

Environment
economics: acid rain
essay sample



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When an atmosphere witnesses the emissions of nitrogen oxides and sulfur dioxides, acid precipitation or acid rain occurs in the environment.

Subsequently, water droplets absorb the abovementioned emission, which undergoes various chemical transformations in the clouds. Rain, mist, hail, dry dust, snow, etc. are some of the forms that are taken by these water droplets that fall on the earth surface. The acidity of the soil is increased by this chemical process, and chemical balance of lakes and streams are affected during the transformations.

More generally, all forms of acid deposition are sometimes included in the term ' acid rain' by the experts. Particularly, two main forms of deposition have been known by the experts. Wet deposition, when rain or other precipitation removes acidic gases and particles during the chemical process. Secondly, dry deposition, when the absence of any precipitation witnesses the earth's surface with regard to the removal of particles and gases, as mentioned earlier.

Any type of precipitation, which has unusually low pH, is defined as Acid rain by the experts. Weak carbonic acid is formed by the disassociation of dissolved carbon dioxide. In this regard, at typical atmospheric conditions, approximately 5.6 pH is given by the weak carbonic acid in the concentrations of carbon dioxide in the atmosphere. Therefore, sometimes, acid rain has been defined as having less than 5.6 pH in the atmosphere. However, a more appropriate definition of acid rain will be having less than 5 pH, as per the natural sources of acidity that were taken in remote areas. According to the United States EPA, large parts of the United States and

Canada are being affected largely by a serious environmental problem of Acid rain.

Weathering in carbonate rocks, as well as, in building, is accelerated by the Acid rain. Acidification of streams, rivers, is also being contributed by this environmental problem. At high elevations, forests are also being damaged by it. Water animals and particularly, fishes are also in danger due to the high acidity level in the streams and rivers in the northern parts.

HISTORY

When layers of glacial ice are analyzed, the levels of acid rain show the evidence for increment in them. From the start of the Industrial Revolution, the pH has been observed to decrease from six to four, which is a very sudden decrease. In this regard, experts have tried to study some of the organisms that are found to inhabit ponds and streams, such as, diatoms, etc.

From this study, information has been gathered and it has been observed that bottom of the ponds witnesses the creation of sediment layers by the deposition of abovementioned organisms, which die over the years. Certain pHs thrive the diatoms, so, an indication of the pH change is given by the increasing depth of layers due to the increasing number of diatoms and such organisms in the water.

Since the Industrial Revolution, an increment has been observed in the nitrogen and sulfur oxides emissions in the environment. In industrialized areas, reporting of less than 2.4 pH has been done occasionally. Particularly,

People's Republic of China is facing the substantial problem of Industrial acid rain in its region, due to a huge number of industries and factories in the country.

Russia and Eastern Europe are also facing the same considerable problem in their countries, due to the same reason of high investment in the sector of industries in the region. Secondly, sulfur-containing coal are burned by these countries for the cheap generation of electricity and heat for their production purposes, which is one of the primary reasons of acceleration of the acid rain in the environment.

During the Industrial Revolution, Manchester in England first reported the occurrence of Acid rain in its city. In the year 1852, the relationship of acid rain and atmospheric pollution was found by Robert Angus Smith. In 1872, the term ' Acid rain' was used for the first time in the history. In 1852, the Acid rain was discovered as mentioned above. However, the observance and studies of this phenomenon began in the late 1960s.

In this regard, a ' dead' lake was researched by a Canadian Harold Harvey. In the 1990s, the United States started giving awareness to the public about the acid rain and its causes. Reports were promulgated by the New York Times during this awareness program. New Hampshire's Hubbard Brook Experimental Forest was chosen for the purpose that demonstrated the devastating affects of acid rain in that region.

CAUSES

Sulfur dioxide is considered as one of the most important gases that causes the acidification of the atmosphere. Therefore, nowadays, importance is being given to the nitrogen oxides emissions, as sulfur containing compounds have been controlled strictly, due to its adverse affects in the atmosphere. In this regard, nitric acid is formed by the nitrogen oxides emissions. Fossil fuel combustion and industry contributed approximately 70 Tg(S) sulfur dioxide, whereas, wildfires give only 2. 8 Tg(S), and volcanoes give 7. 5 Tg(S) per year.

The abovementioned emissions have been categorized into two sections. These are natural emissions and human emissions. We will try to discuss and analyze both types of emissions for a better understanding of the acid rain.

NATURAL EMISSIONS

Volcanoes are considered the source of emitting acid-producing gases in the atmosphere, which is the principal natural phenomenon of the science. Different biological process that occurs on the surface of the earth naturally, such as, oceans, wetlands, rivers, etc. are also considered the cause of emissions in the atmosphere.

In this regard, dimethyl sulfide is one of the major biological sources of producing sulfur-containing compounds in the atmosphere. In remote parts of the planet, thousands of years have witnessed and detected various effects of acidic deposits that are found in its glacial ice surfaces. These type of emissions have been names as Natural Emissions.

