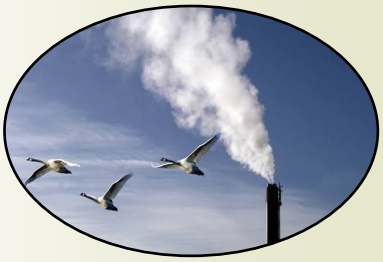
INDIAN INSTITUTE OF TROPICAL METEOROLOGY (IITM), PUNE

ENVIRONMENTAL INFORMATION AWARENESS, CAPACITY BUILDING & LIVELIHOOD PROGRAMME (EIACP) PROGRAM CENTRE

(Ministry of Environment, Forest & Climate Change, Govt. of India)

# Effect of AIR POLLUTION on

# WILDLIFE

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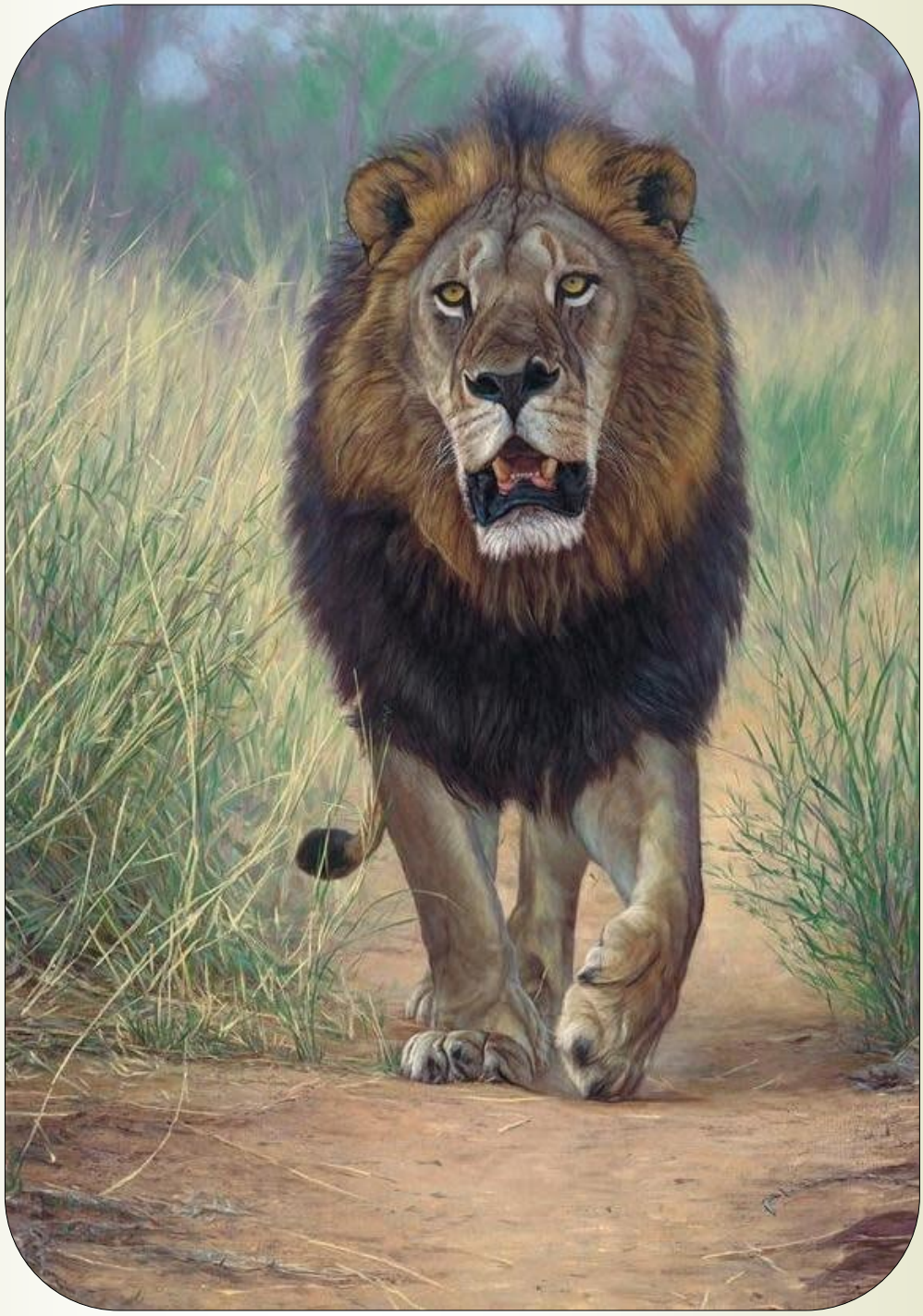

