

# Lesson 2: Part A

## Smart Landscapes

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### Investigative Questions

- 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?

# Smart Landscapes: Lesson 2 Part A



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## Water-Efficient Landscapes & Gardens

Rubric For Smart Landscape Design - Group Name:				
Criteria: Scale of 0-10 (Perfect score 40)	Effective means of storing and channeling water for beneficial use (rain barrels, swales, etc.).	Effective means of temperature control (shade trees, permeable surfaces, etc.).	Effective use of native, drought-tolerant plants (nonnative plant use should be justified).	Attractive and efficient landscape (variety of plants of different sizes, colors, textures, etc.).
Fully Met: 9-10				
Partially Met: 7-8				
Half Met: 5-6				
Did not meet: 0-4				

Total Score:

**Xeriscape** (zeer-i-scape) = "Dry Garden"

# Effective Water Usage



**Store and Channel Water for Beneficial Use**

Create berms and swales to slow, spread out and sink water, to keep it where we need it (as groundwater).



Use rain gutters & rain barrels to capture water for later use.



# Cool it Down

## Create Shade

- Plant trees and use permeable surfaces.
- Cool neighborhoods to promote more recreational use.
- Help mitigate the urban heat island effect.



# Effective Use of Native & Drought-tolerant Plants



**Saves water and provides habitat and food for animals.**



# Attractive & Efficient Landscape



# Warm Up: Lesson 2 Part A

## Before & After... What do you notice?



# Warm Up: Lesson 2 Part A

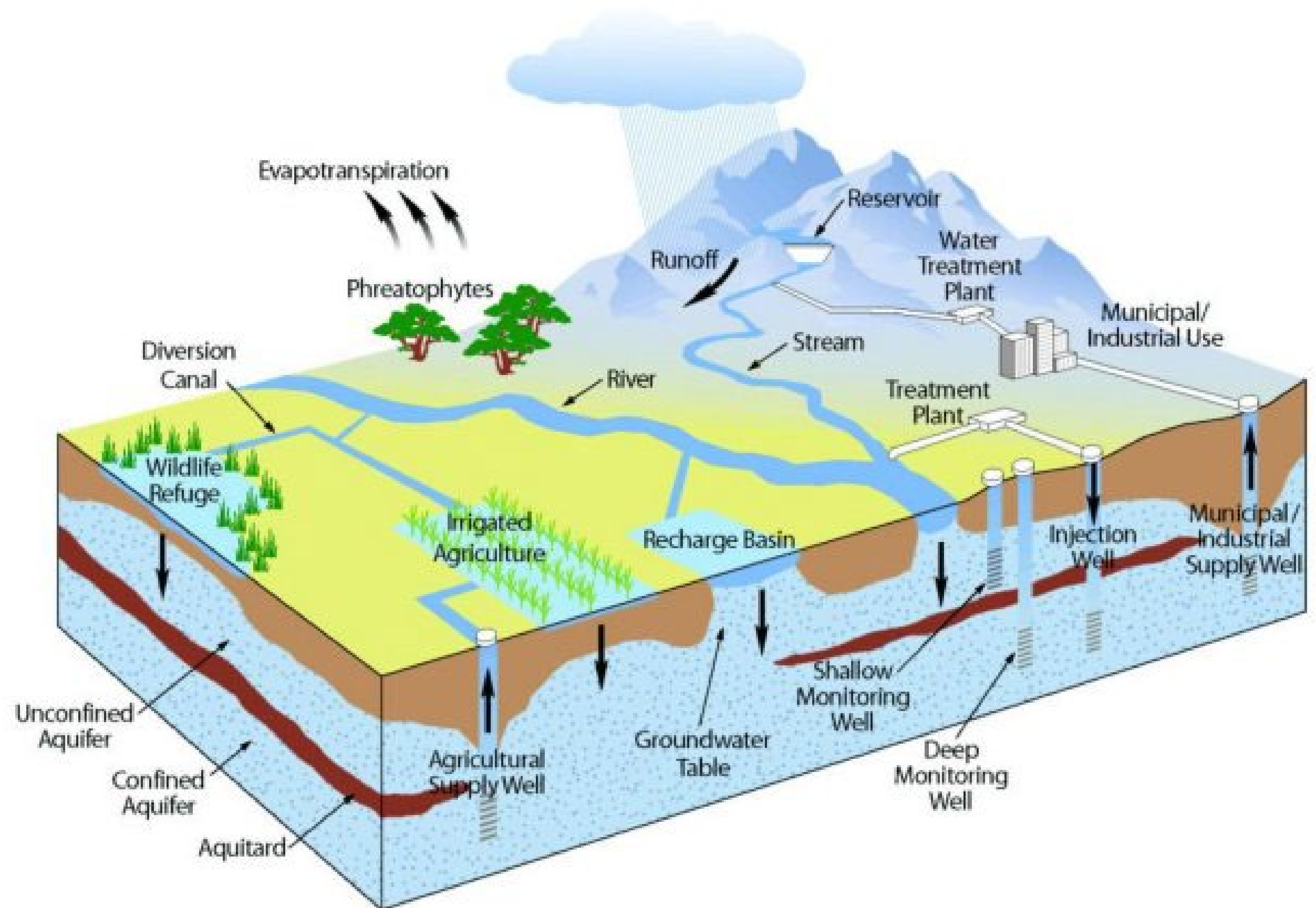
## Before & After... What do you notice?



# Smart Landscapes: Lesson 2 Part A

The water cycle connects us to our watershed and groundwater systems.

Everything is connected!



# Smart Landscapes: Human Impacts

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## *Urban Watersheds*

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### **Investigative Questions**

- How does human impact on the land affect water and heat within a watershed?
- How can we reduce urban runoff and the flow of contaminants from going into our watersheds and groundwater?

# Smart Landscapes: Human Impacts

## Following the Flow



- When rain falls or when snow melts, does the water just sit there? Or does it move? Why?
- We know some of it may percolate down through earth materials into the ground, but most of it flows downhill as what?

Runoff is important as it keeps our rivers, lakes and groundwater flowing. But...





# PERMEABLE

Water can sink in or percolate into the earth materials, where plants can use it, or it keeps traveling further down to reach groundwater (infiltration).

