

Acid Rain in Washington, should we fret?

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Environmental Health

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Introduction:

Rain falls around us, it nourishes the land during times of drought. If that rain causes damage to the very thing it is meant to nourish then that could be problematic. What is Acid Rain? Acid Rain or Acid Deposition is caused by the emission of sulfur dioxide and nitrogen oxides into the atmosphere. Sulfur dioxide and nitrogen oxides are emitted by the burning of fossil fuels. Sulfur dioxide and Nitrogen oxides are emitted from processes that include, production of electricity and vehicular exhaust. (Environmental Protection Agency. 2015) Once in the atmosphere, these pollutants can be deposited in two ways, wet and dry. Wet deposition occurs, when emitted pollutants (i.e. sulfur dioxide, and nitrogen oxides), in the atmosphere mix with water vapor and depart the atmosphere as acid precipitation. (Environment and Climate change Canada. 2013.) Acid precipitation usually manifest with a pH level of 4.0, making it ten times more acidic than the, pH of clean precipitation which is 5.6.(Environmental Protection Agency. 2016) Acidic precipitation can fall in forms such as rain, fog, or snow. Dry Deposition occurs when, said pollutants fall from the atmosphere as particles, or ash and are then absorbed by the surfaces they touch, then once in contact with water the absorbed pollutants are transformed into acid. (Environment and Climate change Canada. 2013) Both wet and dry depositions could pose significant hazards to Washington's rich and diverse ecosystem. If acid rain were to pay a visit it would threaten species living in these rich ecosystems. In Western Washington, acid rain would be particularly dangerous in months like December and

January when 20 or more days can see recordable precipitation. (Western Regional Climate Center. 2016)

This paper examines hazards posed by acid deposition on species of Washington State. Predictions and opinions will be used to make assumptions as to how Washington would be affected by acid deposition. This paper will identify species, which are commonly affected by acid rain in comparison to similar species in the state of Washington.

The Forest/ Stream ecosystem of Washington & Acid Deposition.

The Pacific Northwest is home to a lush ecosystem that contains these beautiful Ancient trees within an uneven-aged forest. This amazing ecosystem includes a large array of tree species, most of these are dominated by Douglas-fir, but also include Sitka Spruce, Western Hemlock, True Fir and Hemlock. (Oregon Wild. 2014) The Pacific Northwest forest ecosystem is rich and diverse, and diversity adds resilience. Acid Rain would leach valuable nutrients from Pacific Northwest forest soils. Species of the Pacific Northwest forest ecosystem rely heavily upon each other. So if one species within that ecosystem is disturbed then so are other species of that ecosystem. Acid Deposition or acid precipitation leaches the mineral calcium from the soil reducing that soil's alkalinity. Overly acidic soil can transform the element aluminum in the soil from a solid into a liquid. Once this happens aluminum makes its journey into the streams and rivers harming fish and other creatures that are sensitive to aluminum, e.g. salmon and

trout. The salmon is an essential species of this ecosystem. Their spawning runs act as transporters of nutrients, from the ocean to streams lakes and rivers. (Rahr, G. 2004) These nutrients enrich the lakes, rivers, and stream ecosystems. If acid rain occurs in Washington or the Pacific Northwest, it would negatively affect salmon populations of the ecosystem. Acid rain and aluminum are believed by some to be a major culprit in the decline of Atlantic salmon, in eastern North America, and in Scandinavian countries. (U.S. Geological Survey. 2008) Acid deposition mixed with the aluminum is particularly devastating to the homes of crayfish, clams and fish of that ecosystem. (12 National Geographic Society) An ecosystem with rich diversity is tenacious and able to withstand short periods of acid rain. So, Washington to may be able to withstand short periods of acid rain as it is a mecca of life. But what's concerning is that species (i.e. salmon and clams) within Washington's ecosystem would decline with sustained periods of acid rain. Since they play a valuable role in their ecosystem, any decline would create a rift that would weaken and destabilize the ecosystem. Meaning that species that rely on salmon and clams would suffer from their decline. This causes further ecosystem weakness, causing the decline of species that rely on the species that rely on the clam/salmon also to suffer. Is it safe to say that acid rain would be detrimental to the biodiversity of an Ecosystem? When acid rain reaps havoc upon the landscape of an ecosystem, it stresses the environment to the point that the trees aren't as tolerant of temperature change and disease. Damage to a species in an ecosystem begets damage to its diversity in turn shrinking that ecosystems resilience. (National Geographic Society)

Acid Deposition history, in the Pacific Northwest and the world.

