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Ecology

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Term Project Summary

Pollution has become researchers topic since the rising of industrialized human culture. The key questions that I am going to relate in my term project are: How does pollution alter the functioning of ecosystems? And What risks does pollution pose to human health? Despite all the different kinds of pollution, I am going to mainly focus on the two major chemical substances of pollution, nitrogen and sulfur, and the impact that general pollution have on human health in this project. The direct and indirect impact that pollution has on the ecosystem are coming back to humans, causing diseases, injuries, and even deaths.

Ecosystems are affected by air pollution, especially sulfur and nitrogen emissions. The most harmful sulfur oxide is sulfur dioxide and it is the most significant single air pollutant. It is produced when sulfur and fuels that contain sulfur are burned and introduced into the atmosphere. Sulfur can be deposited into the field and forest by dry deposition like sulfate and wet deposition like precipitation, however most of the ecosystem are not able to retain sulfur deposition and Sulfur will leach from the soil and take other nutrients with them which will cause a reduction in the growth of vegetation.^[6]As for nitrogen, the most harmful oxides of nitrogen in the air are produced by the combustion process of fuel in the air. The emission of cars can be a significant source of Nitrogen oxides. Nitrogen will deposit from the atmosphere by lightning and bacteria fixation and precipitation. Deposition of nitrogen oxides can directly affect the growth of plants, soil and microbial and even cause tree death. Both Sulfur and Nitrogen can cause acidification and eutrophication by depositing excess nutrients. With acidification and eutrophication, the nitrogen pollutants can reduce biodiversity in some sensitive ecosystems.^[5] Air pollution also has a huge impact on humans as well, as it can form smog which can cause acute illness, chronic disease and possibly lead to death^[2].

As for water pollution, industrial waste is one of the major producers, especially the paper production industry and chemical manufacturing industry.^[2] Some of the waste water that are discharged to flowing water are toxic, but the effect of the rest of the waste remained unknown. Nitrogen can be introduced to water by the leakage of fertilizer, it leaks into streams and flows into big water areas like lakes and rivers.

Inorganic nitrogen pollution will result in weakening the ability of aquatic creatures to survive, grow and reproduce. [7]The reason why excess nitrogen has negative impact on the creature underwater is that the excess of nutrients will cause eutrophication and lead to the blooming of algae. There is a surplus of nutrients for aquatic creatures to live with, they can overstimulate the growth of aquatic plants and algae. The crazy growth of algae will not only cover the light source of other microorganisms but also create a hypoxic condition. The lack of oxygen in the water will lead to the chain reaction that diminishes the amount of creatures in the aquatic ecosystem.[6] The biodiversity of the aquatic ecosystem is indirectly affected by water pollution. Water quality has been a major issue for humans in the twenty- first century, it contaminates human living and drinking water. Drinking unsafe and unhygienic water can easily cause people diarrhea, cholera and other waterborne diseases. The component that can cause most serious and negative human health problem is arsenic.

In this project, I decided to do a scientific interactive booklet about pollution like nitrogen and sulfur and the general impact that pollution on human health. There are five spreads in this booklet. On the cover, there is a crying little girl standing on the earth with the N and S which stand for Nitrogen and Sulfur implying the serious situation that pollution has affected human's life. The first spread is the table of content, the order is Nitrogen pollution, Sulfur pollution, the general disease that pollution cause to human and the citation of the information I used in this booklet. The Nitrogen pollution spread contains four little windows on the left page that can be opened, each window presents a stage of the process from the production of Nitrogen air pollution to the harm that they do to them ecosystem. There is an illustration in each window to make the information more appealing. The explanation of the stages in the process will be provided on the side of the illustrations. There are three windows on the right page about the Nitrogen pollution in water, the three windows each represent the production of nitrogen, how the nitrogen enter the water area and impacts like the eutrophication. Further introduction of the impact of nitrogen pollution is presented under the windows. The second spread is the Sulfur pollution, windows are applied here as well to help explain how the Sulfur pollution enter and affect the aquatic ecosystem. On the right page there is a finding difference game, children or teenagers can find the difference between the normal statue and the statue after acidification. I did the second illustration in the acid rain and with the erosion. Instead of just listing all the consequences of acidification, this game is more interesting and maybe easier for the audiences to learn. The third spread is about the diseases that pollution cause to human. The left page is the diseases that are caused by air pollution like lung cancer. There is cut out lung shape and a color strip which color change from pink to dark reddish violet paper that can be slide under the cut out to

show how the air pollution will affect human lung. The right page is the diseases that are caused by water pollution, I drew a human profile drinking water, the different kinds of pollutants like virus, nitrogen and arsenic are listed next to the mouth. At the bottom of the figure. I listed the types of diseases that water pollution can cause to human, such as blood pressure.

In conclusion, I expect my illustration will work with the text to help kids and students understand thoroughly. I am a communication design major student, so I noticed that there are a lot of editorial illustrations and advertisement campaigns about the environment and pollution, I was inspired by them and decided to do a booklet which can make the information about pollution accessible to more people, and raise their awareness to protect the environment. All the information and research I did above also imply that many people haven't noticed how dangerous and harmful pollution is, so I think it's really important to teach the new generation more about these. My target audience for the booklet is children and teenage, so I will incorporate my illustrations and the information above to present a simple and easy to understand context.

