

The Effects of Pollution on Plant Growth



Hour 3 Honors Biology

### **Introduction**

Looking around the world that one lives in, it is apparent that plant growth is still occurring despite the pollution that co-exists with the plants. However, this does not mean the pollution has no effect on the plants. What effect does the increasing pollution of the world have on today's plant growth? Which type of pollution affects plant growth more- water, soil, or air pollution? Pollution is a very big problem in society today. In fact, it affects the world's entire ecosystem. When plants die or become weakened due to pollution, the health of the animals eating those plants can also become compromised. As a result, the quality and quantity of the animals available for consumption can be affected negatively as well. In the bigger picture, pollution does a lot more damage than one would expect (Mayntz, 2006). This experiment will give greater understanding as to the types of pollution that affect plants most, what plants grow best in pollution, and what happens to plants after they have been polluted.

### **Review of Literature**

From previous knowledge, I know that pollution has a greater effect on wildlife than man. Unfortunately, guess who made that pollution? Yes, nobody is to blame but man. It's as simple as this: man makes pollution, plants die or become sick from that pollution, animals eat the sick plants or starve, and humans' supply of food is compromised! As for the vegetarians, they're not going to want to eat polluted plants, such as fruits and vegetables.

### **Kinds of Pollution**

There are many different kinds of pollution that are each responsible for their own, unique kind of damage. There are nine main types of pollution, including: air, water, soil, noise, radioactive, thermal, light, visual, and personal (Mayntz, 2006). First, air pollution is probably the biggest and most destructive form of pollution. This is mostly because it is the main contributor to the problem of global warming. Because of air pollution, the layers of the atmosphere are slowly falling apart and disappearing. This is a problem because humans need the atmospheric layers to prevent the harmful rays of the sun from damaging our skin. Most air pollution comes from factories burning harmful substances and materials. Next, water pollution is also a big problem, because water flows wherever the current takes it. Water pollution is able to travel great distances in a little amount of time. Most water pollution comes from sewage and chemicals that spill into drains, rivers, lakes and oceans. Another type of pollution that affects plants, and ultimately animals, is soil pollution. Soil pollution is often a by-product from water pollution that has rained on, been sprayed on, or has soaked into the soil. Garden chemicals are also

turned into soil pollution. Soil pollution is a problem because humans and animals need oxygen to breathe and live. They both depend on healthy plants to produce and contribute to the world's oxygen supply and soil pollution can affect plants in a negative way. Next, there are the smaller kinds of pollution, such as noise and visual pollution. Noise pollution is basically noise that disrupts the living of humans or animals. Examples of this would include a highway, train, traffic, screaming, machines, etc. Light pollution is what makes it difficult to see stars in the city. It is difficult because the lights from the cities are stronger than the light visible from the stars. Thus, only the brightest stars can be seen at night. Next, there is visual pollution. Things that make up visual pollution include man-made objects that take one's eyes off of the natural surroundings such as billboards, power lines, street signs, and even entire cities!

Thermal pollution is when something, such as a river, is too warm (Neves, Lourenco, 1996). This can be reduced by cutting down on the amount of electricity used so that less heat is given off into the world. Radioactive pollution is basically nuclear malfunctions and Uranium mining operations. This kind of pollution is rare but extremely deadly. And lastly, personal pollution is a type of pollution that people should take individual responsibility for. Personal pollution affects the human body; a few examples include smoking, drugs, mental and physical abuse. This kind of pollution can be controlled with good decisions and making perhaps a little counseling.

