INDIGENOUS WISDOM:
CENTURIES OF PUEBLO IMPACT IN NEW MEXICO

A Pueblo-Based Educational Curriculum • IndianPuebloEducation.org

MIDDLE SCHOOL CURRICULUM

2nd Edition

Title of Unit: Water Necessity for Life and Cultural Survival

Content Area: Science

Grade Level: 6-8

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The Indian Pueblo Cultural Center K-12 Indigenous Wisdom Curriculum is Supported by:

Indian Pueblo Cultural Center

Gateway to the 19 Pueblos of New Mexico

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Section A: Introductory Materials

Name: Anthony Dorame, Ph.D. and Charlene Lucero
Title of Unit: Water Necessity for Life and Cultural Survival
Content Area: Science
Grade Level: Middle School (Grade 6-8)

Rationale:

Water is a necessity for all living things. In the arid southwest, water is particularly important for survival. Watersheds within New Mexico are areas that are critical to all life. Healthy watersheds positively impact individual organisms, numerous species, and entire communities. In New Mexico, many organisms and cultures have adapted their lifestyles to take advantage of what little water we have. This can be seen in the physical adaptations of many organisms that live near water. These adaptations help these organisms to survive in the New Mexico desert. Similarly, Pueblo Indians in New Mexico have also adapted their lives around water. The core values of love and respect guide Pueblo Indian thinking. This appreciation for water is shown through art and ceremony. Watershed health is becoming increasingly important with the continuation of climate change. In order to sustain and advance the life of Pueblo culture and people it is important for students to understand the importance of water on multiple levels.

Standards:

CCSS-	NM STEM Ready	NGSS
RST.6-8.3 RST.6-8.7	1-SS-1 NM	MS-LS2-1, MS-LS2-2, MS-ESS3-3 HS-LS2-7

Section B: Lesson Plan One

Title: Water - A Life Source for All

Duration: 1-2 Class Periods

Grade Level: Middle School Science

Lesson Objectives:

1. Students will identify human and community uses of water.
2. Students will use a graphic organizer to reflect on their perspective on the multiple ways water is used.
3. Students will identify and locate Pueblo communities who have settled along the Rio Grande watershed.
4. Students will describe a watershed.

Prerequisite Skills:

None

Vocabulary Acquired: **closed basin, tributary, watershed, upstream, downstream, boundary, riparian**

Materials and Resources:

1. Colored Pencils
2. Map of New Mexico
3. Chart Paper
4. Handouts 1-3

Guiding Questions:

1. What is a watershed?
2. Where does our water come from?
3. How do we use water?
4. Can life continue to exist without water?

Core Values:

Balance, Service

Procedure:

Day 1 (50-60 minutes)

1. For the opening, ask students to utilize the concept map to identify how he or she uses water in his/her home and community (use **handout 1**).

2. Draw a concept map on the board and fill in the middle circle to start the map (model what you want students to write).
3. Announce to students they have 5 minutes to complete the task. As students are working, roam the room and assist students with probing questions to help students identify answers. Give the students a two-minute warning.
4. Pair-share: Each student will take two minutes to pair-share their concept map and find commonalities between the two - they can note this on their map by placing checkmarks next to the ideas that are similar.
5. Allow one person from each group to write one of their answers on the board.
6. Whole-group: review responses as a whole group. Ask, "Do we have our uses of water on the board?" If you need to probe further some questions you might ask, "Does anyone here know of some of the ways we use water in our culture?" Possible responses may include, "We use water to grow crops or vegetables" or "We use water for cultural activities, for example to cleanse ourselves" or "We use water in church to bless ourselves". Accept all answers and acknowledge the unique ways water is used by various cultures.
7. Whole group: Ask, **"How is water important to our culture? How is water important to all living things?"**
8. Suggestion: Write the above questions on the board or have them pre written on poster paper or on a projector.
9. Group work: Allow students to respond to the questions and share answers in a group setting. Tell them they have five minutes to come up with an answer. (One possible method is to allow each student within each group to identify if they would like to be a 1, 2, 3 or 4. Allow each number to share their answer within the group. For example, 4's share first, 1's next, 2's to follow and lastly 3's. Allowing each student 30 seconds to share out.)
10. Next call on one student from each group to share out a group answer.
11. Provide students time to return to his/her concept map and make additions. (3 minutes)
12. Say, "So now that we have in our mind the ways we use water, let's think about where we get our water."
13. Solicit answers from students using cold call methods (drawing names from a jar, Popsicle sticks or names on deck of cards).
14. Repeat and record. Many students may have difficulty identifying sources of water. Use guiding questions like, "How do communities water crops?" or "Thinking back in time, where did Pueblo ancestors get their water?"
15. As students respond to the questions, record the answer on poster paper, the whiteboard, etc.
16. Say, "Okay, this leads us to the term, "watershed," let's think about what a shed is." Solicit answers. Say, "Thinking about water and shed together, what kind of definition can we create to describe **watersheds**."
17. How well did we do? Bring up the definition of **watershed**: ***A watershed is a place or location that collects and holds water which moves from higher locations to lower locations***. There can be smaller watersheds within larger watersheds. Write it or project it on the board or have it pre-written on post-it paper to keep displayed in