HUMAN EMISSIONS

Sulfuric and nitrogen compounds are the principal causes of the production of acid rain in the atmosphere. Motor vehicles, electricity generation plants, factories, and various other human sources are responsible for the production of abovementioned compounds that cause acid rain. Hundreds of miles can be carried away by these gases and emissions in the atmosphere, after which, their conversion into acids and acid rain is observed in the environment. These type of emissions that are caused by the human activities are known as Human Emissions.

(Richard Turco, May 1992)

The above-given diagram has been sourced from the American Geophysical Union Special Report regarding the Volcanism and Climate Change. Richard Turco has modified this diagram in May 1992 for the better and diagrammatic understanding of the production of emissions and causes of Acid rain in the atmosphere.

ACID DEPOSITION

Experts have explained and categorized the acid deposition in the two categories, which are wet & dry deposition. Following are brief discussions of these two types of acid depositions:

WET DEPOSITION

When the earth's surface is delivered with the acids that are removed from the atmosphere by any form of precipitation, it is known as Wet Deposition. The raindrops can be considered as the production factor during the

deposition of acids in them. Wet deposition has given importance to the wet removal of aerosol and gases mutually.

Source: (www. epa. gov)

DRY DEPOSITION

Dry deposition is the procedure that occurs in the absence of any precipitation. Around 20 to 60 percent of acid deposition will be responsible by dry deposition. When ground, plants, etc. stick the gases and particles to them, dry deposition occurs in the environment.

EFFECTS

In this part, we will try to understand and discuss various and different effects that have been affecting lives of millions of species around the world. The Acid rain is considered as one of the most usual problems that are affecting the world with its slow process of devastation and destruction. Forests, freshwaters, soils, etc. have been observed to have adverse impacts and affects by the acid rain. In this regard, it has been observed by a number of experts that insects are being killed, as well as, aquatic life forms. In addition, buildings are also causing damage by the pouring of acid rain on its foundations. Human health has also borne possible adverse affects and impacts due to the acid rain in the atmosphere.

Source: (www. epa. gov)

WATER & AQUATIC ANIMALS

Acid rain causes the pH to lower down in the atmosphere. In addition, aluminum concentrations observed a level of increment in them. As a result, fishes and other aquatic animals can borne a lot of damage to themselves. It has been investigated and examined by the professionals that fish eggs do not hatch under the lower pH levels, which are less than five pH.

Similarly, adult fishes are also found to be having very adverse affects due to acid rain, as adult fishes are dying and can be killed by the lower level of pHs in the atmosphere or surface of the water in oceans, streams, and rivers. It has also been noted that biodiversity has observed a reduction in its level due to high level of acidity in lakes. In addition, insect life and a variety of fishes have been eliminated by the acid rain. Particularly, brook trout is one of the most affected aquatic animals that have been adversely affected by the acid rain. They are found in some of the Appalachian creeks and streams.

SOIL

Acid rain can seriously damage the soil biology. Acids can be consumed by some tropical microbes in a very quick manner. However, it has been observed that lower pHs level is not tolerated by some other microbes, and in the result, they are killed by the acid rain. Acid that comes down by the acid rain, denatures the enzymes of the klye shaffers. In addition, toxins are also mobilized by the hydronium ions that are found in the acid rain. Essential nutrients and minerals are also leached away by the acid rain during its adverse affects on the soil.

FORESTS

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The growth of forests is slow down by the pouring of acid rain on them. In this regard, leaves and needles of the trees are found to be turning down after the acid rain, and finally, leaves are knocked out to death with its adverse impact on them. Acid rain is not the only one that is responsible for the death of trees in the forest. However, trees and leaves are weakened by the acid rain, which allow other threats and diseases to target and attack these trees very easily.

As mentioned above, many other problems can also be caused by the damage that is done to the soil by the acid rain. Vulnerability is found especially in forests with high altitude, as clouds and fog often surround these forests, which have more adverse and acidic affects than the usual rain in the atmosphere. Acid rain is also found to be damaging other types of plants.

However, minimization of the effect on food crops is done by various scientific and agricultural measures. In this regard, fertilizers are used for the replacement of lost nutrients in the plants that allow the plants and trees to grow. In cultivated areas, addition of limestone is done, in order to expect stability in the pH level of the plants. However, wilderness lands do not get affected by the abovementioned techniques and procedures. Minerals are depleted from the soil by the Acid rain, and then the growth of the plant is stunted by the acid rain.

HUMAN HEALTH

A number of studies and researches have been done, in order to relate Acid rain and its adverse affects with the human health. In this regard, direct links <https://assignbuster.com/environment-economics-acid-rain-essay-sample/>

of Acid rain to the human health have been suggested by some scientists. However, no scientific proof has so far been received in this regard.