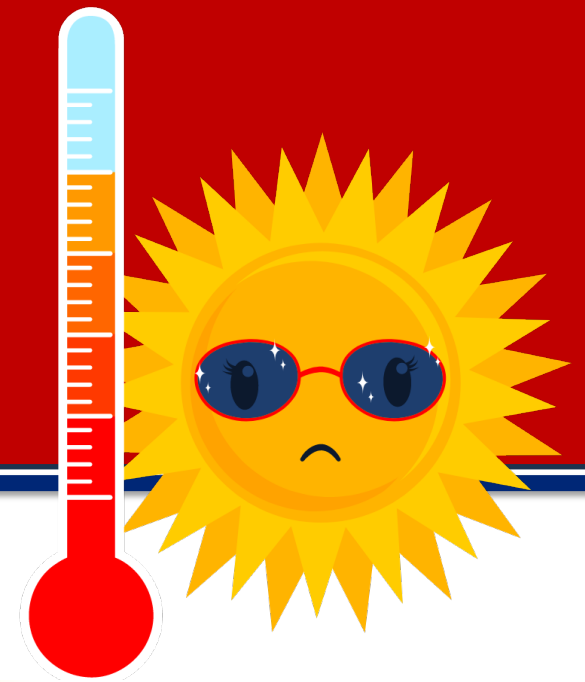
# IMPERMEABLE

Water cannot penetrate or percolate, but rather pools or runs off the surface. These are also called impervious surfaces.