the class for reference.

Exit ticket/Homework Assessment for end of Day 1/50-60 minutes

18. Ask students to draw a picture of a watershed based on the definition shared and write the definition on a paper.

Day 2 (60 minutes)

19. Review previous days content by having students do a pair-share of their completed work.
20. 'Let's look at the watersheds in New Mexico. Give each group a copy of handouts 2, 3 and 4.
21. At this time, you may project an image of the maps on the wall.
22. Explain that the map shows the streams and basins/ponds that make up the watersheds in New Mexico.
23. Whole Group: Read the directions on ***Handout 4*** together. Work out the first river together. If possible, project the worksheet to model what you want students to do.
24. Students should follow the directions and work on ***Handout 4*** identifying the parts of a watershed. As students work, display the map of New Mexico where all students can easily reference. Allow students time to complete this map exercise.
25. Five minutes prior to the end of class, hand each student an index card and ask them to write one reason why water is important to them and list the watershed nearest to them.

Assessment:

1. Exit card to check for comprehension.
2. Group work observations

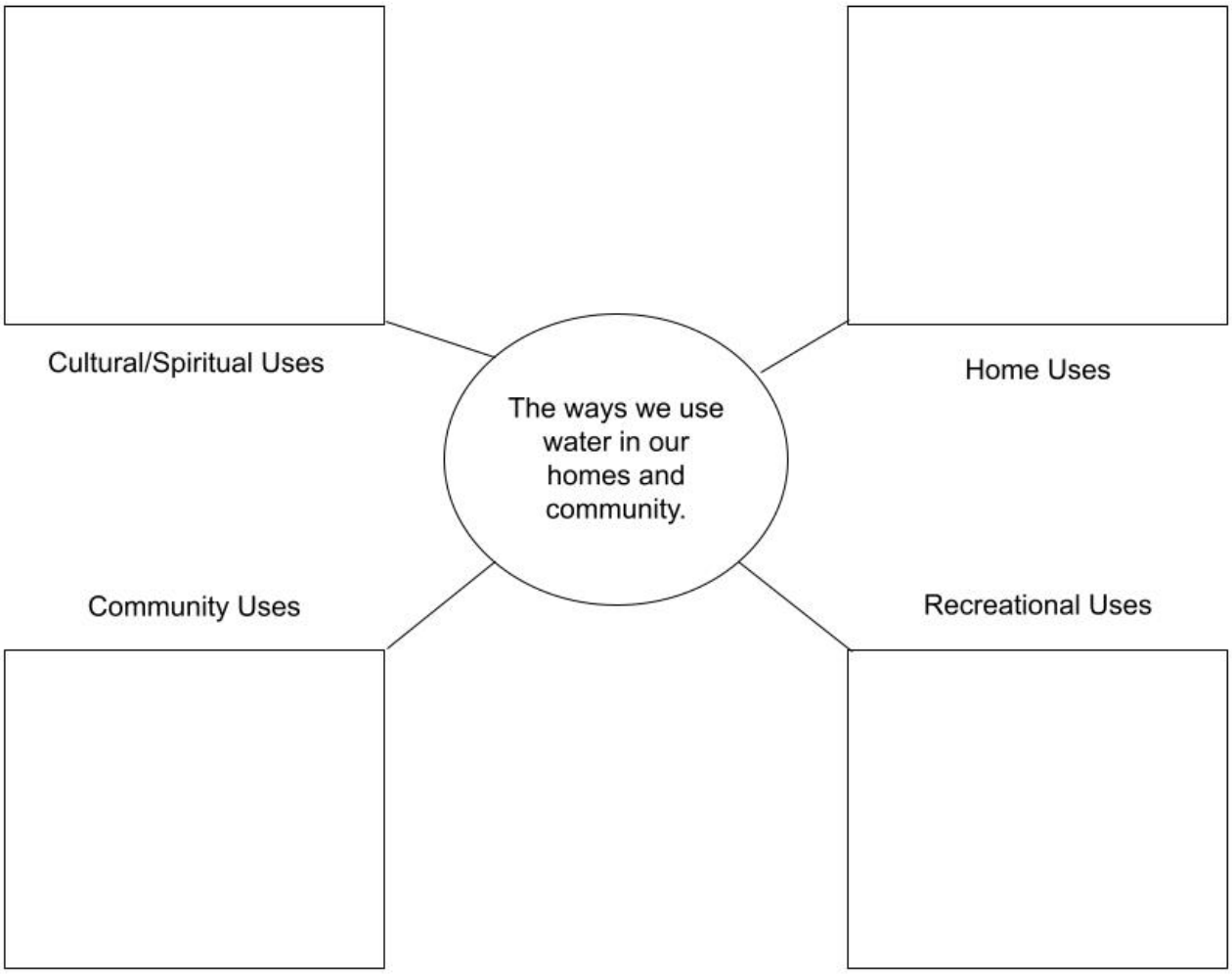
Modifications/Accommodations:

1. Pre-teach vocabulary prior to lessons to promote connections with prior knowledge.
2. Allow extended time to complete assignments.
3. Restate, paraphrase, and emphasize important information.
4. Use more visual material, examples, and demonstrations.

Notes to Teacher:

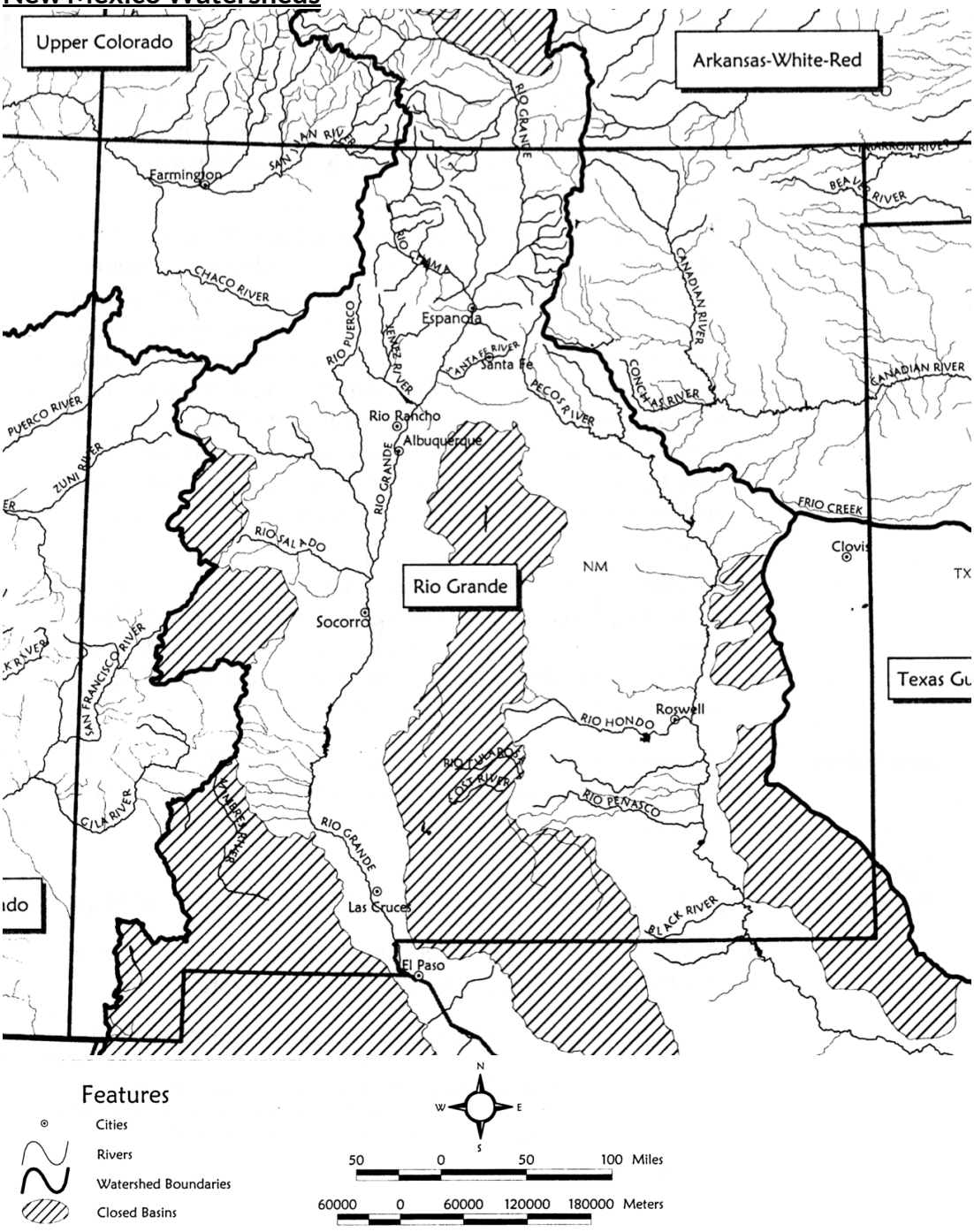
Classroom arrangement: To increase student engagement and talk, arrange tables or desks placed together in groups of four. In order to allow students to easily pair-share and/or work in a group. At the beginning of the year, I allow each group to pick an animal to name their group.

