Lesson 2 – Smart Landscapes – Part A

Investigative Question:

- What does water-efficient landscapes or xeriscaping mean?
- How can you harvest rainwater to transform an impermeable plot of land on your school grounds into a water-efficient oasis?

Slides: **Lesson 2 Part A Slides PowerPoint**
Lesson 2 Part A Slides PDFs
Lesson 2 Part A Google Slides

Materials Needed:

- Spray Bottle
- Colored pencils – 1 per group
- Rulers
- Student notes/observations pages - one per student/or group
- APW Materials left for class to utilize – Fake plants & Student Handbook
  - **Roof Demo Kit:** (aluminum pan, soil, clay, miniature house)
  - **Student Handbook per group which includes:**
    - Background Info on Water Efficient Landscapes
    - Rubric for Smart Landscape Design
    - Images of Landscapes before and After
    - Native Plants for Water-Efficient Landscapes Student Copy Pages
- Storm to Shade Video of xeriscape garden - play at beginning of lesson
- Storm to Shade Green Infrastructure – play at end of lesson
- Storm to Shade Infographic for Green Infrastructure

Warm Up:

1. **Discuss what is meant by the terms low-water use landscaping, Xeriscape** (pronounced zeer-ih-scape), **and water-efficient landscaping.** These terms are often used interchangeably to refer to landscapes that need little water to maintain them. Briefly discuss the Rubric for Smart Landscape Design or "smart" landscaping and see Background Info on Water Efficient Landscapes in the student handbook.

2. **Use slides above or the student handbook to show students the "before and after" photographs of different landscapes.** Students can also spend time exploring the materials APW staff dropped off (the student handbook, and fake plants) to think about what is important for a water efficient garden. When a homeowner, business owner, or institution is deciding what type of landscaping to maintain, the choices are endless. However, in the hot and dry climates found in much of Arizona, outdoor water use for landscaping can consume tremendous amounts of water. Choosing landscaping that requires less water can conserve significant amounts of water, as well as requiring less time to maintain. Water efficient landscapes center around the use of plants that are adapted for arid conditions, often native species that evolved in the local environment.

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Investigations Activity:

1. **Review with students, "what is a watershed?"** Remind them of the definition learned the day before "a land area that drains or flows to a low point". This should be kept in mind as you proceed with today's activities.
   - Use the slides provided above to introduce or review with your students some urban watershed topics.
     - Have students define what a **permeable landscape** is and how water behaves on a permeable surface - water soaks or infiltrates into the soil. Once in the soil, it can go into plants or keep traveling further to reach groundwater. Some water also evaporates. Have students write down examples of permeable landscapes in their notebooks.
     - Have students define what an **impermeable landscape** is and how water behaves on an impermeable surface - water stays on the surface or runs off. Water can also evaporate.
     - Have students define what the **urban heat island effect** is and how water behaves in this landscape – there may be less rain overall because of the heat dome or if there is rain there is more runoff that can't soak in. Water can also evaporate faster. Have students write down examples of things that might increase heat (pavement, buildings, AC units, cars) or suggest things that might cool down the urban environment (trees).

2. **Ask students if they have ever tried to capture and store rainwater from their roof or water from a stream or arroyo.** Discuss some of the benefits of using rainwater; it is free; using it saves tap water; it doesn't contain salts, so plants love it; if it is captured, it doesn't flood the streets. When a yard or ground is designed to make maximum use of rainwater by having topography that slows its flow across the ground (berms, swales, etc.), more water can seep into the soil and help sustain soil moisture levels between rain events. This process of slowing down and spreading out water also helps more rainwater reach our **groundwater** system.

3. **Have students gather around the soil pan. Make sure you start with level, evenly deep soil.** Prop one end of the pan on a book with a one-inch spine to create a slope.
   - Use the spray bottle to simulate rainfall on the "roof" of the house
   - Observe the way the water runs off the roof, where it causes indentations to form in the soil, what runoff and erosion patterns result, etc.
   - Experiment with building small berms to slow the flow of runoff. Ask the students to brainstorm ways they could control the runoff and capture it to store it for future use.
   - Talk about using gutters to direct rainwater, cisterns or rain barrels to store it, and using the topography of the land to control where water runs.
   - Ask them to think about how water flows off the flat roof of their school. Have they observed this happening? How is it directed to the ground and where does it flow after that?

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4. **Take the class outside for a "watershed tour" of your school grounds.** Have each student bring Student notes/observations pages to record their observations, and the **student handbook** so they can reference the questions below and their Native Plants for Water-Efficient Landscapes copy pages (they will be looking at the photos of native plants later in the tour).

5. **Focus on the area around the building first.**
   - Look for places where water drains off the roof, and follow the paths water would take, noticing where it leaves the school grounds. Where are high and low areas?
   - Does the rainwater get used to water landscaping, or does it get directed off the school grounds as quickly as possible?
   - Are there design features in the parking lots where water can flow into low, vegetated areas, or is it curbed? Is most of the ground surface permeable or impermeable to water?

6. **After you have explored the rainwater drainage patterns of your school grounds and identified high and low areas, areas of high runoff, and areas where water can soak in, ask the students to brainstorm ways to keep the water on the grounds where it can be used to water landscaping and recharge the ground water.**
   - How could the rainwater be stored so that it can be used when needed?
   - Ask them to think about where they would place rainwater holding tanks, and how they would get the water from the tanks to the landscaping.
   - How big would the tanks need to be? Calculating the size of holding tanks will be practiced in *Part II* of this activity.
   - Can they think of ways to restore more natural topography to the school grounds to keep water from running off?
   - Are there places where concrete and asphalt could be replaced with more permeable surfaces such as sand or gravel to allow more water to soak into the ground?

7. **Now ask students to focus on the vegetation.**
   - How many different species of plants do they notice? Are there trees, shrubs, cacti, etc? How much of the grounds are covered with turf grass? Are the places that have grass used for play areas and eating areas, or are they just to be looked at?
   - Have the students look at the photos of native plants in their packets. Do they see any of the native plants that are included in their packets growing on the school grounds?
   - Ask them to think about where they would incorporate native species in the landscaping and whether or not the turf grass (which uses high volumes of water) is necessary in all the places it is currently growing. Replacing turf grass with native vegetation (in decorative areas) or artificial turf (in playing areas) can conserve a lot of water.

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Additional Resources:

- City of Tucson Storm to Shade
  - Green Stormwater Infrastructure – animated design example
  - Storm to Shade video by Tucson Water
- https://www.weather.gov/wrh/climate?wfo=twc
- https://storymaps.arcgis.com/stories/b9c35f205ea14015a23b446ff75eeeb4
- Rain Log - https://rainlog.org/map#6.3/34.234/-111.93
- Green Stormwater Infrastructure for Residents – City of Phoenix
- Landscape Plants for the Arizona Desert – Low-Water-Use Plants
- Landscaping with Style
- Low Water Use & Drought Tolerant Plant List – Tucson AMA Area
- Passive Water Harvesting
- When It Rains It Runs Off
- RainScapes Brochure
- Rainwater Storage System
- Harvesting Rainwater
- Welcome Wildlife to Your Garden
- Tucson Water Rainwater Harvesting Maintenance Tips Video
- https://wateruseitwisely.com/saving-water-outdoors/rainwater-harvesting/
- H is for Habitat
- Landscape for Wildlife
- Backyard Habitat
- Guide to Water-Efficient Landscaping – Tucson Water
- Plants for the Arizona Desert
- Build a Rain Garden
- Arizona Groundwater Videos
- **Optional Investigation Activity:** HS Worksheet Runoff & Heat Investigation