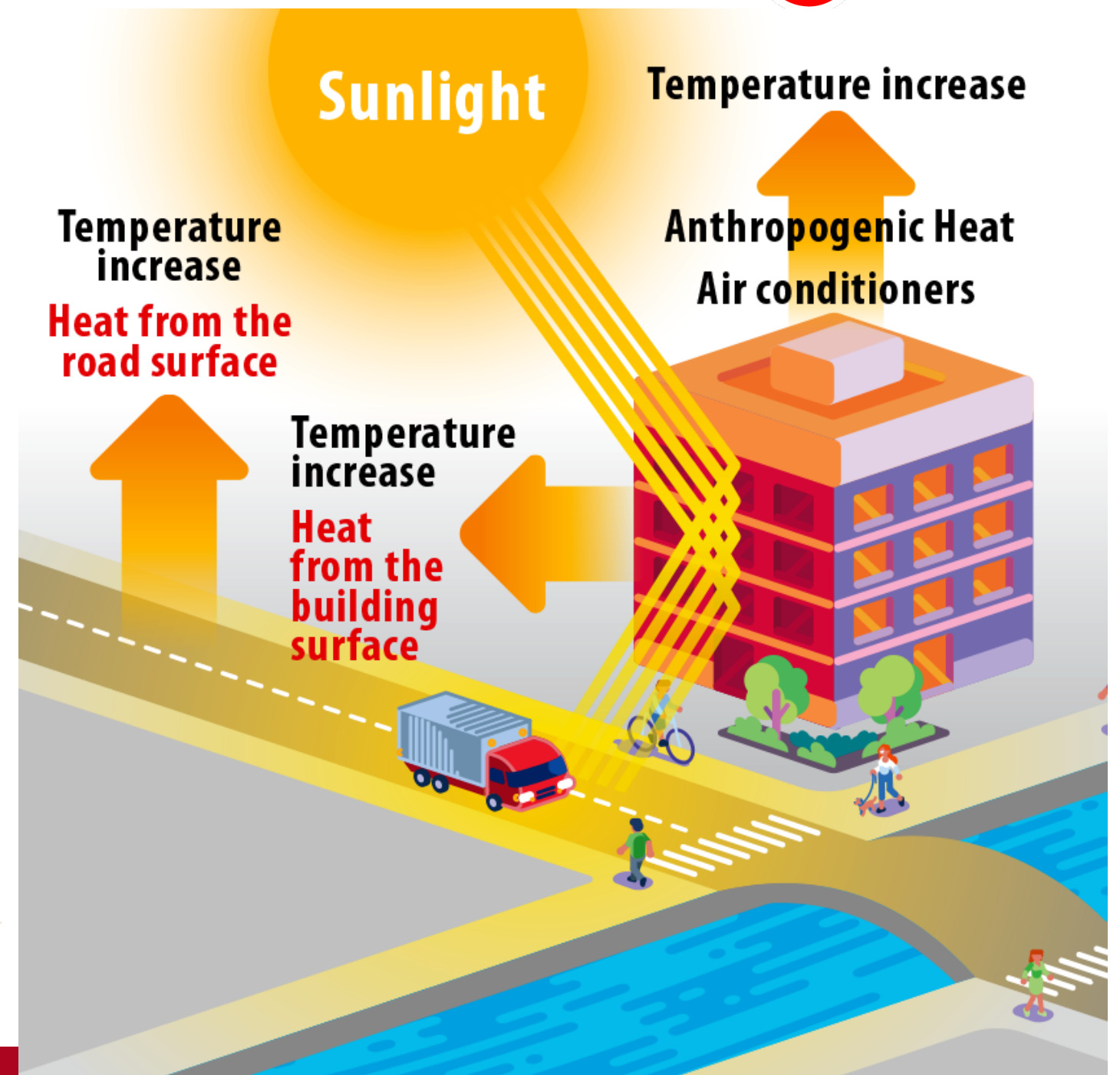


**HOT!**

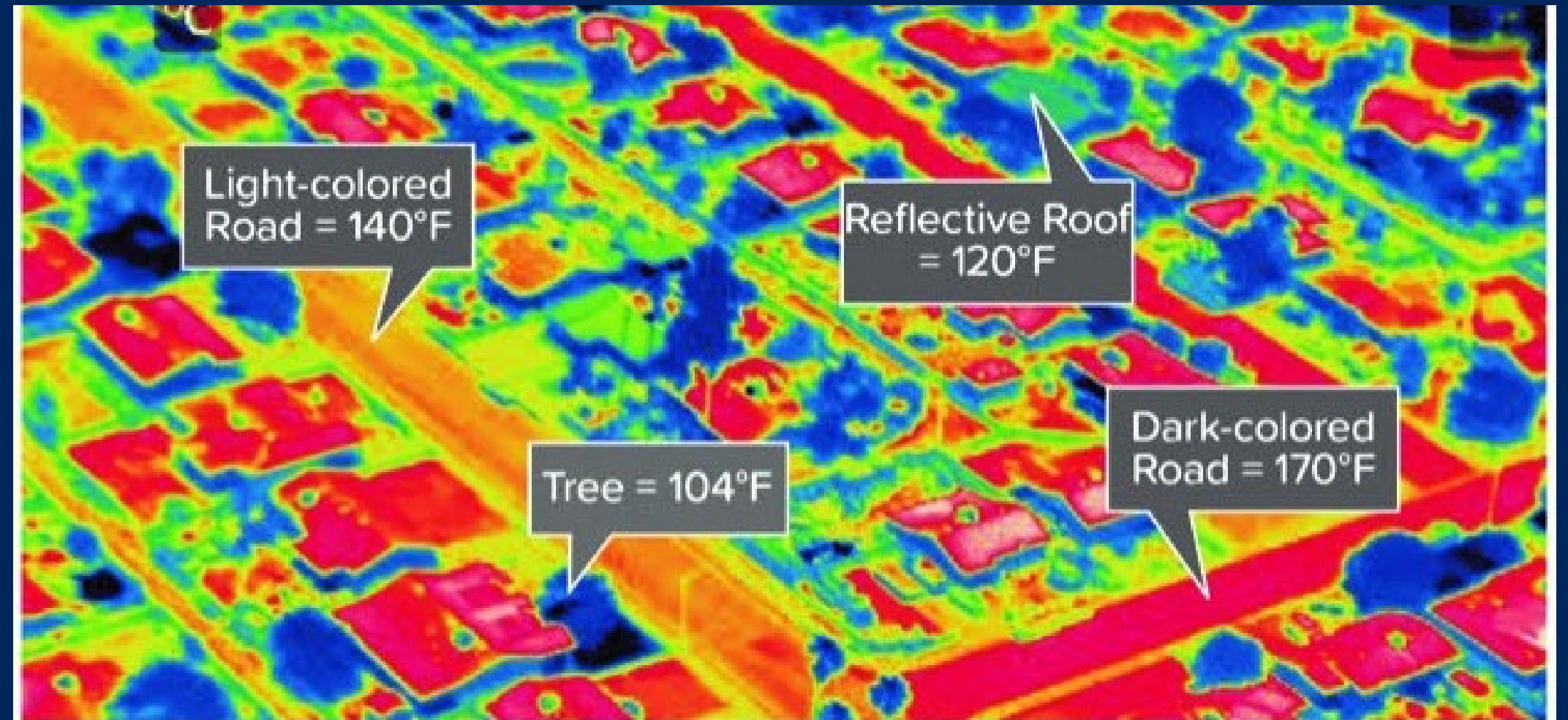