Handout #1: Concept Map for Lesson 1 of Unit "What is a watershed and why should I care?



Handout #2: WATERSHED MAP for Lesson One

New Mexico Watersheds



Handout 3: Rio Grande Pueblos

Handout #4: Student Watershed Handout, "Defining Boundaries"
Student Worksheet

Color the five groups of rivers. Make sure to choose a different color for each group. Color the boxes next to the river groups below to correspond with how you colored the rivers on your map.

Group 1: Rio Grande River

Group 2: Pecos River

Group 3: Canadian/Arkansas/Cimarron/Beaver/Frio River

Group 4: San Juan River

Group 5: Gila/Little Colorado/Black (AZ) River

1. Start with the main stem of one river: trace it all the way up.
2. Next, color all the **tributaries** for that river system the same color as the river. ***A tributary is a small stream that feeds into a larger river.***
3. Then use another color for the next river system, tracing the main stem and the tributaries.
4. Look closely-some streams are very close together, but they belong to different watersheds. Often, they are separated by only a few feet on either side of a mountain ridge. Work your way upstream on each river.

   Locate the boundaries of the watersheds. Draw a line to show the edges of the watersheds.

   Here are some hints to help you draw the boundaries.

   - A boundary separates different river systems. Look for rivers and tributaries that are almost connected, but not quite.
   - There are five main watersheds in New Mexico.
   - The Texas Gulf Basin does not have any rivers or tributaries marked on your map. It is already colored for you.

5. Using the same color as the river system, lightly color in the watershed. Don't color the closed basins.
6. Draw in as many places as you know along the Rio Grande watershed.
7. Reference the New Mexico map and add Cochiti Pueblo, Santo Domingo Pueblo, San Felipe Pueblo, Sandia Pueblo and Isleta Pueblo.New Mexico map and add Cochiti Pueblo, Santo Domingo Pueblo, San Felipe Pueblo, Sandia Pueblo and Isleta Pueblo.
8. Looking at the map, write down at least one reason the Pueblos decided to establish their communities in their current locations.

This worksheet has been modified from the Bosque Education Guide which can be found at: http://www.emnrd.state.nm.us/SPD/documents/WatershedsinNM.pdf

Lesson Plan Two

Title: Understanding Our Impact on Watersheds

Duration: 1-2 Class Periods

Grade Level: Middle School Science

Lesson Objectives:

1. Students will recognize possible reasons for change in a watershed.
2. Students will articulate the importance of water to Pueblo culture.
3. Students will reference maps to identify the flow of water.
4. Students will report understandings to the whole group.

Prerequisite Skills:

None

Materials and Resources:

1. Colored Pencils
2. Map of New Mexico
3. Chart Paper
4. Handout #5
5. https://www.abcwua.org/education/
6. https://www.kunm.org/post/little-room-error-albuquerque-s-wastewater-plant

Guiding Questions:

1. What is a watershed and why is it important?
2. How do the actions people take upstream a river impact the people and communities downstream?