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# EDITORIAL

**Air pollution is an acknowledged widespread problem, rising urbanisation, booming industrialisation, and associated anthropogenic activities are the prime reasons that lead to air pollutant emissions and poor air quality. It affects all life forms. However, when we think of air pollution, we most likely don't conjure up images of plants and animals. But because we are co-existing, knowing how atmospheric pollution is affecting wildlife is important.**

**The effects of air pollution on wild animals are a topic that has been researched for years, and the effects vary greatly depending on the type of animal. Air pollution can have effects such as respiratory illnesses, cancer, and even death. In this document, we mentioned the deadly effects of air pollution on wild animals and reduction of air pollution.**

**- DR. B.S Murthy**

# INTRODUCTION

Air pollution is the greatest environmental threat to public health globally. Air pollution and climate change are closely linked as all major pollutants have an impact on the climate and most share common sources with greenhouse gases.

Man-made pollution is one of the main threats to wildlife habitat. Humans have regarded the air, water, and soil as waste receptacles, giving little consideration to the ecological consequences of pollution. Wildlife populations are constantly confronted with a massive array of pollutants released into the environment.

In the last 80 years, the world chemical output has grown and contaminating entire landscapes, accumulating in bodies of animals and plants, and altering and disrupting the DNA of wildlife in those places.

Out in the seas and oceans, destruction caused to marine life cannot be fathomed. Trash washed down rivers and city streets, mountains of plastic, garbage and debris, are finding their way into the oceans by the ton on a daily basis – causing massive disruption in coastal ecosystems. Pollution from industrial emissions, traffic and other commercial activities have eaten into the ozone layer and altered complete climatic patterns. Ecosystems that have survived and evolved through the ages, dependent on climate and seasonal cycles, have been totally derailed.

These destructive human activities are causing massive extinctions. Up to 30% of mammal, bird and amphibian species are already threatened with extinction, including: 1 out of 4 mammals, 1 out of 8 birds, 1 out of 3 amphibians, and 6 out of 7 marine turtles.

A third of reef-building corals are threatened with extinction. If global temperatures rise by more than 3.5°C, up to 70% of the world's known species risk extinction. Extinction risks are outpacing conservation successes.

# AIR POLLUTION

**Anything humans do that involves burning things, using chemicals, or producing piles of dust has the potential that can cause air pollution.**

**Air pollution is not a 100% man-made problem, some kinds of air pollution occurs naturally, too. For example,**

## NATURAL SOURCES

1. **Wildfire:** **The huge swatches of smoke produced by the forest fire is a poisonous mix of carbon dioxide, carbon monoxide, nitrogen dioxide, formaldehyde, and acetaldehyde – all known for warming the planet.**
2. **Volcano eruption:** **Giant volcanic eruptions spew ashes and a huge amount of sulfur gases, as well as many hundred tons of carbon dioxide ($CO_2$). The sulfur gases when combining with water vapor in the atmosphere and form sulfurous and sulfuric acid, which are detrimental to humans, plants, and animals.**
3. **Radioactive decay of rocks:** **Igneous rocks (Granite) and sedimentary rocks (limestone) contain radioactive isotopes. When uranium in the rocks decays, radon, a naturally occurring radioactive gas is emitted. It is colourless, odourless, tasteless gas and disperses quickly into the air. When inhaled it causes serious respiratory disorders and can lead to fatal lung cancer.**