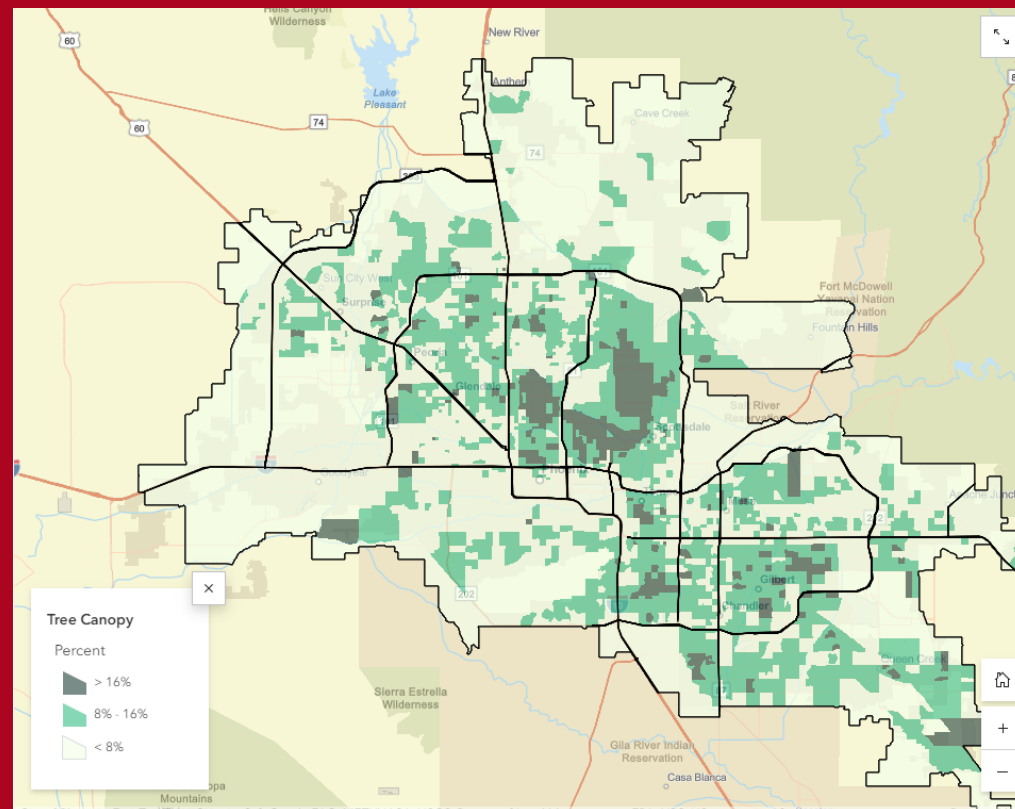
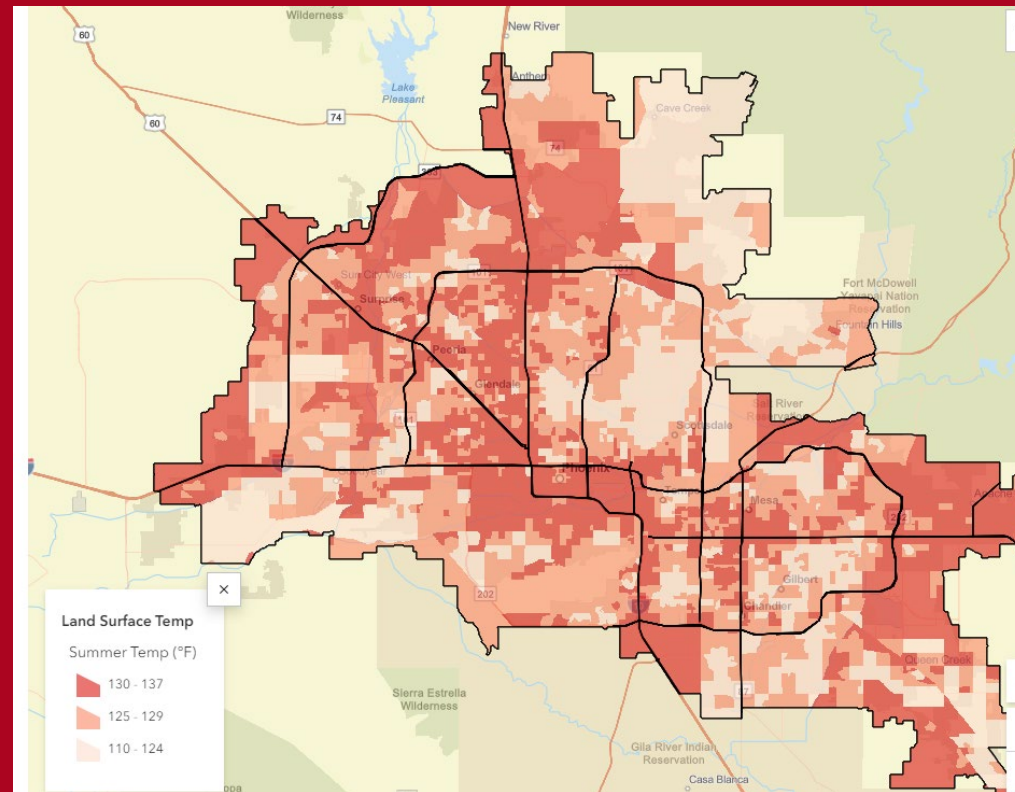
# Too Hot to Handle!



