypes and select a prototype to build. Youth will need three filtration units; one for each soil type: sand, silt and clay. Draw your final prototype design here:
3. Each group will use the filtration units developed by the large group to test each soil. They will observe how quickly water flows through the soil and how much water (in centimeters) gets through the soil into the second cup in one minute increments up to five minutes. They should keep the cup filled to the top with water at all times. This will take teamwork!

Utah State University Cooperative Extension. Agriculture in the Classroom. Types by Texture and Soil Texture and Percolation utah.agclassroom.org/

Photo: Investigate Your Plate campers

Minutes	centimeters of water through sand sample
1	
2	
3	
4	
5	

Minutes	centimeters of water through silt sample
1	
2	
3	
4	
5	

Minutes	centimeters of water through clay sample
1	
2	
3	
4	
5	

After group discussion, the instructor will show a video provided by Creek Freaks, entitled *Soil Percolation Test* www.youtube.com/watch?v=h3s_LNla_aI

TALK IT OVER

Reflect:

- *How do the soil types feel and how are they different from one another?*
- *What did you see when the soil samples were left to settle for five minutes?*
- *How does the flow of water through soil impact plants and animals (think about animals that live in the soil as well as those that live on the land)?*
- *How does the amount of water differ between the sand, silt and clay samples?*
- *What did you learn about your skills in communication, cooperation, decision making, and problem solving?*
- *What was the strangest thing you observed? Why do you think that happened?*

Apply:

- *What did you learn in this experiment that will be able to use at school? at home?*
- *How do farmers and gardeners ensure that plants have access to water?*
- *What type of soil do you have around your home?*
- *What are some other situations where you will need to use skills in in communication, cooperation, decision-making, and problem-solving?*

ENHANCE/SIMPLIFY

Enhance:

- Extend the number of days that plants are observed.
- Use more variables in the experiment.
- Grow different plants.
- Have students maintain a journal of the growth and development of their plants. They might include drawings, a description of their experiment and their understanding of the science of plant growth and development.

Simplify:

- Explain the characteristics of the three types of soil to the youth before they begin the experiment.
- Tell them how to make a filtration unit.

INVESTIGATE YOUR PLATE

Well Water Quality

Activity Plan

Project Skills:
Youth will be able to define groundwater resources.

Youth will visualize the depth of water wells in the area.

Youth will investigate how water samples are collected from wells.

Students will be able to perform basic water analysis using Hach testing kits.

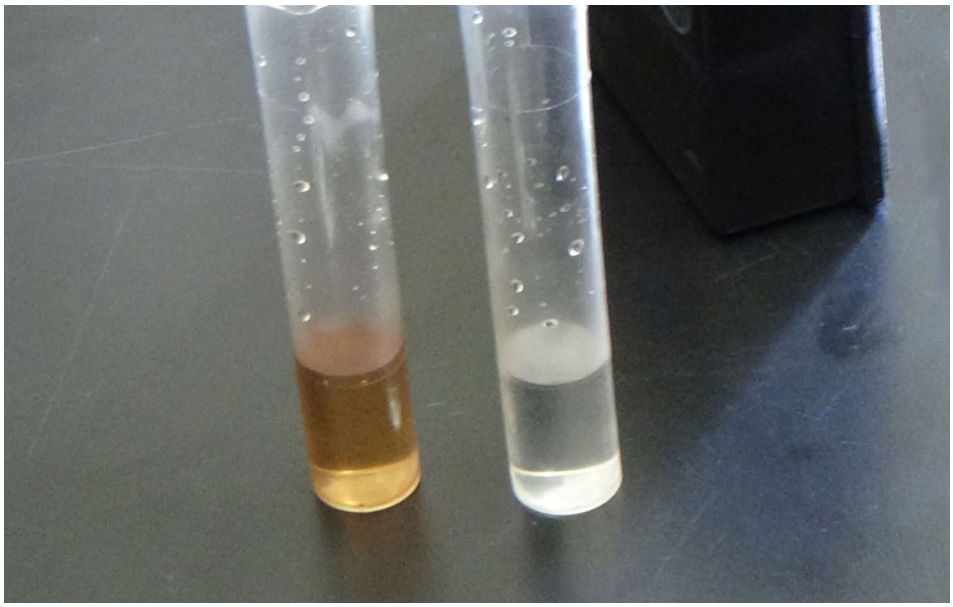
Life Skills:
Problem-solving, communication, critical thinking, cooperation, decision-making

Academic Standard:
WI Academic Standards:
Science C.8 Science Inquiry; Science E.8; Earth and Space Science.
Next Generation Science Standards:
MS-ESS2 – 4; MS-ESS3 – 3;
MS-ETS1 – 1

Grade Levels:
5-8

Time:
45 minutes

Supplies Needed:
Well or groundwater



BACKGROUND

Nutrients, such as nitrogen and phosphorus, are essential for plant and animal growth, but too much of these nutrients in water can cause adverse health effects. Nitrogen and phosphorus are used in agriculture to grow crops. These nutrients occur naturally in soil but are often supplemented by the addition of natural (animal manure) or synthetic fertilizers.

