Activity 4.01.01

Water Use Map

Use the information at http://water.usgs.gov/edu/wuir.html (search USGS irrigation use) to best fill in the map and questions. There are tables and much more information available at this website.

Students should color in the map according to water withdrawals.

EXPLANATION
Water withdrawals in millions per day.

- 0-200
- 200-1,000
- 1,000-1,500
- 5,000-15,000
- 15,000-31,000

1. What region of the United States uses the most irrigation water?_____
2. Why do you think that is?_____

   _____
3. What type of irrigation is used on the most acres in the US?_____
4. Why do you think this is the most used type of irrigation?_____

   _____

5. What type of irrigation is used on the least acres in the US?_____

6. Why do you think this is the least used type of irrigation?_____

_____

7. How much irrigation does North Carolina apply? _____

_____

8. What state applies the least irrigation? Does the size of this state (area) contribute to the volume of water applied? Why or why not? _____

_____

9. What trends have been noted since 1950 in irrigation application in the United States? _____

_____

10. Explain the following table in your own words:

Irrigation freshwater withdrawals for the United States in 2005

Withdrawals Million gallons per day (1,000 acre-feet per year)			Irrigated land (1,000 acres)		
Groundwater	Surface water	Total	Sprinkler	Micro-irrigation	Surface
53,500 (60,000)	74,900 (84,000)	128,000 (144,000)	30,500	4,050	26,600

Activity 4.01.02

Irrigation Systems Research

Irrigation System	Image	Description	Advantages	Disadvantages	Crops best suited for this system
Contour-Levee					
Trickle					
Sprinkler					

Activity 4.01.03

Drought Decisions

Assign students (or groups of students) to each role below. Students will research the issues related to their point-of-view AND prepare a good defense of their interests. Rubric Attached.

You are a citizen of Hydroville, North Carolina. There has been a severe drought in your area this year. The State Legislature has mandated that the local municipal governments cut down on the water consumption of their cities. The mayor of Hydroville has called a meeting of several constituents and wants to know:

1. How do these groups use water?
2. How can these groups cut back on water consumption?
3. Which of these solutions listed below is the ideal solution to serve your group's interest?
    a. Mandatory restrictions on water use
    b. Find new water supplies (Reservoirs, Wells)
    c. Raise the price of water
    d. Cut back/stop new developments
    e. Encourage Water Conservation
    f. Buy water from another city/state
4. Student Roles:
    a. Mayor (This can be a panel of students to make a Town Council if needed)
        - Will be the decision makers for what the town action will be at the end of the debate. You will deliver your decision at the end of the debate elaborating on why you made your decision based on the concerns below.
        - Concerns: You need to be reelected (employment rate, economic success of city, tourism, etc). Research the view of different political groups on water conservation. Research what has worked elsewhere.
    b. Conservation Advocate
        - Do not need to answer all of the questions above, but should be prepared with several examples of water conservation efforts done for other cities and how effective those were.
        - Concerns: You want to conserve water and you realize that a short-term solution will not be SUSTAINABLE.
    c. Restaurant Owner
        - Concerns: The financial success of your business, your employees, and your services provided to the community.
    d. Hospital Board
        - Concerns: Compromised nutrition, hydration, and hygiene of community members, decreased water quality as we change water sources.
    e. Farmer

- Concerns: Not being able to employ workers for harvest, increased food prices as supply dwindles, death of long-term crops like orchards and livestock, irrigation water to save crops.

f. Power Plant Owner
    - Concerns: Steady supply of water for thermoelectric power, employees' jobs, power outages.

g. Landscaper
    - Concerns: Beauty of local community, employees' jobs, financial viability of business

Water Conservation Debate Rubric

Position:_____

Group Member Names:_____

1. Organization
    a. The speakers' statements clearly supported their position in the debate. 5 4 3 2 1
    b. The speakers' statements appeared to be well researched and documented. 5 4 3 2 1
2. Quality of Speech
    a. The speakers addressed the opposing team and made appropriate eye contact. 5 4 3 2 1
    b. Arguments were presented with clarity and appropriate volume. 5 4 3 2 1
    c. Speakers were well rehearsed with minimal reliance on notes. 5 4 3 2 1
3. Response to Others
    a. Rebuttals were specific to opposing arguments and expressed with clarity. 5 4 3 2 1
    b. Rebuttals showed evidence of good listening skills. 5 4 3 2 1
4. Team Work
    a. All team members are effectively utilized and speak during the debate 5 4 3 2 1
5. Total : _____ / 40pts

Activity 4.02.01

Irrigation Design

In this exercise students will be designing an irrigation system for a vegetable garden on campus. They should use the following information to appropriately design their system:

1. Measure the area to be irrigated. Sketch the layout of the bed and its length and width below.

2. Determine the basic type of soil you have in your garden area:
    a. Take a small sample of soil by digging about 6" deep and mixing the obtained sample in a bucket.
    b. Observe the soil for the following characteristics:
        i. What happens when it is squeezed?_____
        _____

        ii. What happens when you squeeze it while it's moist? (take a small amount of soil, enough to fit in your palm, and wet it with a few drops of water – not too much!)
        _____
        _____

        iii. Circle which of the following best describes your soil. You will use this information later.

