1.6 THE EFFECTS OF AIR POLLUTION ON PLANT

Pollution enters the environment from diffuse sources. The causes can be outright, such as the emissions from a coal-burning power plant. Other times, the source may be hard to identify, such as nonpoint source pollution (NSP), where there can be several contributors contaminating surface water. Pollutants can be substances, like pesticides, that do not naturally occur in the environment. Naturally occurring substances also carry risks by disrupting the chemical balance in the air or water. A pollutant, therefore, is any substance that can cause harm. The effects of pollutants can easily be detected on plant structure.

Leaf Structure

Pollutants such as ground-level ozone physically damage leaves by causing chlorosis, or an abnormal yellowing of the leaves, resulting from a deficiency of chlorophyll. Chlorophyll is vital for photosynthesis. This molecule fuels the food-making process by capturing energy from the sun. Without chlorophyll, a plant cannot manufacture food or energy. In areas with high concentrations of ozone, parts of the leaf will die as a result of exposure.

Delayed Flowering

Exposure to vehicle exhaust impacts plant structure by delaying the flowering of exposed plants, as reported in a study published in the journal "Environmental Pollution." A stressed plant will not flower but, rather, will use its resources to survive the threat. The study also noted an increase in senescence or plant aging. Because of the concentration of emissions, plants in urban environments were identified to be at the greatest risk.

Root Damage

Whether the source is acid rain caused by sulfur dioxide emissions or acidic mine drainage from abandoned mines, acidic soils create a complex scenario that results in plants' failure to thrive. Acidic conditions mobilize aluminum ions, normally present in a non-harmful form in the soil. The mobilized aluminum damages root systems and

prevents calcium uptake. The result is an overall slowing of plant growth from a lack of nutrients. Aluminum and other heavy metals can further impact plant structure by reducing soil bacteria. A reduction in soil micro-organisms prevents the breakdown of organic matter, resulting in a reduction of available nutrients.

Stomata Damage

Stomata are the tiny pores found on leaves. Their function is to act as sites of gas exchange between the plant and the atmosphere. Carbon dioxide is taken up through the stomata and oxygen released during photosynthesis. Pollution negatively impacts this plant structure by reducing the size of the stomata, as reported in a 2005 study published in the journal "Cellular and Molecular Life Sciences." When gas exchange is compromised, photosynthesis slows.

EEFECTS OF AIR POLLUTION ON ANIMALS:

- Animals, or wildlife, are vulnerable to harm from air pollution. Pollutant issues of concern include acid rain, heavy metals, persistent organic pollutants (POPs) and other toxic substances.
- Insects, worms, clams, fish, birds and mammals, all interact with their environment in different ways. As a result, each animal's exposure and vulnerability to the impacts of air pollution can be equally different.
- Air pollution can harm wildlife in two main ways.
- It affects the quality of the environment or habitat in which they live
- It affects the availability and quality of the food supply

Air pollution harms habitat:

- Habitat is the place in which animals live, including in and on the soil, as well as in water.

- Acid rain can change the chemistry and quality of soils and water. For example, water bodies can become too acidic for some animals to survive or have normal physiological functions.
- Alternatively, acid rain can increase the release of heavy metals, such as aluminum, from soils into water habitats.
- The result is higher availability of heavy metals in the water column, which are very toxic to many animals including fish.
- Some heavy metals, such as mercury, can be transported in the air long distances away from emission sources.

Although not as well understood, other forms of air pollution, such as smog, particulate matter, and ground-level ozone, to mention a few, likely affect wildlife health in similar ways to human health including harming the lungs and cardiovascular systems. An animal's vulnerability to air pollution is influenced by how it breathes - whether it uses lungs, gills or some other form of gas exchange, such as passive diffusion across the surface of the skin.

Air pollution harms food supply and quality :

- Many heavy metals, toxics, persistent organic pollutants (POPs) and other air pollutants affect wildlife by entering the food chain and damaging the supply and quality of food.
- Once consumed, many of these pollutants collect and are stored within the animal's tissues.
- As animals are eaten by other animals along the food chain, these pollutants continue to collect and increase in concentration. This process is called bioaccumulation.
- Top level predators such as bears and eagles, among many others, are particularly susceptible to the bioaccumulation of these types of air pollutants.

For example, mercury is of great enough concern that it is recommended we limit how often we eat certain types of fish that may contain high levels of heavy metal.

- Air pollutants can poison wildlife through the disruption of endocrine function, organ injury, increased vulnerability to stresses and diseases, lower reproductive success, and possible death.
- Changes in the abundance of any species because of air pollution can dramatically influence the abundance and health of dependent species.

For example, the loss of some species of fish because of higher levels of aluminum may allow insect populations to increase, which may benefit certain types of ducks that feed on insects. But the same loss of fish could be detrimental to eagles, ospreys and many other animals that depend on fish as a source of food.

- It is very difficult to fully understand and appreciate how far and in what ways such changes will affect other species throughout the ecosystem, including humans.

EFFECTS OF AIR POLLUTION ON AESTHETIC VALUE AND VISIBILITY:

- Air pollution can create a white or brown haze that affects how far we can see.
- It also affects how well we are able to see the colors, forms, and textures of natural and historic vistas.
- Haze is caused when sunlight encounters tiny particles in the air.
- The particles scatter light into and out of the sight path and absorb some light before it reaches your eyes.
- The more particles in the air, the more scattering and absorption of light to reduce the clarity and colors of what you see. Some types of particles scatter more light, especially when it is humid.
- Haze is mostly caused by air pollution from human activity including industry, power generation, transportation, and agriculture.

- Natural haze from dust, wildfires, and more also occurs in many parks.
- On hazy days, air pollution can be visible as a plume, layered haze, or uniform haze. A plume is a column-shaped layer of air pollution coming from a point source (such as a smoke stack).
- Layered haze is any confined layer of pollutants that creates a contrast between that layer and either the sky or landscape behind it.
- Plumes and layers can mix with the surrounding atmosphere, creating a uniform haze or overall decline in air clarity.
- Plumes and layered haze are more common during cold winter months when the atmosphere moves less.
- Uniform haze occurs most often when warm air causes atmospheric pollutants to become well mixed.