Background Information

The **urban/rural interface** refers to those geographical regions where densely populated urban areas and less populated rural areas come into contact. As urban populations grow, cities expand their boundaries and encroach up rural areas, impacting them in a variety of ways. Even though the livelihoods and life styles of inhabitants of rural and urban areas may be different, both are located in the same **watershed**, connected by their need for clean and ample supplies of water. The amount of water used by human populations can be measured in **acre-feet (af)**.

Urban areas need a significant amount of water to meet the demands of large human populations. Water in urban areas is used for drinking and household purposes, as well as for businesses and industries for the production of goods and services. Furthermore, as urban areas grow, so does the demand for water. In addition, human activities in urban areas can greatly impact water quality. Pollutants from industrial processes, businesses, and the large numbers of households can contaminate water supplies by adding organic matter, petroleum products, hazardous chemicals, and many other substances.

Rural areas are typically characterized by natural environments and agricultural activities. The natural environment needs adequate supplies of clean water to sustain aquatic life in streams and lakes and terrestrial plant and animal life. Human agriculture needs water to irrigate crops and to water livestock. Crops and livestock affect water supplies as they require extensive amounts of water. Agricultural activities areas also have adverse effects on water quality in that they produce a significant amount of runoff that may include chemicals such as pesticides, herbicides, and pharmaceuticals, as well as animal wastes.
Water pollution is typically categorized into two types of sources: a) **non-point source pollutants**, which are forms of pollution that come from many diffuse sources, caused by rainfall or snow melt that move pollutants through a watershed; and b) **point-source pollutants**, which are caused by single sources, such as factories discharging wastes into a stream or lake. Although point and non-point pollutants can be found in either urban or rural areas, non-point source pollutants are often associated more with agricultural regions because of sediment and nutrient runoff, and point-source pollutants are often associated more with urban areas because there are typically more businesses and industries in these regions.

Why is the urban/rural interface such a concern? Water is a limited resource and as human populations grow and urban areas expand, the increased interface between urban and rural areas threatens the sustainability of natural resources and may adversely affect the quality of human life. Expanding urban areas means not only a greater impact on water quantity and quality due to human interactions, but that rural land areas will decline in size and **extensification agriculture** - growing more crops by extending agriculture to new geographic regions - will be less available. Conversely, agricultural practices will need to become more intensified. **Intensification agriculture** refers to growing more crops by intensifying the use of a given geographic area. Also referred to as “high-input” farming, intensive agricultural practices often involve the use of higher volumes of water through large-scale irrigation and the heavy use of fertilizers and pesticides.
Activity 1
Watersheds and the Urban/Rural Interface

Activity Overview
Human uses and impacts on water quality and quantity differ in some significant ways in urban and agricultural areas, yet both share the same watershed. Understanding the urban/rural interface is important to understand how human activities from both urban and agricultural areas can have a multiplying effect on the environment. In this activity, youth will create a simulated watershed and observe how pollution from urban and agricultural areas mix.

Time Required
- Approximately 20 minutes

Concepts and Vocabulary
- **Point source pollution**: Pollutants that come from a single identifiable source.
- **Non-point source pollution**: Pollutants that come from a widespread area.
- **Urban/rural interface**: Geographical regions where densely population urban areas and less populated rural areas come into contact. Interactions between these areas affects land use and natural resources.
- **Watershed**: An area of land where ground water and surface runoff drain to the lowest point in that region.
Life Skills
Activities that promote positive youth development advance the development of life skills. Life skills promoted through this activity include:
- Head: Critical Thinking and Learning to Learn
- Heart: Communication and Sharing
- Hands: Contributions to Group Effort, Responsible Citizenship, Teamwork
- Health: Self-Responsibility

Subject Links
- Science and Language Arts

National Science Education Standards Supported
- Unifying Concepts and Processes Standard - Fundamental science concepts that unify and connect scientific disciplines
  - Evidence, models, and explanation.
  - Change, constancy, and measurement.
- Content Standard A: Science as Inquiry Standards
  - Abilities necessary to do scientific inquiry
  - Understanding about scientific inquiry
- Content Standard F: Science in Personal and Social Perspectives
  - Natural resources - Increasing human consumption places stress on the natural ecosystem.
  - Environmental quality - Natural ecosystems processes may be impacted and changed by humans in ways detrimental to both nature and humans.
  - Natural and human-induced hazards - Changes in environment designed by humans can bring benefits as well as hazards.
  - Science and technology in local, national and global challenges - Everyone needs a basic level of science understanding in order to participate fully in civic processes that can impact the environment.
- Content Standard G: History and Nature of Science
  - Science as a human endeavor - Science is a part of society and all youth can be scientists.
  - Nature of scientific knowledge - Science knowledge is built on evidence from experiments and observation.