## What else happens when we have impermeable surfaces?



# Urban Heat Island Effect



This is a thermal photograph of a Phoenix neighborhood taken from a helicopter on a hot summer day. Look how different the surface temperatures are of the hot surfaces, like streets and roofs, compared to the cool ones, like trees!

# Air Temp, Quality & Rain Changes Too!

## What else happens when city temps are warmer?

CLIMATE

### What is a heat dome?

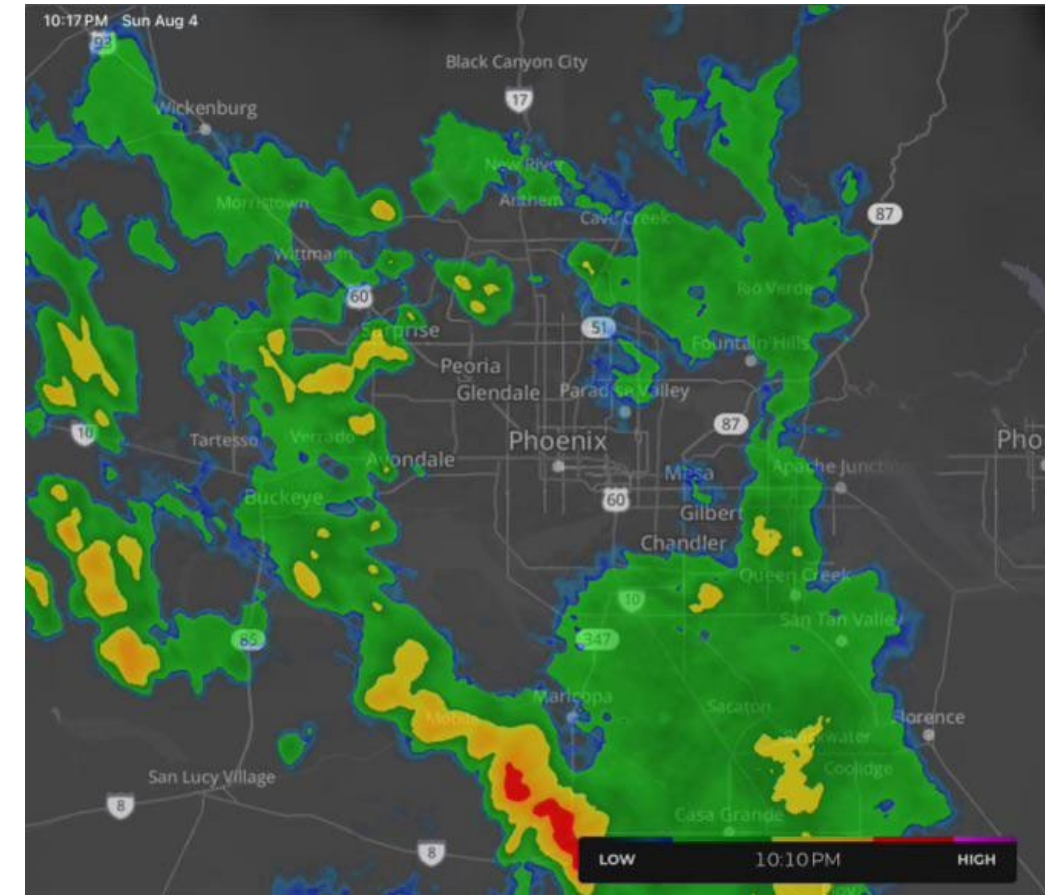
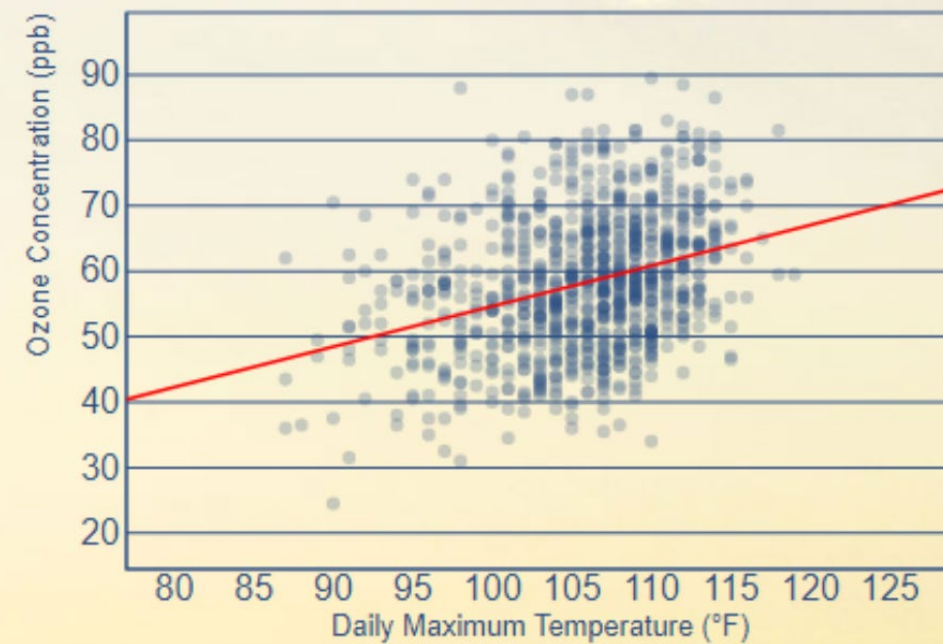
A high-pressure system in the atmosphere that traps heat over a certain area.