Core Values:

Balance, Service and Respect

Procedure:

1. Recall the definition of watershed and identify the specific review the maps created in lesson 1.
2. Ask the question, "Why should I care about a watershed?" Ask students to record answers in a journal (3 minutes)
3. Each student should take out their maps created in lesson one.
4. Have the students compare their maps to a completed enlarged map displayed on the board to ensure accuracy.
5. Pass out handout #1.
6. Read the directions and questions as a whole group.

7. Probe students, for clarifying questions to ensure everyone is on task.
8. Read the scenario as a whole group.
9. Allow students time to work in groups to answer the questions. Roam the room to answer clarifying questions and provide guiding questions.
10. Ten minutes prior to the end of class have each group share one possible step Mr. Jojola can take to identify the source of the problem.
11. Five minutes prior to the end of class, hand each student a post-it note and have them write one reason why we should care about watersheds.

Assessment:

1. Exit card
2. Completed handout
3. Group work observation

Modifications/Accommodations:

1. Pre-teach vocabulary prior to lessons to promote connections with prior knowledge.
2. Allow extended time to complete assignments.
3. Restate, paraphrase, and emphasize important information.
4. Use more visual material, examples, and demonstrations.

Notes to the Teacher:

Classroom arrangement: To increase student engagement and talk, arrange tables or desks placed together in groups of four. In order to allow students to easily pair-share and/or work in a group.

Name:	Date:	Class Period:

Handout #5:

Directions: Read the scenario below and complete the prompts that

follow. Scenario:

Mr. Jojola has been farming in the Pueblo of Isleta for the past thirty years just as his father and his grandfather did before him. As the years have gone by, he notices many changes, for example: each year he has noticed that the amount of water has decreased and the number of people farming declines. Last year his neighbor down the road lost two acres of chile when he was not able to irrigate due to the lack of water in the river.

This year Mr. Jojola decided to plant two acres of blue corn, knowing that many people will be in need of the corn and the husk for the winter ceremonies. He has been taking pictures of his crops every week to document any major changes and when he irrigates he closely observes the water as it flows in.

It's week five and Mr. Jojola goes out to irrigate. As he opens the water and watches it flow into his field, he notices some distinct changes in the color of water. He wonders, "Is this water safe for my corn?" Realizing that he cannot afford to lose his crop he rushes to close the gate to the field to prevent the water from entering.

Mr. Jojola does not want to irrigate until he sees some clarity in the water. He knows his crops will need water soon so he needs to figure out a solution. He decides to call some friends up North. He calls on his friend Mr. Bird, who oversees the water in Cochiti Pueblo. Mr. Bird says that when he conducted water tests in the last few days everything tested well and water appeared clear.

Mr. Jojola then contacted his friend from San Felipe, Mr. Sandoval. Mr. Sandoval advised him that during the past few days the water was clear and nothing appeared out of the ordinary.

1. Take out your map from yesterday and add the following businesses to the map:
    a. Albuquerque Bernalillo County Water Utility Authority - located just North of Isleta, but south of Albuquerque and Sandia Pueblo. It sits on the East side of the Rio Grande River.
    b. Read the article: "**Power Surge Sends Sewage Into Rio Grande"** By ED WILLIAMS • MAR 4, 2015, https://www.kunm.org/post/power-surge-sends-sewage-rio-grande
    c. Erickson's fertilizer plant - located just North of Sandia, but South of San Felipe.

2. Why did Mr. Jojola contact the Pueblos north of Isleta?

3. Look at the map and identify three possible steps Mr. Jojola can take to identify the source of the problem.

    Step One:

    Step Two:

Step Three:

4. What might Mr. Jojola do if the water does not clear up within the next two days?

5. Why might Mr. Jojola want to identify the source of the water problem?

6. Why should we care about our water and watersheds?

Lesson Plan Three

Title: Cultural Diversity and Adaptations of Organisms within Riparian Ecosystems
Duration: 4-5 class periods (60 minutes)
Grade Level: Middle School Science

Lesson Objectives:

1. Students will be able to identify the physical adaptations that the Beaver, Rainbow Trout, Blue Heron, and Canadian Goose have for surviving in or near water.
2. Students will be able to conceptualize the cultural connections between fish and Pueblo Indian pottery designs.
3. Students will understand that diverse cultures exist in New Mexico and each has adapted unique perspectives of riparian ecosystems.