Even though the ground is an excellent mechanism for filtering out particulate matter, such as leaves, soil and bugs, dissolved chemicals can still occur in large enough concentrations in groundwater to cause problems. The physical properties of an aquifer, such as thickness, rock or sediment type, and location, play a large part in determining whether contaminants from the land surface reach groundwater. Because groundwater moves slowly in the subsurface and many contaminants sorb to the sediments, restoration of a contaminated aquifer is difficult and may require years, decades, centuries or even millennia. Much of the U.S. uses groundwater as its main source for drinking water. Too much nitrogen, in the form of nitrate (NO_3), in drinking water can be harmful to young infants and young livestock. Excessive nitrate can harm the body's ability to carry oxygen, leading to weakness, vomiting and trouble breathing.

Additionally, if nitrogen and phosphorus are applied in excess, they can migrate into surface water resources through erosion of soil. If nitrogen and phosphorous are in high concentrations in surface water, they can lead to high production of algae and lake vegetation. Much of the U.S. uses groundwater as its main source for drinking water. Too much

samples (at least 100 mL)

Hach® Nitrate (Nitrogen) Color Disc Kit (item # 1416100)

Hach® Phosphorus, Orthophosphate Test Kit (item # 224800)

distilled water
timer

Do Ahead:
Collect at least 100 millliliters of ground-water sample in a clean plastic container

What is Groundwater?
KQED Quest
www.youtube.com/watch?v=oNWAerr_xEE

Sources:
Created by
Joanna M. Skluzacek, 4-H STEM Specialist, UW-Extension

Water Quality, U.S. Geological Survey Water Science School, U.S. Dept of Interior. (2016) - http://water.usgs.gov/edu/waterquality.html

Test Kit Reference Guide, Hach Company, Loveland, CO www.hach.com/testkitsguide (2016)

Photo: Investigate Your Plate campers

nitrogen, in the form of nitrate (NO_3), in drinking water can be harmful to young infants and young livestock. Excessive nitrate can harm the body's ability to carry oxygen, leading to weakness, vomiting and trouble breathing.

WHAT TO DO

ACTIVITY: Groundwater Video

www.youtube.com/watch?v=oNWAerr_xEE

ACTIVITY: Water Quality Testing with Hach® Test Kits

Youth will test for nitrate–nitrogen and phosphate using Hach® Test Kits. Students will test three samples from differing depths and locations and compare and contrast nutrient levels.

The participants will use the Hach® test kits according to the instructions provided for low-level nitrates and phosphates and document the results.

TALK IT OVER

Reflect:

- *Did the values of nutrients differ with depth?*
- *Why might nutrient values differ with depth?*
- *How might the location of the well or water sample impact nutrient values?*
- *What did you learn about your skills in communication, cooperation, decision-making and problem-solving?*
- *What was the strangest thing you observed? Why do you think that happened?*

Apply:

- *What did you learn in this experiment that you will be able to use at school? At home?*
- *How do farmers and gardeners ensure plants have access to nutrients?*
- *How can farmers or homeowners reduce the amount of nutrients they apply to the soil but still have enough for plants to grow?*
- *What are some other situations where you will need to use skills in communication, cooperation, decision-making, and problem-solving?*

ENHANCE/SIMPLIFY

Enhance:
Attain a data set that describes nutrient levels in different parts of the U.S. or local environments for youth to draw conclusions. Have the youth bring a water sample from their home to test.

Simplify:
Demonstrate the analytical procedure for before experimentation begins.

INVESTIGATE YOUR PLATE

Worksheet A: Exploration of Soil Types

Activity Plan

Answer each question about your soil samples marked Sample 1, Sample 2 and Sample 3.

1. Each bag has approximately the same amount of soil. Compare how much each bag weighs. Be specific. For example: sample 1 weighs approximately twice as much as sample 2.