Annotated Bibliography:

[1]Schwarzenbach, RenÅ© P., Thomas Egli, Thomas B. Hofstetter, Urs Von Gunten, and Bernhard Wehrli. "Global Water Pollution and Human Health." *Annual Review of Environment and Resources* 35.1 (2010): 109-36. Web. 18 Feb. 2017.

This is a secondary resource. This article mainly talks about the major chemical component in the water pollution and how water pollution do damage to human health. The chemical pollution of natural water, wastewater and unsanitary drinking water have been issues that harm people's lives and spread waterborne diseases. Author provides readers with charts and data that can help people to comprehend his idea.

[2]Turk, J., and J. T. Wittes. *Ecology, Pollution, Environment*. London: Saunders, 1972. Print.[Book from Pratt Library]

This book is a secondary source. Chapter 5 and 6 talked about how the water and air pollution are produced and their harm to both ecosystem and human. The severe condition of pollution can cause acute illness, chronic disease and possibly leading to death. The author also mentioned the policy to control the water and air pollution like water purification and separate the pollutants from air.

[3]Anderson, Jonathan O., Josef G. Thundiyil, and Andrew Stolbach. "Clearing the Air: A Review of the Effects of Particulate Matter Air Pollution on Human Health." *Journal of Medical Toxicology* 8.2 (2011): 166-75. Web. 18 Feb. 2017.

This is a secondary resource. This article talks about the data of air pollution in the world and how are they affecting human life and health. Particles produced with the pollution in the air will not only harm people's lung, but also do damage to people's Cardiovascular.

[4]"Air Pollution, Ecosystems and Biodiversity." *Air Pollution, Ecosystems and Biodiversity - Air Pollution - Environmental Policy - UNECE*. UNECE, n.d. Web. 04 Mar. 2017.

This website introduces the major pollutants of air pollution and how are they harming the ecosystem. The UNECE association is the short for United Nations Economic Commission for Europe, the web page also explain how they are controlling and helping the situation.

[5]Anders, Arvidson, Persson Linn, and Lannerstad Mats. *Impacts of Pollution on Ecosystem Services for the Millennium Development Goals*. N.p.: Stockholm Environment Institute, 2010. Print.

The air pollution section (from page 7-15) of this report provide me information about impacts of air pollution on ecosystem services. This report the different types of pollutants like nitrogen oxide, sulfur dioxide and so on.

[6]Lovett, Gary M., Timothy H. Tear, David C. Evers, Stuart E.g. Findlay, B. Jack Cosby, Judy K. Dunscomb, Charles T. Driscoll, and Kathleen C. Weathers. "Effects of Air Pollution on Ecosystems and Biological Diversity in the Eastern United States." *Annals of the New York Academy of Sciences* 1162.1 (2009): 99-135. Web.

This journal mainly talk about the effects of air pollution on ecosystems and biological diversity in the eastern United States. The author demonstrate how the air pollutant go into the atmosphere and accumulate in the terrestrial ecosystem.

[7]Camargo, Julio A., and Álvaro Alonso. "Ecological and Toxicological Effects of Inorganic Nitrogen Pollution in Aquatic Ecosystems: A Global Assessment." *Environment International* 32.6 (2006): 831-49. Web.

This is a secondary resource. This journal talks about the acidification and eutrophication of aquatic ecosystem. Moreover, it talks about the different types of chemical components of water pollution like nitrogen. The author also present the adverse effects pollution have on animals and aquatic ecosystem.

Nitrogen & Sulfur

pollution on Earth



Sandra Oh

SCIENTIFIC BOOKS

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Nitrogen

In Air



Although Nitrogen are crucial for vegetatons, excess amount of nitrogen oxides are toxic and can directly affect the growth of plants.

Extra Nitrogen will lead to acidification and eutrophication. Acidification will cause the leach out of other base nutrients of plants and eutrophication can lead to oxygen depletion.

Nitrogen

In Water



The nitrogen that is leaking from the agriculturally used fertilizer will dirty the water. It leaks into streams and flows into big water areas like lakes and rivers. Nitrogen pollution in the water will affect the ability of creatures in water to survive, grow and reproduce.

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Sulfur

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The most harmful sulfur oxide is sulfur dioxide and it is the most significant single air pollutant. Sulfur dioxide can also cause acidification which is harmful to both terrestrial and aquatic ecosystems.

Accidification



Find the differences

Acid rain is caused by emissions of sulfur dioxide and nitrogen oxide. Acid rain can cause the paint to peel, the erosion of statue and some adverse impact on forest and ecosystem.

Sulfur

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Before
Polluted

Disease



Air Pollution



Air pollution has a huge impact on humans as well, as it can form smog which can cause acute illness, chronic disease and possibly lead to death.

Particles produced by human activities like burning fossil fuel and power plant in the air will cause serious lung diseases.

However, particles not only harm people's lungs, but also do damage to people's Cardiovascular system.

Pull this strip
↓

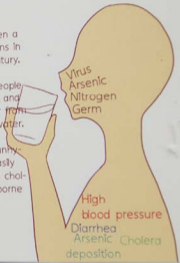
After
Polluted

Water Pollution

Water quality has been a major issue for humans in the twenty - first century.

Nowadays 1.1 billion people lack access to water, and 2.6 billion people suffer from low quality and dirty water.

Drinking unsafe and unhygienic water can easily cause people diarrhea, cholera and other waterborne diseases.



Disease



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