### **Why Plants are Important**

The world's largest type of forest, Taiga, which is also referred to as, a boreal forest, is categorized by all of the coniferous trees and plants in it (Woodward, 1997). This kind of forest stretches from Russia, to Mongolia, Japan, Norway, Sweden, Iceland, Finland, United States,

Canada, and the United Kingdom! Near the Denali highway in Alaska Range, Alaska, is one of the world's largest coniferous forests, referred to as White Spruce Taiga. This forest covers hundreds of thousands of acres and is said to be one of the easiest places in the world to breathe, due to all of the oxygen being made! Unfortunately, if the air pollution in large cities due to large industries, automobiles, factories, and everyday household appliances, is shifted towards large forests, it can have a negative consequence. What happens next? As the air thins out, animals' health would decline due to the poor air quality and lack of plants, and the food supply would decrease. Before you know it, the whole ecosystem, known as the world, has taken one step closer to a giant tragedy. Along with the benefits of these incredible ecosystems, there can also come hazards. Due to dry conditions in the past few years, wildfires have easily sparked and rapidly spread. Due to the composition of the pine trees, when they burn, the thick, black smoke "chokes" other trees. This kills more trees than most kinds of pollution do (Beitler, 2006).

### **Pollution and Plants**

One of the main reasons that plants and pollution don't mix, is that humans need plants to live. Without oxygen, humans and animals cannot live, and plants play an important role in providing oxygen. Also, many plants, including fruits and vegetables, serve as food for humans and animals. The three types of pollution that affect plants the most include air, water, and soil pollution. Plants can be affected by air pollution; if the plants don't have clean air to process through their leaves, oxygen cannot be produced (Gardiner, 2006). Water pollution also has a huge impact on plants, due to the fact that all plants need water to survive. When water that has been significantly contaminated is given to plants, it often affects the plants making them weak. One form of water pollution is acid

rain. Acid rain is so destructive that it can make it so fish can't live in some lakes. Acid rain also erodes soil, and plants are broken down to nothing. (Casiday, Frey, 1998). Lastly, soil pollution is created in many ways, including acid rain, and also by pesticides being put on plants (Shayler, McBride, Harrison, 2009). Soil pollution contributes to the erosion of soil and plants as well. One may think that soil pollution does not affect water plants. However, it actually does. When rain or any water source makes contact with polluted soil, it eventually washes the now polluted water and soil into ponds, lakes, rivers, etc. affecting water plants. Unfortunately, as pollution in the world increases, the effects it has on plants can only increase.



From Left to Right: Air Pollution, Soil Pollution and Water Pollution

### **Hypothesis**

If polluted water, soil, and air is used to grow plants, then the growth and health of the plants will be compromised because pollution affects plant growth in a negative way; with water pollution having the greatest effect and air pollution having the least effect. In order for plants to successfully grow, they require soil, water, and air. Soil provides nutrients and a foundation for the plant to grow in, and water and air are both needed for photosynthesis to occur. Water pollution will have the greatest effect on plant growth because water is the greatest necessity for healthy plant growth. Because the effect of air pollution takes longer to negatively impact the plant growth, these plants will be affected the least. The independent variables in this experiment will be the temperature that the plants are grown in and the type of seeds that are planted. The dependent variables will be the types of pollution given to the plants: water, soil, and air pollution.

### **Method/ Procedure**

#### **Materials**

- Grass seeds/ beans
- 8 small pots
- Potting soil
- Ruler and camera
- Pen and note pad
- Water pollution
- Soil pollution
- Air pollution
- Transparent container



### Steps

1. 25 grass seeds will be planted in each of four containers (labeled A, B, C, D), containing two cups of soil, ½ inch under the soil
2. Four beans will be planted in four containers (labeled A, B, C, D), containing two cups of soil, ½ inch under the soil.
3. Grass seed A and bean A, will be planted in healthy soil, watered with clean water, and kept in clean air.
4. Grass seed B and bean B, will be planted in healthy soil, watered with clean water, and kept in polluted air.
5. Grass seed C and bean C, will be planted in polluted soil, watered with clean water, and kept in clean air.
6. Grass seed D and bean D, will be planted in healthy soil, watered with polluted water, and kept in clean air.
7. Plants will be watered one time daily, three tablespoons.
8. Measurements will be taken every two days for plant growth.
9. Observations will be recorded on a notepad, regarding the size, and color of the plant, and will then be transferred onto a chart or graph.