# MAN-MADE SOURCES

**Mostly related to the burning of multiple types of fuel, it can be from stationary sources, such as smoke from power plants, factories and waste incinerators, and traditional biomass burning. It can also be from mobile sources, like motor vehicles, ships, and aircrafts. Controlled burn, quite common in agriculture practices, farming and forest management is also a big source of man-made pollution. Mining operations, fumes from paint, aerosol sprays and other solvents, waste disposition in landfills, generating methane gas, and military resources, such as nuclear weapons, are the other anthropogenic sources for air pollution.**

# MAJOR AIR POLLUTANTS

**Any gas, aerosol (liquids or solids dispersed through gases), or particles could qualify as air pollutants if they have reached a concentration high enough to harm.**

- **Sulfur dioxide (SO2):** Emitted during the combustion of sulfur-containing fossil fuels, such as coal and petroleum. In moist conditions, it becomes sulphuric acid, causing acid rain and smog.
- **Carbon monoxide (CO):** It is formed when fuels have too little oxygen to burn completely. This highly dangerous gas contributes to the greenhouse effect, smog, and acidification.
- **Carbon dioxide (CO2):** It isn't generally considered as a 'pollutant' but higher concentrations can contribute to global warming and climate change.
- **Nitrogen oxides:** Nitrogen dioxide (NO2) and nitrogen oxide (NO) pollution come from vehicle engines and power plants. They are also known as "indirect greenhouse gases".
- **Volatile organic compounds (VOCs):** Derived from petrol and gasoline reservoirs, industrial plants, paint, and varnishes, or agricultural activities. VOC air pollution plays an important role in ozone shaping in the lower atmospheric layer.
- **Particulates:** Arise from natural sources, such as volcanoes, or human activities, such as combustion or traffic.
- **Ozone:** Also called trioxygen, ozone is formed via photochemical transfer of oxygen. It causes smog and contributes to acidification and climate change.
- **Lead and heavy metals:** Aerosols of lead and other toxic heavy metals also contribute to air pollution.

# HOW DOES AIR POLLUTION AFFECT 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 Toxic air is a threat to wildlife and biodiversity. The visual impact may not be obvious if not closely looked into, but from the evidence effect is deleterious.**

**Altered animal behaviour:** An increasing number of studies demonstrated that pollutants can trigger bizarre behaviour in animals. For example, endocrine disruptors, heavy metals, and PCBs have a direct influence on the social and mating behaviours of animals.

**Diseases and Mortality:** In most cases, the effect is indirect but slowly kills animals by disrupting biological processes. Air pollutants disrupt endocrine function, cause organ injury, increase vulnerability to stresses and diseases, lower reproductive success.

Prolonged exposure to air pollutants can increase the expression of markers of neurodegenerative disease pathologies. Organ toxicity arising from CFCs and $NH_3$, volatile organic compounds (VOC), Mercury, CO, NOx, and $SO_2$ is a silent killer, taking the lives of wildlife.

**Biodiversity loss:** Air pollution is a major driving force changing the basic structure and function of ecosystems.

For example, excess deposition of airborne nitrogen (N) in the form of ammonia is among the main stressors to biodiversity. Biodiversity is critical for animals because an impairment can result in alterations in the food chain and loss of certain species. Biodiversity loss can also increase the risk of infectious diseases.

**Change in species distribution:** Industrial air pollution can cause a change in the abundance of a particular species.

For example, the loss of certain fish species due to higher aluminium levels may allow insect species to increase, which may in turn benefit ducks that feed on insects. But this loss could be detrimental to eagles, ospreys, and other animals that depend on fish as their food.

**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.

**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.

**Harming Wildlife:** Gases, solid particles and aerosols are polluting the air. Air pollution negatively affects wildlife by changing plant communities. Stunted plant growth from atmospheric ozone affects the quality of habitat and food sources.

Birds are threatened directly by coal power production exhaust, which damages their respiratory systems.

Air pollution also indirectly threatens birds. pH level increases result in fish kills, causing a decline in food sources. Mercury accumulates in the food chain, wreaking havoc on predatory bird populations.

**Acid Rain Killing Wild Animals:** Acid rain, primarily caused by sulfur and nitrogen released into the atmosphere from automobiles and the combustion of oil and coal, discharges toxic aluminium into water systems. Acid rain has numerous disastrous effects on ecosystems, especially aquatic ecosystems. pH levels are changed, killing many wild animals outright and throwing ecosystems completely out of balance

Gravity draws acid rain towards water bodies in low areas. When the acidity in these water bodies increases, fish and other organisms lose their ability to survive and reproduce.