   Write your observations:

2. Open the bags and feel each soil sample. Write your observations:

3. Each group will use three clear plastic cups. Fill the cups approximately ½ full of water. Take one spoonful of each soil and stir the sample into individual cups. Write your observations:

4. Let the soil samples settle for about five (5) minutes. While you wait, go to question 5. Write your observations:

5. There are three major soil types: Sand, Silt and Clay. Which sample corresponds to each type? Why?

INVESTIGATE YOUR PLATE

Worksheet B: Water Percolation through Soil Types

Activity Plan

Answer each of the questions individually and be prepared to share your answers with your fellow students.

1. How might the flow of water through soil impact plants?

2. How might the flow of water through soil impact animals?

3. How might the flow of water through soil impact water supplies (groundwater or surface water)?

INVESTIGATE YOUR PLATE

Worksheet C: Design a Water Filtration Unit

Activity Plan

1. Each student will draw a prototype for a water filtration unit using two paper cups, one tack, one pencil and two cotton balls. **Draw your design here:**

2. The large group will review the prototypes and select a prototype to build. Students may work in groups of three and each group will need three filtration units; one for each soil type: sand, silt and clay. **Draw the final prototype design here:**

3. Each group will use the filtration units developed by the large group to test each soil. During the investigation, the students will collect data on: 1) the speed at which water flows through the soil sample and 2) the quantity of water that flows through the sample each minute.

4. Use a timer to determine how quickly water flows through the soil by monitoring how much water comes through the filtration unit each minute for five minutes. Use a ruler to document how much water (in centimeters) gets through the soil into the second cup in one minute increments up to five minutes. Remember to keep the filtration unit filled to the top with water at all times. This will take teamwork!

Minutes	centimeters of water through sand sample
1	
2	
3	
4	
5	

Minutes	centimeters of water through silt sample
1	
2	
3	
4	
5	

Minutes	centimeters of water through clay sample
1	
2	
3	
4	
5	

Investigate Your Plate

July 20-24, 2015

Pioneer Farm – UW-Platteville

Monday

Each day remind them that they will present on Friday.
They need to document what they are doing, how they are doing it and important data.

On Friday you will also describe how farm products/research is used to develop foods for animals and people. Plus the relationships between the different aspects of the environment.

Timeframe/Location	Activity	Learning objectives	Responsibility
11:00/Foyer	Welcome/intros		Amy, Deb, Lori, Pam
11:30	Lunch/Panel		
12 Noon/classroom	Career panel– Animal Science	Will let the team know closer to workshop	Lori, Pam, Amy
12:30/outside?	Freetime (options/sports)		
1:00	introduce Friday group activity--15 minutes Introduction to plants activity and video...amazing plants	As a result of this activity students will be able to: Identify the relationships between water, plants, animals, technology, soil and people.	Joanna Deb Ivey
1:30/classroom	Apple Activity and video, begin maps		Deb and Lori
2:00/classroom	Animals, AnimalPedia boards	Students will increase understanding of interconnectedness	Lori, Pam, Amy
2:30/classroom	Continue animals		Lori, Pam, Amy
Quick break if possible			
3:00/classroom	Begin maps		All
3:30/Classroom	DOTS and Farm Tour and plant seeds during DOTS (Groups of 4-5)	Introduce students to scientific research and context through digital media presentations and discussion.	Alex, Mike, Justin, Sarah, Jennifer
4:00/rotation through 4 data sites	DOTS and Farm Tour and plant seeds during DOTS	Connect students to the scientific research discussed by using analogous data collection tools in their own classroom.	Alex, Mike, Justin, Sarah, Jennifer

4:30/rotation through 4 data sites	DOTS and Farm Tour and plant seeds during DOTS	Students develop scientific questions, conduct independent data collection, and share their discoveries with others.	Alex, Mike, Justin, Sarah, Jennifer
5:00/rotation through 4 data sites	DOTS and Farm Tour and plant seeds during DOTS	Students relate learning from their independent inquiries to the scientific research discussed in the initial content session.	Alex, Mike, Justin, Sarah, Jennifer
5:30/rotation through 4 data sites	DOTS and Farm Tour and plant seeds during DOTS		Alex, Mike, Justin, Sarah, Jennifer
6:00/Cooper	Break and dinner		
7:30/Cooper	Movie night	Agricultural movie or other	
	snack		
10:00	Lights out		

DOTS learning objectives:

As a result of attending the session students will:

(1) Gain skills and knowledge to use tools (DOTS)
(2) Gain better understanding why tools exist/application to Ag. Industry
(3) Identify career possibilities
Increase ability to create and test a hypothesis (identify what you want to know and then test it)