Clay Soils	Loam Soils	Clay Soils
• Loose particles when dry. • Falls apart when squeezed • Will crumble easily when wetted and squeezed into a ball.	• Clumps can be broken easily when dry • Will form a ball when wetted and squeezed.	• Dry sample is made up of hard clumps. • When wet the sample will feel slick. When squeezed between forefinger and thumb the sample will flatten into a ribbon and hold shape.

3. Once your return to the classroom from measuring outside, redraw your garden to scale using a ruler on the back of this page. Follow these steps to make a scale drawing:
    a. Decide your scale. This paper is 8.5” by 11” and you want your garden drawing to fit on this page. How many
        i. Divide 10 by your garden length (the longer side). Ex: 10/18 = 0.55.
            1. 10/_____ = _____
            2. *Note: 10 = the length of your paper minus an inch so it’s not too crammed
        ii. Round your number DOWN to the lower half number. Ex: 0.5
            1. _____ (answer from above) rounded down = _____
            2. *Note: Rounding up will not work because your drawing will not fit.
        iii. This number tells you how many inches on your paper are equal to one foot in the real world. Ex: 0.5” in your drawing = 1’ in your garden.
        iv. Now do the totals. Your garden length was measured to be 18’ so multiply by 0.5” to find your scaled down length. Ex: 18*0.5 = 9”. Draw a 9” long line for the length of your garden.
            1. _____ *_____ = _____” length in my drawing
            2. *Note: Lines on rulers are 1/16” NOT 1/10”. Measure accordingly.
        v. Repeat step iv. for the width of your garden.
            1. _____ *_____ = _____” width in my drawing
            2. Ex: 10’ wide: 10x.5 = 5” on paper.
4. Decide what plants to grow.
    a. Get the options for crops from your instructor.
    b. Look on the seed packet or information provided on your crop to find the row spacing.
        i. My recommended row spacing is: _____ (Ex: 5”)
    c. Draw these rows on your scale drawing.
        i. Use step 2.a.iv again to find out the spacing between rows for your drawing. If the row spacing is given in inches you need to convert it to feet first.
            1. _____ (distance in inches)/12 =_____ (distance in feet)
            Ex: 5”/12 = .4’
            2. _____ *_____ = _____” row spacing in my drawing
        ii. Scale down your row spacing to fit on your paper. (Multiply by your scale number– the number of inches that are equal to a foot in your drawing).
            1. _____(scale number)*_____(row distance) = _____ (row spacing for drawing)
            2. Ex: 0.5 * 0.4 = 0.2”
        iii. How many rows will you be able to fit in your garden? Divide your garden width by your row spacing.
            1. Draw your rows and see. _____ in my garden.
            2. *Note: You should maintain a 1’ border around your garden to leave space to walk etc. Remember to scale down this border to match your drawing scale. Start drawing your first row inside this border. Ex: 0.5 *1 = 0.5”
5. Design your irrigation system to match.
    a. You will want:
        i. A lateral drip line for each row.
        ii. A mainline to run the width of the garden and supply the lateral lines.
    b. Draw your irrigation lines.

        i. Remember to use a different color or type of line to distinguish between your rows of crops and irrigation lines.
    c. Choose the emitter spacing you prefer for your garden. Choices are 12”, 18”, or 24”.
        i. Choose based on your type of soil.
            1. To allow for proper infiltration of the water use the following spacing for your soil type. Circle your soil type and spacing.
            2. Clay = 24”
            3. Loam = 18”
            4. Sand = 12”
    d. Draw your emitters on your scale drawing by placing “x” or other symbol on your map at the appropriate spacing.
        i. Change your emitter spacing to the scale you’re using.
        ii. Change the emitter spacing into feet first!
            1. _____ (distance in inches)/12 =_____ (distance in feet)
            2. 18/12 = 1.5’
        iii. _____(Scale Number)*_____(Emitter spacing in feet) = _____
        iv. Ex: 0.5*1.5” = 0.75” between emitters.
6. Other options.
    a. Have students look up current pricing for the components of the irrigation system and write out an estimate for installing the system.
    b. Actually buy the materials to install the system.
    c. Build a scale model using standard class supplies like pipe cleaners, construction paper, tape, etc.