Acid rain has already killed off fish populations in hundreds of lakes. Acidic rivers and streams, resulting from acid rain, causes respiratory distress in fish

Clearer water from higher acid levels also results in temperature and light increases in the water, causing native fish to relocate to cooler and darker habitats.

Amphibians have changed both physiologically and behaviourally due to air pollution. Ozone damages their immune systems. Insects are especially susceptible to the dangers of air pollution. Air quality fluctuations can cause insects to relocate, affecting the plants and animals connected to them.

Insects more resilient to air pollution digest organic waste less effectively, resulting in a buildup of organic waste when air pollution increases.

Metal smelters release toxic metals through tall smokestacks that have negative effects on wild animals. Pollutants cause environmental contamination both close to the source, and downwind of smelters.

Air pollution is damaging lung tissues of animals. Chlorofluorocarbons (CFCs) have damaged the ozone layer that protects the Earth from ultraviolet radiation. Ozone molecules near the ground damage wildlife lung tissues and reduces plant respiration by blocking openings in leaves. A plant not able to photosynthesize at a high rate due to inadequate respiration cannot grow. Holes in the ozone layer also cause skin cancer in wildlife.

Greenhouse gases from air pollution are warming the planet. Through photosynthesis, plants convert carbon dioxide into oxygen and use the carbon to grow. But the amount of carbon dioxide being released by human activities is much greater than plants can convert.

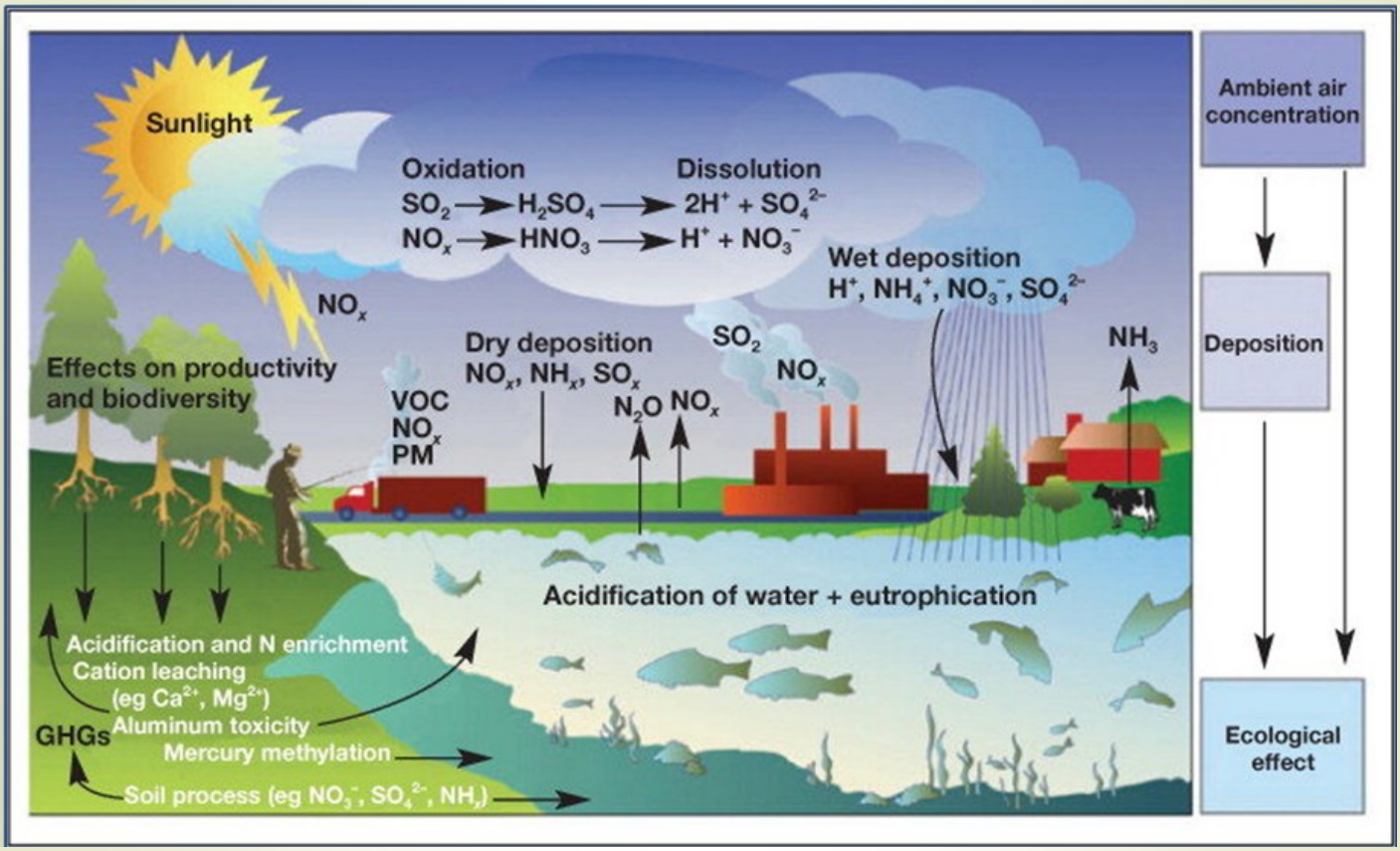
Ice and frozen ground are melting near the Poles. As a result, habitats and resources are changing for plants and animals. Ocean warming and rising sea levels are affecting shallow marine environments, including coral reefs. Less rainfall, caused by global warming, is limiting water resources for plants and animals.