### Results

#### Grass Seeds:

A-No Pollution      Total Growth: 13cm 2mm

B-Air Pollution      Total Growth: 9cm

C-Soil Pollution      Total Growth: No growth

D-Water Pollution      Total Growth: 2cm 4mm

#### Beans:

A-No Pollution      Total Growth: No growth

B-Air Pollution      Total Growth: No growth

C-Soil Pollution      Total Growth: No growth

D-Water Pollution      Total Growth: No growth

**Table: Pollution Effects On Plant Growth**

<u>Plant ID</u>	Days 1-8	Days 9-11	Days 12-14	Days 15-17	Days 18-20	Days 21-23	Days 24-26	Days 27-29
Bean A	No growth	No growth	No growth	No growth	No growth	No growth	No growth	No growth
Bean B	No growth	No growth	No growth	No growth	No growth	No growth	No growth	No growth
Bean C	No growth	No growth	No growth	No growth	No growth	No growth	No growth	No growth
Bean D	No growth	No growth	No growth	No growth	No growth	No growth	No growth	No growth
Grass A	No growth	2 ½ cm	5cm 5mm	8cm 8mm	10cm 7mm	12cm	12cm 6mm	13cm 2mm
Grass B	No growth	2cm 7mm	5cm 6mm	6cm 9mm	7cm 8mm	8cm 3mm	8cm 5mm	9cm
Grass C	No growth	No growth	No growth	No growth	No growth	No growth	No growth	No growth
Grass D	No growth	7mm	1cm 8mm	2cm 3mm	dying	dying	dead	dead

**Growth in Centimeters/ Millimeters**

**Key**

- A- no pollution
- B- air pollution
- C- soil pollution
- D- water pollution

(Above) In the table, each plant is shown with how tall it grew (See key above). The measurements are marked down after the first day of growth and then marked down by every third day. The chart shows the results of which plant grew the best, and then you are able to determine what kind of pollution affects plants the most.

### **Conclusion**

In the experiment that I ran, eight pots of plants were set in a sunny spot, four bean plants, and four grass plants. They were each watered with clean water (or dirty depending on what kind of pollution was being experimented) every other day. The bean plants never grew, they just molded. But the grass plants grew very well and delivered great results. First, the grass with no pollution grew the most, up to 13cm and 2mm. Next, the grass affected by air pollution was sprayed every few days with Febreze and Kaboom cleaning spray, this was to simulate toxic fumes being exposed to the plants in the wild. The grass grew a total of 9cm but struggled to grow after being sprayed. Next, the plants with water pollution were watered every other day with a mixture of water, salt, liquid soap, and motor oil. This is to simulate plants being exposed to polluted water in the wild. This grass grew a total of 2cm and 3mm but after the 17<sup>th</sup> day, the grass stopped growing and soon died. Lastly, the plants that were affected by soil pollution did not grow at all. The soil consisted of salt, liquid soap, and motor oil.

Based on my experiment, I believe that soil pollution affects plant growth the most. I think this because soil polluted grass was the only kind of grass to not grow at all. I believe that the harsh chemicals in the soil were stopping the plants from starting to grow. One reason I have to believe that water pollution did not affect the growth of the grass as much is that the contaminated water still contained H<sub>2</sub>O this allowing the plants to start growing a little bit. Then, once the plant needed more clean water to maintain life, it couldn't get enough so it died. The contaminated soil soaked the seeds in the non water-filled mix of chemicals and substances before the seed even had a chance to grow. And since the soil didn't contain water until the seeds

were already contaminated, the seeds were unable to start growing. Next, the air polluted grass grew fine, only until it was sprayed with chemicals, then the growth slowed down. The air pollution finally caught up the quick growing grass and started to kill it. Although, the grass did not fully die, just majorly slow down growth. Lastly, the non polluted grass grew fine reaching a height of 13cm and 2mm.

**Pictures**

(Below) A small piece of grass struggles to grow after being watered with polluted water.



(Left) Two cups of grass quickly grow, the one on the left recently being sprayed with air pollution.



(Above) On the last day of taking measurements, this non polluted grass is at a height of 13 centimeters ant 2 millimeters.



(Above) At the end of the experiment, this cup of air polluted grass is slowly dying after repeatedly being sprayed with chemicals.

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