The Consequences of Human Nature on Mother Nature

The Effects of Oil from Infrastructure on Wildflowers

Research Question: Does oil from runoff pollution affect the growth rate or survivability rate of wildflowers in the surrounding area?

Objective/Motivation:

• Our objective through this project was to find out what effect this polluted runoff has on land-based plants like trees, crops, and of course, wildflowers.

What is in runoff/nonpoint source pollution?

- <u>Nonpoint source pollution</u> (any pollution that does not come from a pipe) can often contain toxins that are harmful to the environment.
- It can come from highways, driveways, gravel lots, and even your backyard!
- <u>Runoff pollution</u> is often a mix of several different components, including (but not limited to): sediments, heavy metals, pesticides, fertilizers, plastic waste, and oil/grease.
- All of these components can have adverse impacts on the environments ("Controlling Nonpoint Source Runoff", 1995; Kayhanian et al., 2003; "Erosion Sediment and Runoff Control", 2012; Bank et al, 2003).



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Table 1. Typical pollutants found in runoff from roads and highways.

	Pollutant	Source
Sedimentation Particulates		Pavement wear, vehicles, the atmosphere and maintenance activities
Nutrients	Nitrogen & phosphorus	Atmosphere and fertilizer application
	Lead	Leaded gasoline from auto exhausts and tire wear
	Zinc	Tire wear, motor oil and grease
	Iron	Auto body rust, steel highway structures such as bridges and guardrails, and moving engine parts
	Copper	Metal plating, bearing and brushing wear, moving engine parts, brake lining wear, fungicides & insecticides
	Cadmium	Tire wear and insecticide application
	Chromium	Metal plating, moving engine parts and brake lining wear
	Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, bushing wear, brake lining wear and asphalt paving
	Manganese	Moving engine parts
	Cyanide	Anti-caking compounds used to keep deicing salt granular
	Sodium, calcium & chloride	Deicing salts
	Sulphates	Roadway beds, fuel and deicing salts
Hydrocarbons	Petroleum	Spills, leaks, antifreeze and hydraulic fluids and asphalt surface leachate

Erosion, Sediment and Runoff Control for Roads and Highways. (2012

Why does this matter?

- Most of runoff pollution comes from "<u>impervious</u> <u>surfaces</u>", artificial structures covered with waterproof materials like asphalt.
- These surfaces (roads, sidewalks, and driveways) have only increased with urbanization- meaning that pollution from these surfaces has increased.

What does this have to do with wildflowers?

- Wildflowers: often used to prevent runoff on the side of roads and highways.
- 500+ acres planted near highways in VA (VDOT Wildflowers Color Virginia 2005)
- More popular than grass swales and turfgrass due to their tough nature and cost effectivity.
- Catch pollutants in their stems and leaves, meaning that polluted runoff will sink into the soil rather than harm the plants or aquatic ecosystems nearby.

What effect is runoff having in recent years?

- The rate of urbanization in Virginia is still on the rise, meaning that impervious surface area will be on the rise, subsequently increasing runoff pollution.
- Though information about oil and wildflowers specifically is limited, we know that wildflowers are a tough plant that have the potential to withstand pollution- including oil!



In conclusion:

- The information about the effects of oil, specifically on wildflowers is highly limited.
- We do know that runoff that comes from impervious surfaces will only increase as impervious surface area in Virginia continues to increase.
- Evidence was found for wildflowers' ability to catch pollutants in their leaves and stems, and cause pollutants to sink into the soil rather than runoff into nearby land or aquatic ecosystems.
- Although more research needs to be conducted, it may be beneficial for the environment to surround highways with wildflowers.

References: Agbogidi, et.al, 2007; Agbogidi, Bank, F. G., Cazenas, P. A., & Granato, G. E., 2003; EPA, 1995; Kayhanian, M., Singh, A., Suverkropp, C., & Borroum, S., 2003; Virginia Department of Environmental Quality, 2017; Washington, D.C.: Transportation Research Board, 1992