High pressure acts as a cap, trapping heat at the Earth's surface

The heat in turn prevents convective clouds from building up, reducing the chances of rain

The end result is a continual build-up of heat at the surface that is experienced as a heatwave

### Hotter Phoenix Temperatures Mean More Air Pollution



City smog



Wildfires



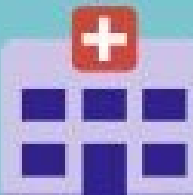
Poor air quality



Respiratory illness



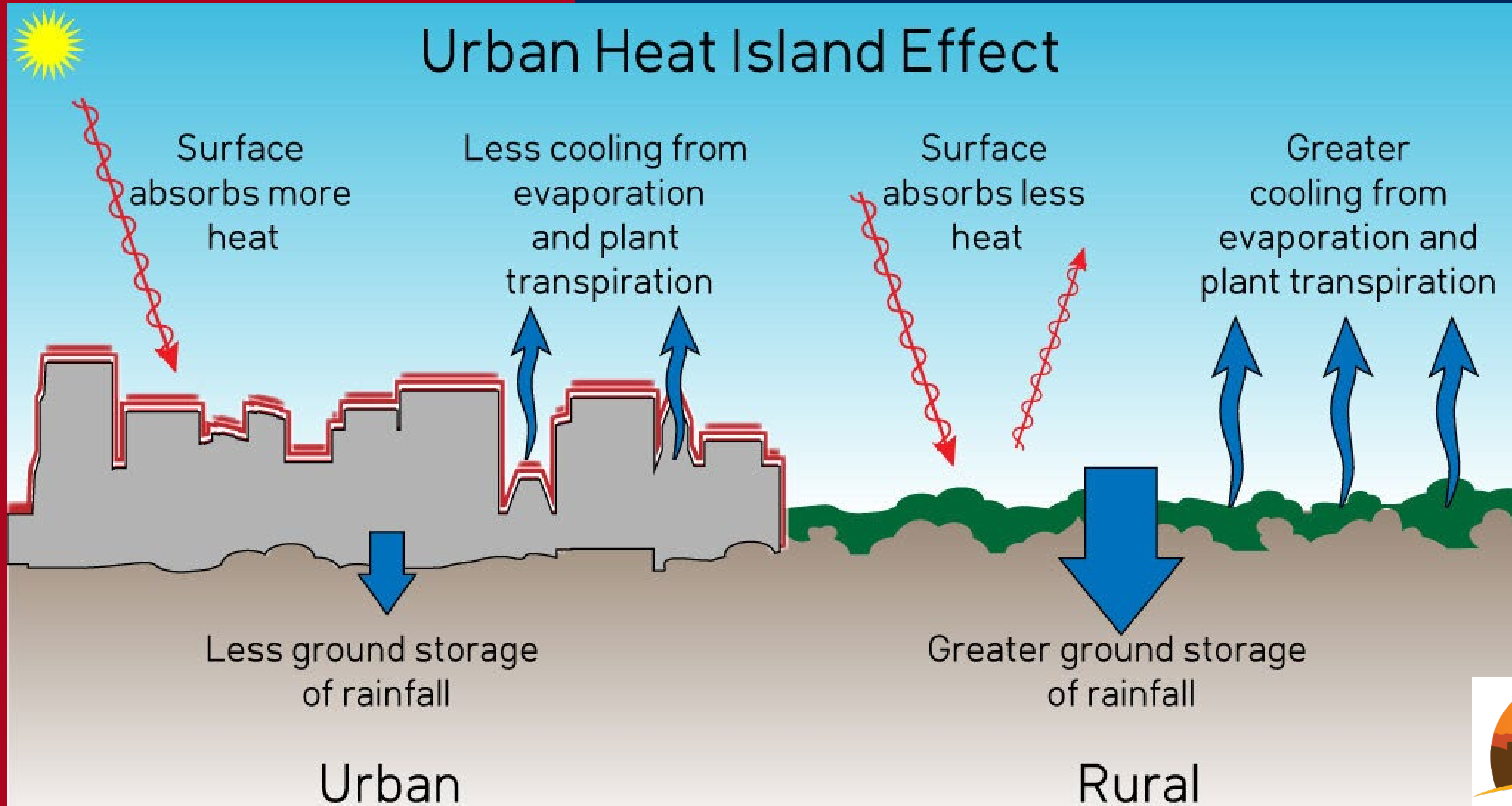
Heart-related illness



Hospital visits



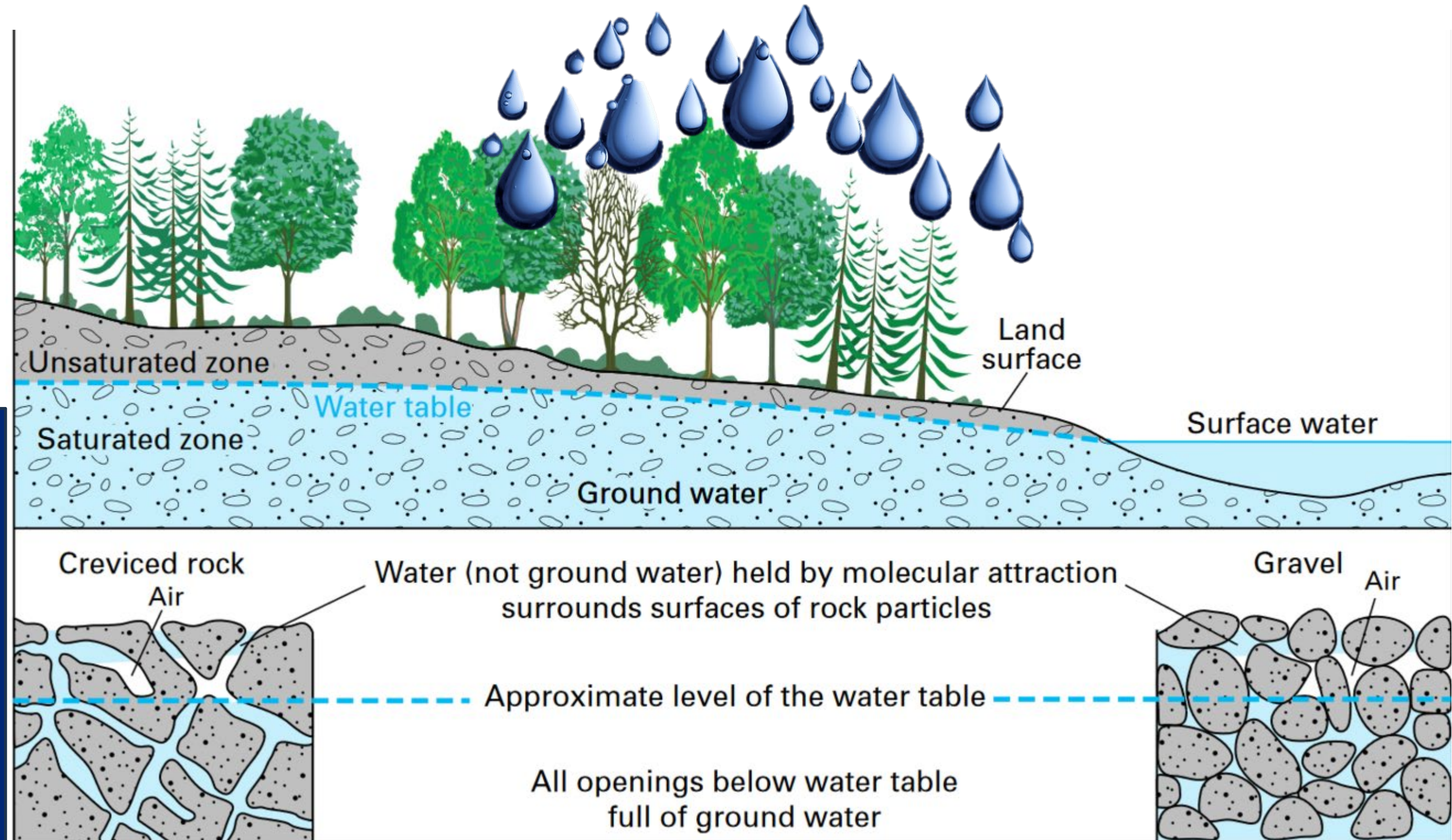
# Urban Heat & Water



# Let's Dig In!

## Pore Spaces

Groundwater moves between the spaces and pores and is pulled down due to gravity. The bigger the spaces between the materials, the faster or easier the water can move between it.

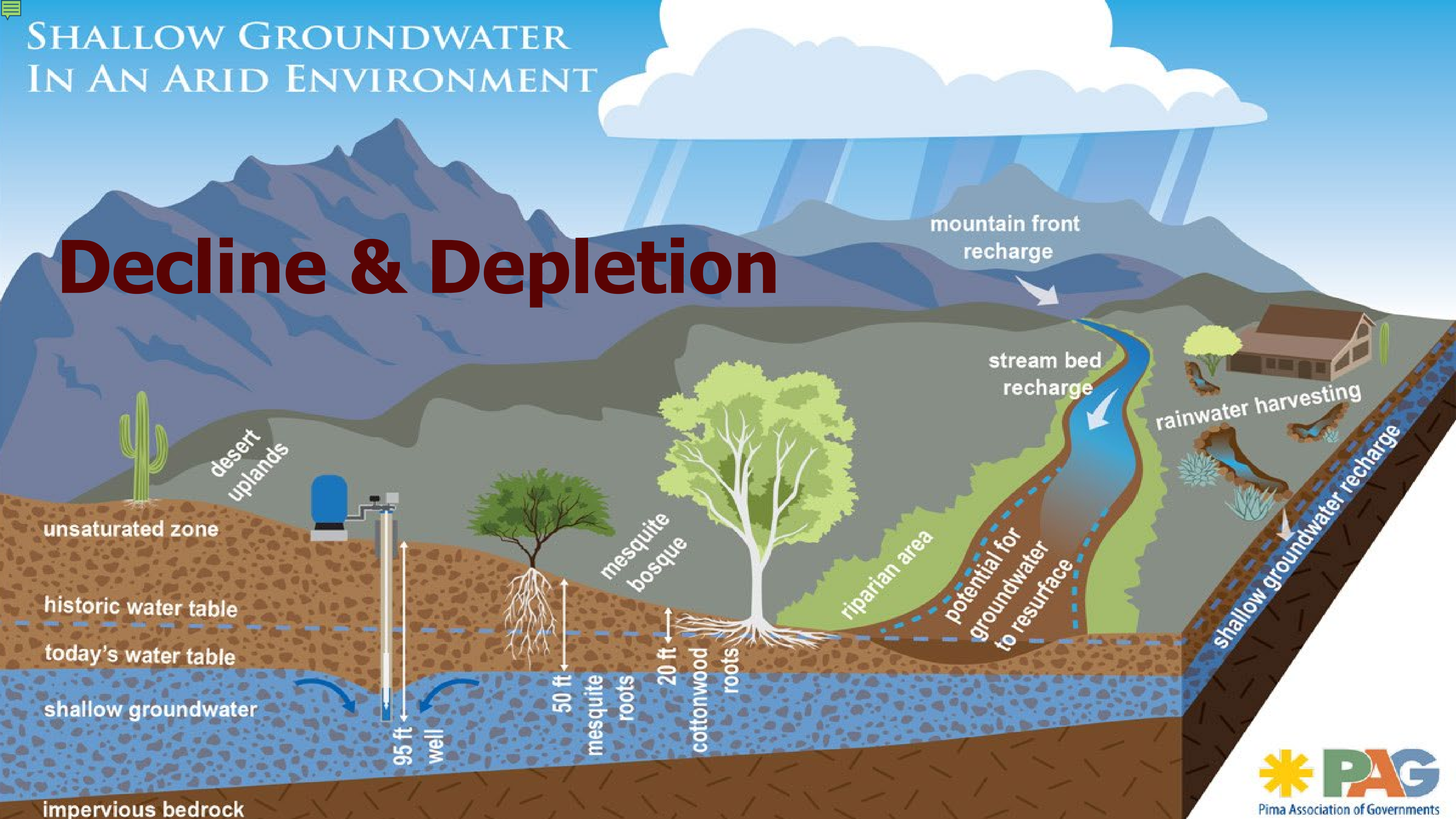


## Aquifer:

An area where significant groundwater is present. Groundwater flows between layers of earth materials.