Activity 4.02.02

Irrigation Model

<u>Irrigation Methods and Gallons per Minute</u>

1. Students will be provided with the following materials (or as many as can be made available)
    a. Straws
    b. Cardboard
    c. Paper Cups
    d. Paper Plates
    e. Clay
    f. Aluminum Foil
    g. Rubber Bands
    h. Tape
    i. Toothpicks
    j. Glue
    k. Paperclips
    l. Stop Watches
    m. Calculators
    n. Measuring Cup
    o. Whatever other materials you have around!
2. With these materials groups of students will be asked to design two irrigation systems:
    a. One that has a steady flow and would be comparable to a sprinkler or flood irrigation.
        i. The goal is to get higher flow system to deposit all 2 cups of water into another cup placed 3 feet away.
    b. One that disperses water slowly modeling a drip irrigation system.
        i. The goal of the low flow system is to get 2 cups of water to drip out over the paper plates or whatever catching system is used. Water should not only drip out of the first opening but also the last which should be 3 feet away as well.
3. Students start off knowing what their materials will be and then give them an appropriate amount of time to plan, depending on the class. (30 plus minutes)
4. Students build and test their irrigation systems.
5. During the test, while one team member pours water into the system other members should be timing how long it takes the water to flow through and out of their system.
    a. We know that amount to be 2 cups.
    b. Students will then use the following equation to calculate how many gallons per minute their systems would use and use that information to compare the water use of each system.

2 cups
---------- = # of gallons dispersed
16 cups

# of gallons dispersed
---------- = gallons per minute dispersed in your system
Time to disperse (in minutes)

Activity 4.02.03

Water Consumption School Checklist

Students will spend some time examining the parts of a school where water is often used and how they could improve the water use at their school and in the landscape or agricultural program.

1. Students start by doing a sweep of the building or school.
    a. Bathrooms:
        i. Are there any leaking faucets? Y/N
        ii. Are there any toilets leaking or constantly running? Y/N
        iii. What type of faucets is installed?_____
        iv. Do these faucets make it easier to waste water?
        _____
        _____
    b. Landscapes:
        i. Is there any irrigation going to the landscape? Y/N
        ii. What type of irrigation is used to water plants (spot watering is fine if no system is installed)
        _____
        iii. If there is irrigation, how often does it water? _____
        iv. Is there a rain gauge? Y/N
        v. How would a rain gauge improve an irrigation system's performance?_____
        _____
        vi. Are the landscape beds mulched? Y/N
        vii. When irrigating the landscape is water contained to the landscape or is it spreading on to the sidewalks or roads?_____
        _____
        viii. What type of plants is installed?_____
        _____
        ix. Look up a few of these plants - are any of them drought-tolerant, meaning they would need to be watered less?_____
        _____
2. Are there any other classes in which students could discuss water conservation?
_____
3. According to your brief survey is there anywhere on campus where water is being over-used? Identify one area and develop a slogan for a water conservation campaign centered on that idea. Make a poster displaying your slogan in an eye-catching creative way.
4. What incentives are there for building users to follow a water conservation program if you were to start one?
_____
_____
_____
    a. Are there any you can think to offer if none are in place?
    _____
    _____

Activity 4.02.04

Irrigation Conservation Service Learning Project

Assign students into heterogeneous teams. Students should work together to identify a member/organization who would benefit from an irrigation system. Students will collaborate with one another and a community member, determine what type of system would help the person/organization, design and create the system (fundraising for the materials), and communicate their project to the community via a website, poster, or another method of publication.

Students are responsible for every step of this process. Simple methods or ways to execute this situation maybe to design and install a rain barrel or other catchment and very passive system. Another method maybe to create a tripod or stationary overhead sprinkler for a small space. Students can also identify a space at the school that would benefit from this project.

Students should keep all receipts, records, donations, and images for a final project submission. Students may choose to record and disseminate their information via a social media outlet. Steer student engagement and learning with this simple checklist (all of which must be communicated on the final project platform).

Identify a member/organization of the community. Who/what is their name and contact information? When did you contact them? How? Keep your records of all communication.	Determine their needs. What is their objective? What is their problem with irrigation? What irrigation delivery system do you feel will best meet their needs? Why? What crops will they grow?	Design your irrigation system. List all of the materials and costs of the materials. Where can these be purchased or how can they be donated? Create a design to scale. Keep images.	Who will purchase the materials? How will these be paid for? Where will these be purchased? When will they be purchased? How will you construct the materials- school or off site? Keep receipts and images.	Construct the irrigation device/system. Record part of the construction and create a one-minute video that summarizes the process. This can be a slideshow. Document the steps from start to finish.
Deliver the system and give it a try. What was the date and time of delivery? Record an image of the delivery. Where was the irrigation system/item delivered- location? Who delivered the system? Who received the system?	Upon delivery, try to use the system after installation. Record the first trial with a video or a series of images that can be included in a slide show.	Communicate after the delivery of the system. One or two-weeks late follow up to make sure that the system is working and is useful. Document the follow up conversation.	Create a table or spreadsheet that outlines costs of equipment and the time involved in this service- learning experience. Outline what you learned from this project and how it benefitted the community.	Deliver your learning journey with all of the steps into one package. You can create a website, deliver the steps over a series of Instagram or other social media platforms. Share your service learning journey with your school via a poster, presentation or other method of delivery.