Volunteer Tip: For more information on life skills, please visit http://www.extension.iastate.edu/4h/lifeskills/

Volunteer Tip: For more information on the National Science Education Standards, please visit http://www.nap.edu/openbook.php?record_id=4962
Suggested Groupings
Groups of approximately 3-4 youth

Materials Needed for Each Group
- Flip chart paper and writing implements
- One (1) roll of aluminum foil (18-inch width)
- One spray bottle per group
- At least two water-soluble markers per group (watercolor markers work well)

Getting Ready
- Cut a piece of aluminum foil for each group that measures approximately 18” x 18”.
- Fill the spray bottles with water.
- Divide the youth into four groups of 3-4 individuals.
- Provide each group with 1-2 sheets of flip chart paper and writing implements.
- Provide each group with two (2) watercolor markers. Make sure each group has two different colors.

Opening Questions/Prompts
Ask the youth to share their answers to these questions either verbally or by recording their responses on the flip chart paper provided.
- Explain what you know about different ways that water is used by humans who live in agricultural areas.
- Explain what you know about different ways that water is used by humans who live in urban areas.
- Discuss ways in which urban water use is similar to agricultural water use. Discuss ways they are different.
- Discuss the types of pollutants you think might be present in urban and agricultural areas. How do you think they might be similar? How do you think they might be different?
**Procedure (Experiencing)**

1. Explain to the youth that the foil represents a large piece of land. Each square inch of the aluminum foil represents 10 square kilometers.

2. Instruct the groups to draw a line down the center of the foil using one of their markers.

3. Using **one** of the water color markers, draw pictures that depict an urban setting on one side of the piece of foil. Using the **other** water color marker, draw pictures that depict an agricultural setting on opposite side.

4. Have each group loosely crumple their piece of aluminum foil and then gently pull out all four corners of the square. This should return the foil to its approximate square shape, but still allow for the foil to have some “peaks and valleys” that represent different land forms.

5. Using a spray bottle to simulate rain, have the youth gently spray their foil. Spray water on the foil from a distance of approximately 10-12 inches above the foil. Spray the foil approximately 10 times consecutively to simulate a rain storm.

6. Instruct the youth to record their observations and make comparisons with other groups.

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**Volunteer Tip:** See Figure 3 below.

**Figure 3**

- **a.** Square piece of aluminum foil, approximately 18” x 18” (45.7 cm x 45.7 cm).
- **b.** Loosely crumple the foil.
- **c.** Gently pull out all four corners of the square.
- **d.** The foil should return to its approximate square shape, but have some “peaks and valleys” that represent different land forms.
Sharing, Processing, and Generalizing
Follow the lines of thinking developed by the youth as they share and compare their thoughts, observations, and procedures; if necessary, use more targeted questions or prompts to get to particular points. Specific questions might include:

1. Ask the youth to explain what happened when they sprayed their “land” with water.

2. Discuss the significance of the flow of water through their “land” with respect to the “urban” and “agricultural” areas they identified.

3. Discuss ways you think the movement of water across your land might impact the potential mixing of pollutants from urban and agricultural areas.

Concept and Term Discovery/Introduction
Be sure to introduce the terms urban/rural interface, watershed, point source pollution, and non-point source pollution within the context of water usage, water quality, and water quantity. (Note: The goal is to have the youth develop concepts through their own exploration and define terms using their own words.)

Concept Application
The true test of learners’ understanding is when they can apply new knowledge and skills to authentic situations. When engaging youth in inquiry-based learning, hands-on activities serve as vehicles for learning new concept knowledge and skills; however, it is the application of new knowledge or skills to independent, real-world situations that is the critical factor in the learning process. Thus, to complete the cycle of experiential learning it is important to provide youth specific opportunities for authentic applications. Suggestions for real-world applications for the activity include:

1. Have youth investigate their community or a community in their area. Where is there an interface between urban (or suburban/small town) and rural. What are the potential types and sources of point and non-point pollution?

2. Contact your state or regional water resources control board or water resources agency, offices that regulate water allocation and help ensure water quality protection. Learn strategies that your state or region has in effect or planned to manage issues that arise with respect to the urban/rural interface.