Prerequisite Skills:

1. A basic understanding of animals that live in or along the Rio Grande River in New Mexico is very helpful.
2. An understanding of ecosystems
3. An understanding of predators and prey

Materials and Resources:

1. PBS: Predators, Science Trek, URL: https://nm.pbslearningmedia.org/resource/idptv11.sci.life.oate.d4kpred/predators/
2. YouTube Video on Adaptations, Internet search - Animal Adaptations for Kids, Learn about physical, life cycle, and behavioral adaptations of animals or use this URL: https://www.youtube.com/watch?v=m2MibjJgyjs
3. Handouts:
    a. Handout 6- Adaptation & Diversity Pretest
    b. Handout 7 - Adaptation & Diversity Posttest
    c. Handout 8 - Glossary
    d. Handout 9 - Pictures
    e. Handout 10 - Pictures
    f. Handout 11 - Adaptation Worksheet
    g. Handout 12 - Picture of pottery
    h. Handout 13 - Picture of pottery

Guiding Questions:

1. What is an ***adaptation***?
2. What is a ***riparian ecosystem***?
3. What specific adaptations have organisms developed that enable them to survive in riparian ecosystems?

4. How do Pueblo Indians express their appreciation for ***riparian ecosystems***?
5. What are some of the ways that Pueblo Indians show their respect for ***riparian*** areas?
6. How do Pueblo Indian bird symbols relate to Pueblo expressions of nature?
7. How does human activity impact the quality of the Rio Grande river?

Core Values:

Respect, Love, Balance

Procedure:

1. Share this background information with students. You may want to cut and paste to a document: "Many of the animals that live around water have special adaptations that allow them certain advantages, and thus increase their chances of survival. For example, the webbed feet and paddle-like tail of the beaver allow it to swim with little effort. The fur of the beaver also helps to insulate and maintain body temperature. The Canadian goose is also a good swimmer thanks in part to the large webbed feet that it has. Goose feathers also provide a good insulating layer from the cold rivers and lakes. Wading birds like the blue heron have long legs that allow them to wade into deeper water in search of food. Their long bills act as fishing spears enabling the heron to catch fish and other small aquatic creatures. The above-mentioned animals also have significant cultural meaning to Pueblo Indians. Many of the tribal stories involve beavers, Canadian geese, and blue herons."
2. Begin by providing students with attached pre-test (handout 6), to determine students level of understanding about adaptations of organisms, and of the diversity of cultural perspectives of Pueblo tribes.
3. Upon completion of the pre-assessment, watch the PBS Science Trek: Predators: https://nm.pbslearningmedia.org/resource/idptv11.sci.life.oate.d4kpred/predators/ and/or https://www.youtube.com/watch?v=m2MibjJgyjs
4. Allow students to share aloud their understanding of the word adaptation. Have students record in their notebook or vocabulary cards.
5. Now give students copies of handouts 9 and 10.
6. Have the students look at the pictures of a beaver, Canadian goose, Blue Heron, and Rainbow Trout provided in the appendix.
7. Ask students if they know what they have in common. Ask students to predict the habitat that each of the species lives in.
8. As a class, brainstorm a list of other animals that use the same habitat as the beaver, Canadian goose, and blue heron and bull trout.
9. Tell students that they will be studying animals that live near water. Ask students to choose two additional animals that they think live near water. Ask students what is special about these animals that allows them to live in or near water.
10. Explain to students that many riparian organisms are now threatened because of the reduction of flows within rivers. An increase in the human population has resulted in more water being used to support humans rather than the natural ecosystems. An increase in the human population also has resulted in more chemical pollution being introduced to the rivers. (This information will be used by

students to complete the adaptation worksheet.)