Tuesday

Timeframe	Activity	Learning objectives	Responsibility
8:00 breakfast/ free time			
9:00	Welcome/review day schedule		Sarah and Jennifer and Joanna
9:30/classroom	introduction.. marketing chain Embryology of chick	Students will be able to: Identify ages/stages of production animals	Lori, Pam, Amy
10:00/classroom dairy, yearling, feeds	Life cycle of animals Ages and stages...walking field trip with info boards	Students will increase -- Knowledge in differentiating animals feeds and digestive problems --Understand that plants and animals have different life cycles	Lori, Pam, Amy
10:30/barns	Photos of chicks in eggs, poultry in various stages of development, and candling of eggs, feeds	Students will increase understanding of interconnectedness of animals, plants, soil and human use	Lori, Pam, Amy
11:00/classroom	plant parts, video...seed to flower What do plants “eat”.		Deb
11:30/classroom and weed garden.	Plan experiments to determine impact of light, water, etc. on plants Mapping	Students will increase understanding of the impact of nutrients, water, light and soil on plants	Deb
12 Noon	Lunch		
12:30/plants and crops	Career panel– plants, crops and machinery	Students will Identify career possibilities related to plants	Deb
1:00	Free time		
1:30 2:00	Soil introduction, view soil layers at Farm. Soil types by texture activity	Students will learn about soil texture and determine the textures of several soil samples.	Joanna/Justin
2:30	Break -15/20 minutes		

3:00	Soil erosion with rain simulator	Students will understand how rain intensity effects erosion of four soil types	Joanna/Justin
3:30/classroom	Reflection on map/journal		All
4:00	Free time/games/movie		
5:30 dinner	Travel into Platteville Climb the M, walk on campus, something in town?		
6:30			
7:00-9:00			
9:00	Back to Farm		
10:00 lights out			

Wednesday

Timeframe	Activity	Learning objectives	Responsibility
9:00	Welcome/review day schedule		
9:30	sock seeds in a shoebox		Deb
10:00			
10:30	Farm tour/scavenger hunt with questions and observations form -weed area -crops – corn, grasses, etc. -machinery -birds, animals -economics -mapping	Students will Recognize farm crops that are significant agricultural products of the Midwest Students will increase understanding how farm crops are impacted by sun, water, technology, nutrients, weed and people Students will Identify career possibilities	Deb
11:00	Check chicks and plants		Deb, Lori, Pam, Amy
11:30/classroom	mapping		
12 Noon	Lunch		
12:30/classroom	Career speaker – water or agricultural engineering	Students will Identify career possibilities	Joanna
1:00/outside	Free time		
1:30/well areas on farm	Water well testing for Nitrate, phosphate, chloride, turbidity and pH. Where does NO3 and PO4 come from?	Students will observe the research wells on the Farm	Joanna
2:00		Students will take samples from different depths	Joanna and Gretchen (UW-P Faculty)
2:30/Cooper or wetlab		Students will test samples for nutrients	Joanna
3:00			
3:30	Review map		
4:00	Free time/games		
5:30 Dinner			
6:30/ can be in arena if raining	Chicken coop building	(can be exchanged with astronomy Thursday depending on weather)	
10:00	Lights out		

Thursday

Timeframe	Activity	Learning objectives	Responsibility
8:00	Breakfast/free time		
9:00	Welcome/review day schedule- Field Trip day!!		
9:30	Supermarket math (15 minutes (maybe on bus?)	Students will: Identify the components of a cheeseburger	
10:00	Trip to Sunflower plots	Youth will learn about the UW-Platteville sustainability project. Understand some products made from sunflower oil. Press sunflower seeds. Youth will tour UW-P campus and experience campus life.	Joanna and others
10:30			
11:00			
11:30	Travel to UW-P campus for lunch		
12 Noon	Lunch and tour of several departments on campus		
12:30			
1:00			
1:30			
2:00	Travel back to Farm		
2:30/classroom	Maps and begin prep for Friday's presentation.	All In your group, each member needs to have a part of the presentation	they need to document what they are doing, how they are doing it and important data. Investigate Your Plate. On Friday you will also describe how farm products/ research is used to develop foods for animals and people. plus the relationships between the different aspects of the environment.
3:00			
3:30			
4:00	Free time/games		
5:30 Dinner			
6:30	Intro to astronomy		
7:00-9:00	Build telescopes		Jeff and Joanna
9:00	Night sky viewing		
10:00 lights out			

Friday: Economics, summarize, presentation prep / finish map, eval/survey, each youth shares one thing, parking lot discussion (where does this go exactly?), lunch, oral presentation to parents, parent eval, optional tour with parents

Final chicken and plant checks

Friday presentations:

describe the relationships between the areas explored this week

what did you learn about careers anything surprised you about our guests

teamwork, leadership