# SHALLOW GROUNDWATER IN AN ARID ENVIRONMENT

## Decline & Depletion



# Smart Landscapes: Human Impacts

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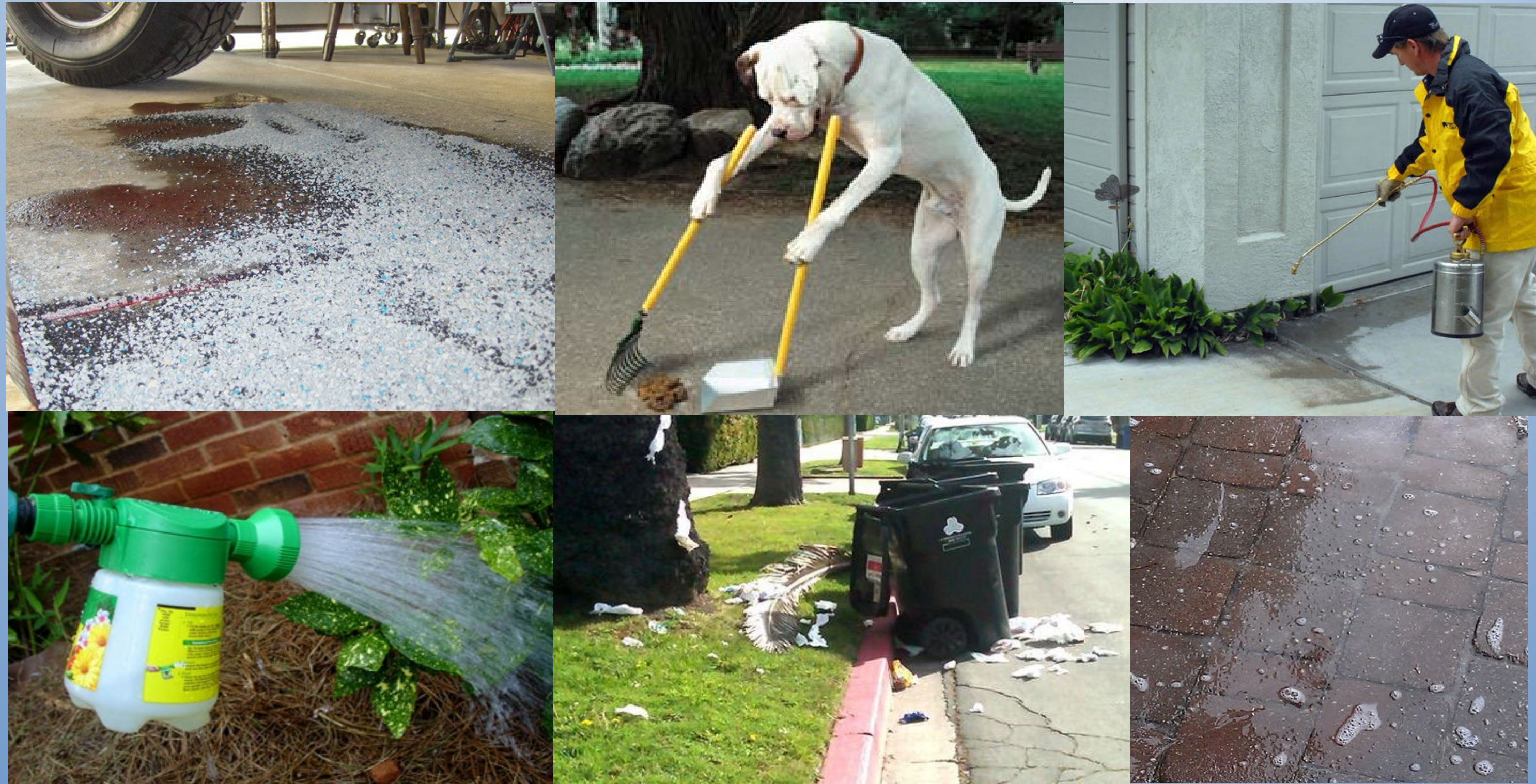
**In our city centers and neighborhoods  
what happens to that runoff?**



Rain  
becomes  
storm  
water!



# What makes storm water a bad thing?



**SOIL – SEDIMENTS – ROAD SALT – VEHICLE SPILLS – FERTILIZERS – PET WASTE  
– HEATED WATER – GREASE – TRASH – DETERGENT – SOLVENTS**



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# Where does storm water go?



To our rivers,  
lakes, and  
natural  
environment.