11. Provide students with pictures of Pueblo Indian pottery that shows the bird, fish and other symbols related to rivers that are provided in the appendix (handouts 12 and 13). Explain to them that Pueblo Indian pottery makers express their appreciation for rivers by painting riparian animals on their artwork.
12. Tell students that they will complete the adaptation worksheet (handout 11) based on the adaptations of animals for living near water and the threats to their habitat. The worksheet may be done individually or in small groups.
13. Discuss the adaptations that the animals they listed in the adaptation worksheets have for living in or near water and the associated threats that they have identified.
14. Explain to students that Pueblo Indians have unique perspectives of the organisms found in riparian ecosystems and often this appreciation is expressed through art, particularly pottery making. The inclusion of symbols such as fish and birds on pottery is an expression of the reverence that Pueblo Indians have for these places.
15. Ask students to talk with a partner about what adaptations the beaver, Canadian goose, and blue heron have for life around water, and how these adaptations enable them to survive in riparian ecosystems.
16. Have students also discuss how Pueblo Indians use art to express their appreciation of organisms found within riparian systems.
17. Students will be observed as they are comparing and discussing the diversity of animals found at the river and some of the adaptations that they have for life near water.
18. Ask students to identify one particular way that Pueblo Indians express their appreciation of riparian ecosystems through art (pottery).
19. Review student adaptation worksheets as a class to ensure their understanding of physical adaptations.
20. Give students attached post-test.

Vocabulary Introduced:

Adaptation Ecosystem Culture Diversity Riparian

Assessment:

The pre-test and post-test, which can be found in the appendix, should be given to students prior to the lesson, and at the end of the lesson. These are a very useful tool for evaluating and tracking student comprehension of the lesson. Teachers may modify the assessments as needed.

Modifications/Accommodations:

1. Pre-teach vocabulary prior to lessons to promote connections with prior knowledge.
2. Allow extended time to complete assignments.
3. Restate, paraphrase, and emphasize important information.
4. Use more visual material, examples, and demonstrations.

Notes to the Teacher:

1. The teacher may wish to modify the lesson to introduce only science concepts one class, and cultural information during a second class.
2. The teacher may wish to add the "Lesson Extension" to create a personal connection with the lesson taught.

Handout #6:

Unit Two - Adaptations and Diversity

Middle School Science

Pre-test

Name:	Date:	Class Period:

1. Name three water loving animals found in New Mexico and identify a unique physical feature that allows it to survive in or near water. Name what type of advantage is gained from having this feature. (Finding food, swimming, etc.).

Organism	Physical Feature	Advantage
Example: Frog	WEBBED FEET AND COLOR	Allows it to move around quickly and easily in water. Helps it hide from predators.

B. These features are called, (select the appropriate answer: a, b or c):
   a. Arms
   b. Adaptations
   c. Alligators
   d. none of the above

C. How do Pueblo Indian people express their appreciation for river dwelling animals using art? Are there other ways that this appreciation is shown by Pueblo Indians?

D. If the river changes, for example loses water (drought) or gains too much water (floods) or becomes heavily polluted, how might it impact the organisms (living things) that depend on the water to live?

Handout #7:

Unit Two - Adaptations and Diversity

Middle School Science

Post-test

Name:	Date:	Class Period:

2. Name three water loving animals found in New Mexico and identify a unique physical feature that allows it to survive in or near water. Name what type of advantage is gained from having this feature. (Finding food, swimming, etc.).

Organism	Physical Feature	Advantage
Example: Frog	WEBBED FEET AND COLOR	Allows it to move around quickly and easily in water. Helps it hide from predators.

E. These features are called, (select the appropriate answer: a, b or c):

a. Arms

b. Adaptations

c. Alligators

d. none of the above

F. How do Pueblo Indian people express their appreciation for river dwelling animals using art? Are there other ways that this appreciation is shown by Pueblo Indians?

G. If the river changes, for example loses water (drought) or gains too much water (floods) or becomes heavily polluted, how might it impact the organisms (living things) that depend on the water to live?

Handout #8:

Glossary

Source: www.meriam-webster.com/dictionary

Note: You may add additional vocabulary to this page as you work through the lesson.

- Riparian-relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater <*riparian* trees>

- Vegetation- plant life or total plant cover (as of an area)

- Relationship-the state of being related or interrelated; a specific instance or type of kinship.

- Culture-the customary beliefs, social forms, and material traits of a racial, religious, or social group;

- **Adaptation**- any alteration in the structure or function of an organism or any of its parts that results from natural selection and by which the organism becomes better fitted to survive and multiply in its environment. This could be a physical feature such as a longer tongue or color of skin that helps it survive.