Air pollution is particularly hazardous to animals when in the form of acid rain. Acid rains kills fish by increasing water acidity. Rising pH (a measure of acidity) levels are destroying plants and trees.

# Pollution Disrupting Ecosystems

**Thousands of synthetic chemicals are being released into the environment at alarming rates, altering the distribution of naturally occurring substances. Wild animals are facing conditions they have never experienced before. These alien conditions disrupt the delicate biological balance that has evolved over thousands of years.**

**Toxic metals from human activities accumulate to create a bewildering number of hazards to wildlife. Animal agriculture, fossil fuels, mining, metal refining, and waste-water discharge create toxic levels of pollutants beyond what naturally cycles through soil, air and water.**




**Pollution is having detrimental effects on the health of wildlife. Synthetic chemicals, acid rain and oil are all toxic. Additional types of pollution harm wildlife in indirect ways, changing or destroying their habitats. Carbon dioxide is accumulating in the atmosphere, resulting in changes in climate and the distribution of habitats.**

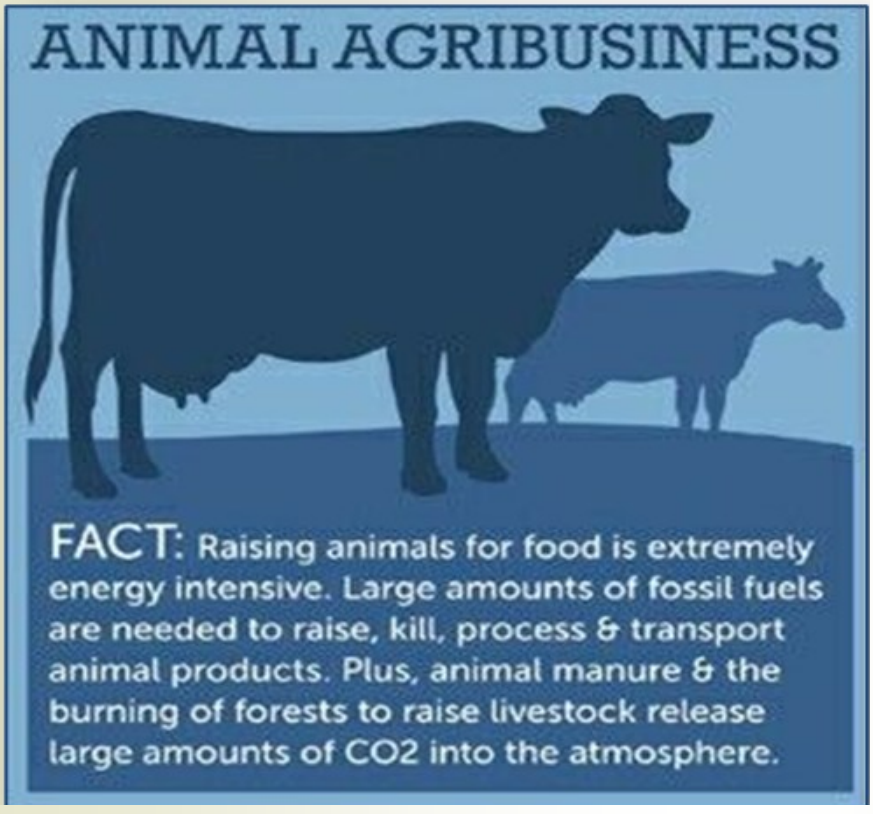
**The ozone layer is being damaged by chlorofluorocarbons, causing destruction from the effects of excessive ultraviolet radiation on wild animals and their food sources. Grasslands, marshes and canyons are being destroyed by solid waste landfills.**