# Check out Green Stormwater Infrastructure



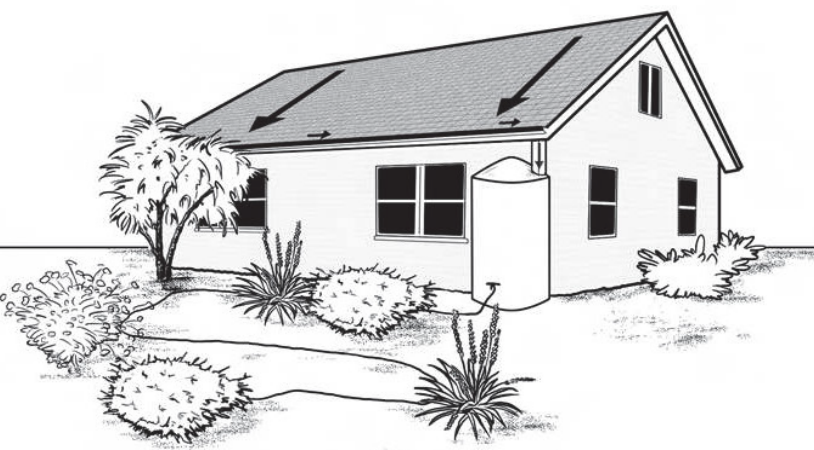
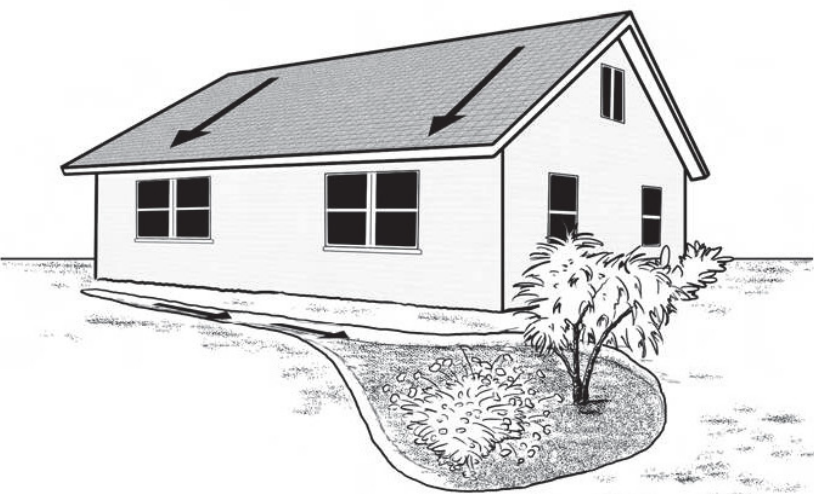
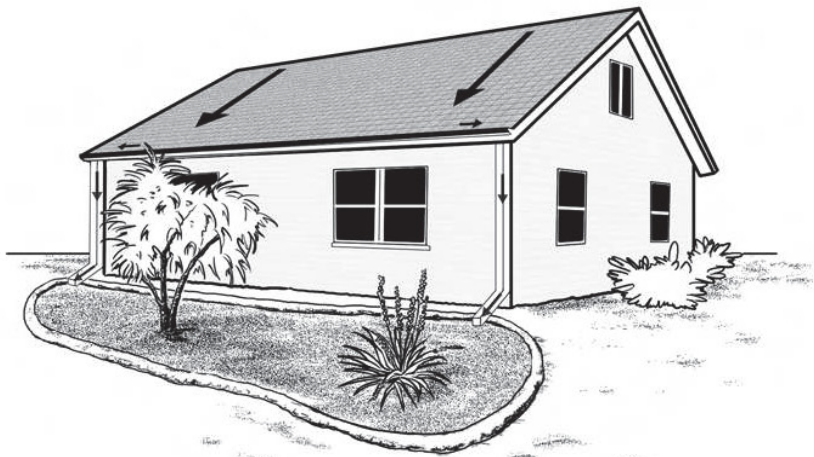
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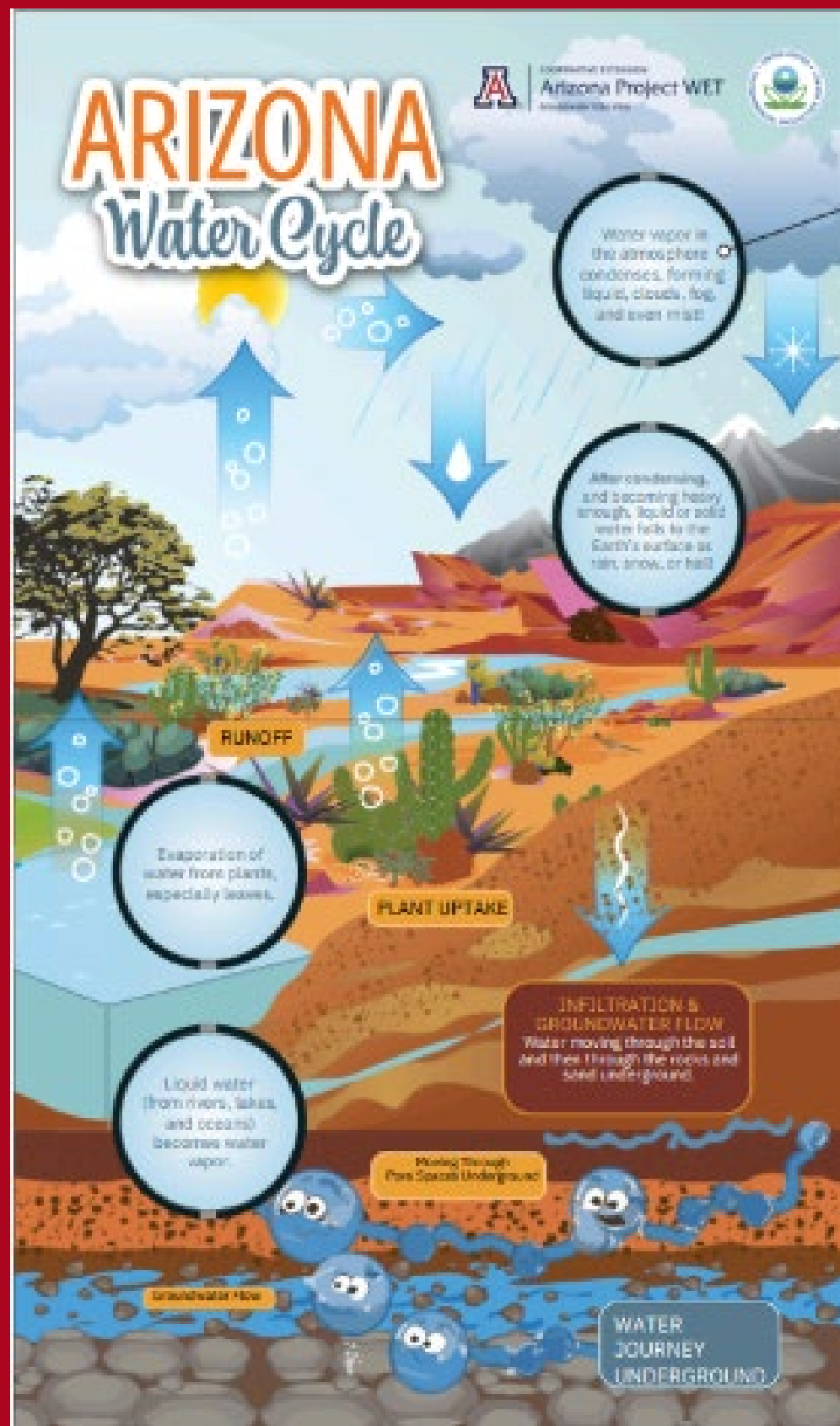


# Smart Landscapes: Human Impacts

## Lesson 2: Part A - Activities:

- Activity 1: Soil Pan
  - Student groups simulate and observe how water runs off a roof and then experiment to see if they can capture the runoff.
- Activity 2: “Watershed Tour” of School Grounds
  - Student groups record observations of where water drains on their school grounds (find high and low areas, impermeable vs. permeable spaces). They brainstorm ways to keep the water on the grounds for landscaping and focus on native plants.





## Lesson 2 Part A Wrap-Up

- Now we know changes we make to the land affect the water and even the temperature within our watersheds.
  - So how do those changes interact with the water in the water cycle and groundwater?
  - Can we reduce the flow of runoff and contaminants within our watershed ?
- What can we design instead?

**Systems and System Models  
& Cause and Effect**