



OBJECTIVE ‖‖‖ To demonstrate how permeable pavement can help mitigate flooding in cities

MATERIALS

- ‖‖‖ Paint tray or baking dish
- ‖‖‖ Sponges
- ‖‖‖ Spray bottle
- ‖‖‖ Cup
- ‖‖‖ Toy houses, trees, or animals (try LEGOS!)
- ‖‖‖ Paper towels
- ‖‖‖ Water bucket

INSTRUCTIONS

- 1. Permeable Surfaces: Adapting to Flooding and Extreme Weather**
 - a. Set up the trees, houses and animals in the tray or dish.
 - b. Spray the water on the tray. This represents rain falling on roadways or other impermeable paved surfaces.
 - i. What happens? It collects on the roadway and on the pavement.
 - c. Now, pour the water on the impermeable surfaces. This represents heavy rain and flooding, which has been happening to a greater degree due to climate change.
 - i. What happens? The water rushes off, taking the trees, houses and animals with it.
 - d. Dump out the water and reset the trees, houses and animals.
 - e. Now “plant” some grass, represented by the sponges, on some parts of the tray. Spray the rain on this permeable grass surface and the impermeable roadway.
 - i. What happens? The water is absorbed into the “grass” while it collects on the roadway.
 - f. Pour the flood water on the sponge and the roadway.
 - i. What happens? The water is absorbed into the grass more easily and the trees, houses and animals do not get rushed away.

BACKGROUND INFORMATION

Permeable Surfaces

‖‖‖ What is the difference between permeable and impermeable surfaces? Permeable surfaces (also known as porous or pervious surfaces) allow water to percolate into the soil to filter out pollutants and recharge the water table. Impermeable/impervious surfaces are solid surfaces that don’t allow water to penetrate, forcing it to run off.

‖‖‖ Impermeable Surfaces

- Asphalt
- Concrete



- Pavers
- Traditional stone, brick or concrete

☞ Permeable Surfaces

- Planting beds
- Mulched beds
- Gravel
- Permeable pavers
- Turf

☞ What is the impact of impermeable surfaces on the environment? Urban and suburban sites typically contain large expanses of impermeable surface, causing a host of problems:

- Pollution of surface water: When stormwater runs off impermeable surfaces, it picks up pollutants as it flows into storm drains. The contaminated water then flows directly into rivers, lakes, wetlands and oceans, generating problems for biodiversity as well as public health.
- Flooding of surface water and erosion of stream banks: During periods of heavy rainfall, large amounts of impermeable surfaces generate large amounts of runoff. This sudden influx of runoff into rivers can cause flash flooding and erosion of stream banks.
- Water table is not adequately recharged: Because impermeable surfaces send rainwater into storm drains rather than allow it to percolate down to our aquifers, groundwater may be used faster than it is recharged
- Formation of stagnate water puddles. On impermeable surfaces where runoff has no drainage route, stormwater can puddle for long periods of time. Stagnate puddles can become breeding places for undesirable insects such as mosquitoes.
- Heat island effect: Due to the heat-absorbing quality of asphalt and other paving materials, sites with high ratios of impermeable surfaces increase ambient air temperatures and require more energy for cooling.

☞ How can I reduce the amount or effects of impermeable surfaces?

- Provide maximum permeability of surfaces in your landscape.
- Replace surfaces in your landscape to promote maximum permeability.
- Reduce the environmental impact of impermeable surfaces through on-site management of stormwater, such as:
 - Rain gardens: Rain gardens, sometimes called bio-retention areas, are shallow depressions in the landscape that capture stormwater and allow it to gradually percolate into the soil. Planted with moisture-loving plants that help filter out pollutants, rain gardens provide an attractive way to reduce the impact of stormwater on the environment.
 - Rain barrels and cisterns: Water tanks stored above and/or below ground can capture rainwater from downspouts for later use. They are available in many styles, materials and sizes to accommodate a variety of needs.
 - Green roofs: A green roof is a specially-engineered rooftop that supports plant life and captures rainwater before it runs off. Green roofs have been utilized in Europe for 30 years and are quickly gaining popularity in the United States.
 - French drains: French drains are ditches filled with gravel or rock



used to capture stormwater and direct its flow. They can be utilized on the downslope side of impermeable surfaces to move runoff to an area where it can infiltrate the soil.

- Permeable pavers: Permeable pavers are specially fabricated paving units designed to replace asphalt and other impermeable paving materials. Interconnected pore spaces within the material channel water into the underlying soil or into a special storage layer which forces slow percolation during periods of heavy rainfall. Permeable pavers are often laid on a bed of sand or gravel to enhance drainage properties.
- The Philadelphia Water Department helps run the Philadelphia RainCheck Program, which offers subsidized groundwater-runoff reduction solutions: <https://www.pwdraincheck.org/en/>