# ANIMAL AGRICULTURE
# A MAJOR THREAT TO WILDLIFE

**Pollution from animal agricultural is one of the biggest threats to wildlife. Pesticide usage in agriculture has jumped 26-fold in the last 50 years causing serious consequences for the environment.**

**Animal agriculture produces significantly more greenhouse gases than all of the traffic in the world combined. Spouting out huge percentages of carbon dioxide and nitrous oxide, the industry is leaving behind pollutants known to remain in the atmosphere for more than 100 years.**

**Animal waste also produces toxic levels of methane and ammonia, which leads to climate change as well as acid rain.**





**Cows alone produce approximately 120lbs of manure per day, resulting in about 150 billion gallons of methane each day. Unmanageable amounts of animal waste is collected in cesspools and is either sprayed on fields or left to sit. The toxic fumes from the pools are emitted into the air and harm the environment.**

**Pesticides not only harm wild animals through long-term exposure via the food web; direct exposure also kills wild animals. Pesticides drift, decimating mammal, bird and fish populations.**

# WHICH ANIMALS ARE MOST AFFECTED BY AIR POLLUTION?

**Birds are among the first to get affected by the noxious mix of pollutants. Birds have a more efficient respiratory system than any other species hence they are directly and indirectly affected by air pollution. They spend more time in the open air, exposing them to greater levels of toxic fumes coming from vehicles, power plants, and factories.**

**Air pollutants disrupt bird communities. Ozone (O3) and nitrogen oxides (NOx) cause direct, irreversible damage to birds' lungs. Long-term exposure can lead to lung failure, poor immune system and reproductive success, population decline, and more.**

# EFFECT OF AIR POLLUTION ON ANIMAL HEALTH

**Animals face the effects of air pollution just as humans do. The only difference is that effects on animals are not always immediately seen because they can develop over time and be difficult to diagnose.**

- ⇒ **Studies have shown that toxic fumes from factories, cars, or other sources hurt the development of their lungs, leading them to suffer respiratory diseases such as asthma in adulthood.**
- ⇒ **Air pollution also affects creatures deep down at a cellular level by causing DNA damage, leading to mutations and cancerous cells.**
- ⇒ **The most vulnerable species include wildlife near busy roads with lots of traffic noise; this disturbs habitats and reduces foraging opportunities – bad news for endangered populations like tigers!**
- ⇒ **Air pollution also affects their ability to reproduce, so there's an increased risk of infertility and congenital disabilities.**
- ⇒ **Pollution can also cause hormonal changes in plants which, if they're eaten by animals higher up the food chain, such as cows or chickens, could affect human health.**
- ⇒ **Animals' immune systems are also compromised when exposed to pollutants. This compromises their natural defences against disease, making them more vulnerable to illness – even something as common as a cold!**

## 1. Pollution can cause respiratory problems in animals

The most deadly effect of air pollution on animals is respiratory problems. Air pollutants can cause lung issues, asthma, and bronchitis in both humans and animals alike.Pollution affects the immune system as well. Air pollution affects animals through their food sources, too, since plants absorb toxic chemicals from polluted soils into their roots and shoots, and then these toxins enter our bodies when we eat vegetables or fruits grown there.