Handout #9:

Canadian Goose

Blue Heron

Handout # 10:

Trout

Beaver

Handout #11: Adaptation **Worksheet**

Name:	Date:	Class Period:

Directions: Use what you have learned about different organisms to fill out the information below.

Organism	Physical Adaptation	Threats to Habitat
Rainbow Trout		
Beaver		
Blue Heron		
Canadian Goose		
Write an animal of your choice here:		

Handout #12: Picture of Pottery

http://www.icollector.com/Two-Pueblo-Pottery-Pieces-Acoma-Bowl-Santo-Domingo-Jar_i9687416

Handout #13: Picture of Pottery

http://www.rgmunnauctions.com/SANTO-DOMINGO-POTTERY-BOWL i17678700

Section C: Culminating Activity/Lesson Extension

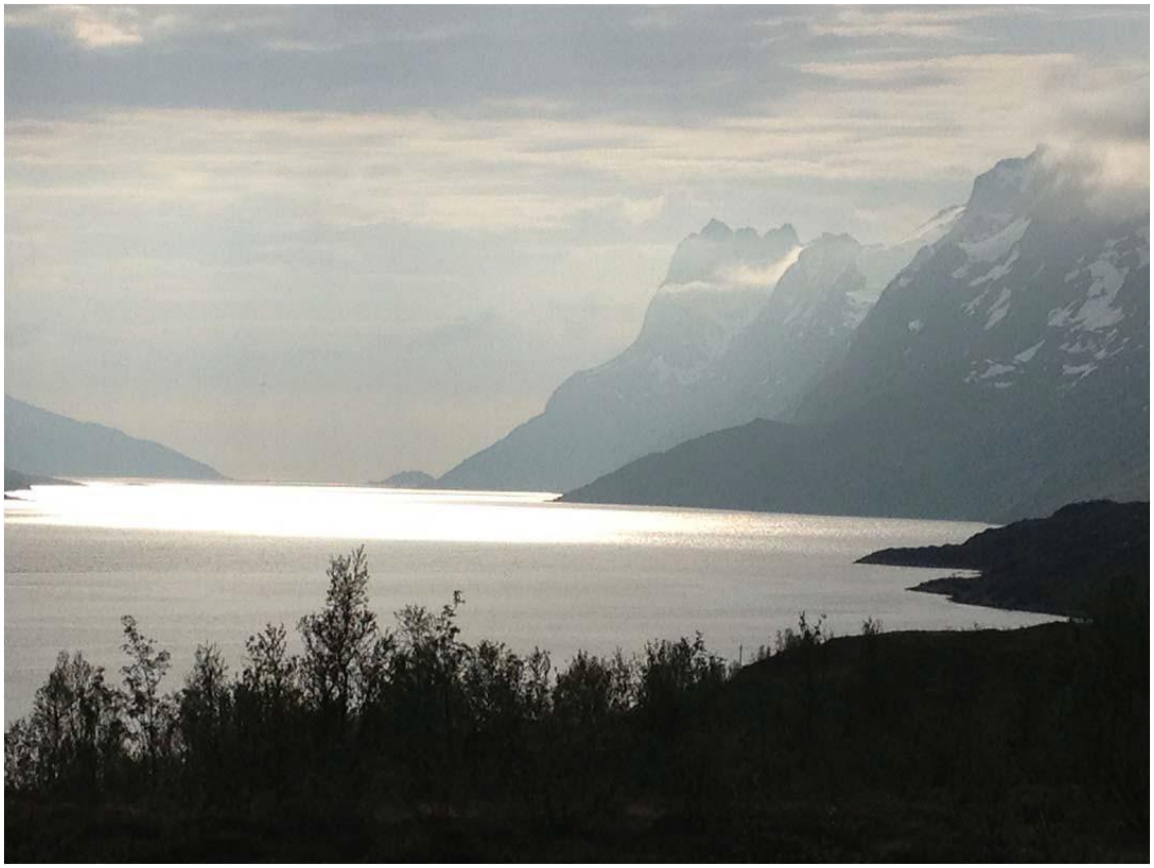


Photo taken by Tony Dorame

Create a poster, brochure, handout, or cartoon that meet the following criteria:

- Teaches others about a watershed and its components
- The importance of watersheds to all organisms (living things)
- The cultural significance of water to the Pueblo Indian people
- Identifies a minimum of two actions that can damage or improve the quality of the river system and the living things that depend on it.