The term acid rain was created in 1872 by Robert Angus Smith. Smith witnessed acid rain in industrial cities of England. He compared rainfall pH from industrial cities with rainfall pH of cities without pollution. Of course, the cities with less pollution had a higher rainfall pH. In the 50's it was realized that maybe Smith was right. It was in Norway where acid rain was the contributing cause of rapid population degradation. In the sixties, Canada witnessed the same curse of rain as Norway in the fifties. During the sixties findings of acid rain in North America influenced the need to find out everything about acid rain. It was the seventies when scientist came to the realization that industrial pollution isn't just a local issue, but pollution from one area can travel to other regions and inflict damage. With this piece of the puzzle brought to light, the acid rain problem was no longer a regional scale problem it was a national one. In the eighties congress created Acid Deposition Act. ADA created 10-year research program conducted by the National Acidic Precipitation Assessment Program (NAPAP) (Environmental Protection Agency). The research looked at the effects of acid rain on manmade features and ecosystems as well, as created funding and monitoring. In 1985, an article caught reader's eyes with its title *Acid Rain Spreads Its Cloud to West*, the article draws reader attention to the fact that acid rain pollution was moving west. This article is an informational article that describes, how pollution is being carried through the U.S. informing people it's moving west. (Coates, J 1985) In the nineties the Clean Air Act was passed by Congress and put a cap on the total sulfur dioxide and nitrogen oxide. Another article from 2009 written by a group of high school

students in Cordova, Alaska; explains how high amounts of fossil fuels are emitted into the ocean and atmosphere, from China's overproduction of happy meal toys. The factories that make the happy meal toys are coal burning production factories. The burning of coal emits sulfur dioxide and nitrogen oxides into the atmosphere which then gets deposited locally and can travel great distances to pollute regional and even internationally. This can be witnessed in looking at China's internal pollution epidemic. That pollution also travels all the way to the western US, acidifying large areas. The students explained how the excessive combustion of fossil fuels by China threatens the livelihood of salmon populations in Alaska and creating problems for that ecosystem. E.g. water acidity and aluminum from soils because of acid rain is detrimental to salmon. (U.S. Geological Survey. 2008)(Allen, J *et.al.* 2009) But toy factories in China are just a tiny portion of this, most of China's production factories are coal burning factories. (Lidman, R. 2016) So, once you throw China's other factories to the mix, you may begin to see how other communities in Alaska and even Washington may be effected. These are but a few stories about the effects of acid rain on ecosystems.

Acid Rain (deposition) in the Pacific Northwest: The Legislation.

The legislation is always important in matters of pollution. When areas are oppressed by pollution, people tend to look their government for answers. The Acid Rain Program is a program that provides, market-based incentives as a means of abating pollutants that cause acid rain. (Environmental Protection Agency) The Acid Rain Program was created with

amendments to the Clean Air Act in 1990. (Environmental Protection Agency) These emissions are required to be monitored at all times by a continuous emissions monitor. (Environmental Protection Agency) The Acid Rain Program has been successful in deterring sulfur dioxide and nitrogen oxides. The Acid Rain Program is a cap and trade program, meaning emission levels are capped and polluters have to conform to the cap. The incentive is companies have a choice in regard to how they abate pollution. Allowances are awarded to companies to use in the abatement of pollution. Companies have a certain amount of allowances to accomplish this, if it can be achieved with less then they will have leftovers. The company can save the leftovers or sell them to companies that have run out of their allowances. This is what the EPA says about cap and trade systems. "Cap and trade is an environmental policy tool that delivers results with a mandatory cap on emissions while providing sources flexibility in how they comply. Successful cap and trade programs reward innovation, efficiency, and early action and provide strict environmental accountability without inhibiting economic growth."(Environmental Protection Agency) This statement suggests you can have your cake and eat it too. "Provide strict environmental accountability without inhibiting growth." Is it practical to believe that you can always have both? I feel the EPA's statement implies we can only abate pollution as long as it doesn't compromise our ability to promote profit and job growth. By no means am I saying that job growth is bad.

Conclusion.

Earth's population growth is infinite, so more room to grow is consistently needed. To create room trees are cut. Production rates also increase, creating more pollution, making conditions in that ecosystem favorable for acid rain. Acid Rain (Deposition) would pose significant dangers to the Pacific Northwest ecosystems if it presented itself. Furthermore, acid rain in the future is possible in Washington. As populations continue to grow this becomes even more likely. Its effects are harmful to forests, fish, clam, rivers, lakes, streams, and oceans. The harm done to wildlife of an ecosystem by acid rain can be devastating to communities that rely on the wildlife. Damage done by acid rain can reduce an ecosystem's resilience by making its inhabitants more susceptible to disease. I believe that as communities become more involved in reducing pollution the healthier we will be and feel as a species. In my opinion, one day we will have to choose either market or conservation of life and it is hard for me to believe that we could possibly make the wrong choice. I think to prevent crashing into this point, it is important to remember to do the small things, like reminding ourselves to cut back on electricity, or to recycle, and finding ways to effectively communicate these reminders to the public. The small things could help reduce the risks for acid rain. Will acid rain just be a memory in stories of our past or will news articles once again demonize it for its heinous crimes against our environment?

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