## 2. Pollution can lead to severe health complications for animals, including cancer

Air pollution effects on animals can be severe. Pollution affects the lungs of many different types of the animal by causing cancer, respiratory problems, and acute effects like asthma. Animals may also develop heart diseases or even brain damage that could lead to neurological disorders. Air pollution is usually much worse for wild animals because they do not have access to healthcare as quickly. Air pollution effects on wildlife are hard to measure as we don't know its long-term effects.

But some research found that there were higher rates of tumor growths among those who live near heavily polluted areas are at risk of developing leukemia. The effects on wildlife are still not well understood by researchers, but it is clear that pollution does have effects. Pollution can also create a smog layer and acid rain, which has its effects on animals.

In places of high air pollution, the animals' eyes may become dry or irritated because there is less oxygen in the air to help them breathe easier. The animals may find themselves with more respiratory diseases as their lungs work harder to take in clean air.

## 3. Animals are as sensitive to the effects of air pollution as humans are

Animals are as sensitive to the effects of air pollution as humans are. They may experience some or all of these effects:

Eye irritation and infections, nosebleeds, coughing fits due to inflammation in the lungs

Allergies that can result in asthma attacks.

Liver damage. As our livers detoxify themselves, they must have plenty of water from a clean source to do so; however, this isn't always possible when polluted surfaces like asphalt and concrete surround us.

The decreased ability for animals that fly, such as birds, to carry out their daily activities where there's lots of confusion about what direction to take over ground covered with pollutants – specifically nitrogen dioxide ($NO^2$) gas molecules released into the atmosphere by cars.

## 4. Animals are especially vulnerable because they have respiratory systems that are much more sensitive than humans

Animals are especially vulnerable because they have respiratory systems that are much more sensitive than humans.

Animals, including mammals, birds, and amphibians, need healthy air to survive. The effects of pollution on animals can vary from species to species, but the effects of being exposed to different types of contaminants are always harmful to every animal's health.

Some effects include death due to suffocation or poisoning by gases; reduced growth rates in many populations as well as a decreased ability to reproduce; cancers and other chronic diseases caused by exposure over time."

# THE EFFECTS OF AIR POLLUTION ON ANIMALS INCLUDE LUNG DAMAGE, HEART PROBLEMS, INFLAMMATION, AND CANCER

**Air pollution affects not just people but also animals.**

A. **Lung damage:** The effects of air pollution on humans include lung problems like asthma and bronchitis- and the same effects are seen in other species such as birds. Pollutants can enter into their respiratory system, which causes inflammation that leads to difficulties breathing through the nose or mouth.

B. **Heart Problems:** Air pollutants can lead to cardiac disease from an increase in blood pressure, for example, aortic stenosis, because they create stress on the heart muscles themselves after being inhaled by living organisms. Consequently, it's possible this could cause blockage or rupture within the coronary artery due to a lack of sufficient oxygenated blood flowing throughout these arteries.

C. **Inflammation:** When poisonous gases come into the respiratory system of animals, the effects can be inflammations in various parts of the body, such as the eyes, for example. This is because they are causing a response from an individual's immune system to help fight off these harmful substances that have entered their bodies and affect them on different levels.

D. **Kidney Problems:** The kidneys work with other organs like the lungs, liver, and brain when it comes down to maintaining homeostasis or balance within the internal environment of our bodies. They filter out toxins and waste products that may come into contact with this vital organ due to toxic air pollution particles floating about near ground level, where most breathing happens naturally by living organisms.

## ANIMALS MAY ALSO SUFFER FROM THE EFFECTS OF PESTICIDES SPRAYED ON CROPS OR LAWNS

**The pesticides that are sprayed on lawns and crops daily are also harmful to animals. The effects of pesticides on animals may include difficulty breathing, lethargy, muscle spasms, vomiting, or loss of coordination. Animals that live close to the ground have a much higher risk for inhaling air pollutants than other species.**

**The effects of pollutants near the ground can be caused by direct contact with them when walking through soil depressions such as puddles or standing water where particles tend to collect. This type of pollution has adverse effects on animal health like respiratory problems, eye irritation, and local skin inflammation, which appear right after exposure and sometimes require long periods before they heal completely. Polluting chemicals accumulate in the top layer of soil above shallow rocky aquifers.**

## Animals are also at risk from poor air quality because they cannot protect themselves as humans do

**For the poor air quality effects on animals, many effects can happen to the animal. For example, ammonia is a colourless gas with an irritating odor. It irritates the eyes and respiratory tract when inhaled over long periods, leading to pulmonary edema or inflammation in the lungs.**

**Methane is also another pollutant that is harmful to animals because it causes smog pollution and acid rain, and other environmental effects such as global warming.**

**Carbon Monoxide has been one of the most dangerous substances found in air pollutants where oxygen levels drop too low from breathing.**
**Nitrogen Dioxide has been linked with asthma attacks among children due to lung development issues, while high concentrations may trigger heart problems.**

## Air pollution causes congenital disabilities and other health issues for animals as well as humans

**Air pollution causes congenital disabilities and other effects on animals as well as humans.**

**Air pollution caused by industrialization has led to a decrease in biodiversity, which is the number of different species occupying an environment or region.**

**Some effects that air pollutants have on animals are cancerous cells, pulmonary edema (or fluid in the lungs), acute myocardial infarction (heart attack), and cardiac arrhythmia (abnormal heartbeat). The effects range from mild to lethal depending on each animal's immune system response towards these chemicals and how much they come into contact with them.**

**The effects of air pollution on animals can be seen in many ways. Still, it is always important to acknowledge the effects that could harm all animals and their environment.**

**To understand this phenomenon better, we need more studies conducted with different species so that scientists can get enough data about how these effects impact the health of each group's population.**

**Furthermore, researchers should conduct epidemiological research looking into correlations between exposure levels of pollutants and disease rates among humans who work or live near toxic sites rather than conducting experimental lab tests involving human subjects since those often produce inconclusive results because they do not reflect real-life conditions as closely as possible.**

## Some species are more vulnerable than others, including sea turtles and whales who rely on their sense of smell to find food

**Some species are more vulnerable than others, including sea turtles and whales who rely on their sense of smell to find food. Some species are more vulnerable than others, such as sea turtles and whales who rely on their sense of smell for locating prey.**

**Some effects that air pollution has caused in animals include death by choking or suffocation because the smog blocks oxygen from entering the lungs; impaired reproduction due to reproductive organs not being able to function correctly after exposure to pollutants like dioxin, which can lead to miscarriages; the damage done by mercury poisoning when breathing polluted air combined with eating contaminated fish.**

# We Must Act Now


**Pollution, along with habitat loss and degradation, over-exploitation, unsustainable practices, and invasive alien species, are affecting biodiversity around the globe. The result is the massive destruction of ecosystems and a frightening reduction in biodiversity.**

**Earth's ecological system has been in balance for millions of years, but is now threatened by human activities. Current extinction rates are likely to result in collapses of ecosystems on a global scale.**

**Pollution has had devastating impacts on wildlife. Most types of pollution are not necessary, and others can be drastically reduced. Technology is available that can significantly reduce pollution.**

**Reduced consumption of fossil fuels would also bring down emissions of toxic metals and acid rain. Shifting to plant-based, organic farming would eliminate the massive amounts of pollutants produced by the animal agriculture industry.**

**Awareness, creativity, and a willingness to modify our lifestyles will curtail threats that pollution causes to both wildlife and humans. You can help wildlife and ecosystems by supporting environmental groups that are fighting polluting practices, as well as by making your own conscious decisions regarding eating choices, waste management, harmful chemicals and irresponsible household products.**

**While air pollution damage is irreparable, not all hope is lost. There are still ways to reduce its effects on humans, plants, and even animals. They include:**

- **Limiting the use of fossil fuels;**
- **Recycling instead of burning trash;**
- **Not using products that contain chemicals that can pollute the air;**
- **Supporting companies that are looking to reduce air pollution.**

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