Some studies and researches have shown results that illnesses are caused by a large fraction of the Acid rain, which consist of fine particles of nitrogen dioxide and sulfur dioxide. In addition, premature deaths have also been related to the acid rain and its impacts in the human life. In this regard, a number of governments and health related organizations and bodies are working and performing researches, in order to have a better understanding and preview of the Acid rain's affects on the human life and health.

OTHER AFFECTS

Certain building materials and historical monuments can be damaged by the acid rain. Weathering on ancient and valuable statues can be caused by the Acid rain. In this history, considerable damage has been observed by the Acid rain in a number of historical and important buildings of the past. One of the primary reasons of this impact on the buildings is that calcium compounds that are used in the building stones react chemically with the sulfuric acid that is found in the acid rain.

Some of the notable stones that are affected by the Acid rain are marble, sandstone, granite, limestone, etc, which are often used for the production of gypsum. Old gravestones are also seen to be affected by the acid rain. Particularly, inscription is found to be completely illegible by the pouring of acid rain on the gravestones. In iron, oxidation rate is also found to be increasing by the acid rain. It has been examined and noted by the experts

that sulfate also causes the reduction of visibility, as well as, nitrate affects the human eyes, which is found to be very usual in the atmosphere.

COSTS & BENEFITS OF THE ACID RAIN REDUCTION

In this part, we will try to comprehend and analyze the benefits that are prospected by the reduction of Acid rain from the environment, as well as, we will also try to study the costs that is borne, in order to reduce the amount of Acid rain from the atmosphere.

In this regard, a study was done that showed the predicted benefits for the year 2010 that will be on affected population. These benefits were calculated per capita. The benefits regarding the morbidity came out to be US\$ 3. 50 per capita, whereas, a big gap turned out to be regarding the mortality with US\$ 59. 30. Aquatic were also considered during the study, and they showed US\$ 0. 62 per capita. Recreational and residential visibilities were also calculated and their related benefits showed 3. 34 and 5. 81 per capita.

In this regard, we can observe a reduction in the risk of human mortality by reducing the amount of acid rain in the atmosphere. For all the United States residents, the average per capita benefits were presented in health and recreational visibility benefits. Therefore, it is very necessary to take steps regarding the reduction of acid rain from the atmosphere, which is devastating our environment effectively.(Dallas Burtraw, et al, 1997)

The abovementioned diagram has been made by Dallas Burtsaw, and his time in their company, Resources for the Future, in order to present costs and benefits, which come out after the reduction of acid rain with the help of

different policies and programs related to the environment. In the abovementioned diagram, five modeled cities of Atlantic City, Washington, Charlottesville, Albany, and Knoxville have been included as the sample locations in understanding the residential visibility benefits.

Populations that engage themselves in recreational fishing have been included in the aquatic benefits. During the studies, it was only known that there was not a big gap between the benefits and the cost of the reduction of acid rain programs. In this regard, different programs are being implemented for this reduction process. For instance, sulfur dioxide is being reduced by an allowance trading system, which is known as SO₂.

Similarly, nitrogen oxides are reduced by another reduction system, which is known as NO_x. United States Environmental Policy has also been instituted by two important innovations that have been implemented by the 1990 Clean Air Act Amendments. In this regard, allowances are transfer by the firms among their facilities, or they are also given an opportunity to bank them, in order to re-use them in upcoming years.

Briefly, we will conclude that a substantial margin can observed between the costs of the reduction, as compared to the benefits that are achieved after the reduction process. However, the mortality benefits dominated the rest ones, as the cost of the reduction program is several times less than the predicted benefits by the experts. However, there is still need for improvement in the credibility of the experts and critiques who predict the benefits for the programs. On the other hand, it has been noted that most of the exposures are involuntary done by the environmentalists, if we compare

the labor market behavior's studies that has been done in the region.

Therefore, environmental exposures may be avoided by the labor ones by underestimating their willingness.

PREVENTION

Positive results have been produced due to the efforts of American and other industrial countries around the world, in order to reduce Acid rain and its adverse affects from the world. in this regard, 1980s level of pH has been reduced by one-third regarding the sulfur dioxide emissions in the atmosphere. The prevention methods that are being used for preventing the harmful emissions and effects of Acid rain have been categorized into different types. We will try to discuss and analyze different solutions in this regard:

TECHNICAL SOLUTION

In the United States, sulfur-containing gases are removed from their stack gases by the utilization of Flue gas desulphurization in a number of coal-burning plants in the country. In the United States and several other countries on the globe, one of the commonly used examples of Fuel gas desulphurization is a wet scrubber. Hot smoky stack gases are extracted from a reaction tower with the help of a fan.

These gases are then transferred into the tower from the power plant. This type of reaction tower is known as the wet scrubber. The tower is also injected with the slurry form of limestone. After that, extracted stack gases are then mixed with the limestone, and present sulfur dioxide is combined

with it. pH-neutral calcium sulfate is produced by the calcium carbonate of the limestone. This scrubber has already removed the abovementioned calcium sulfate from itself. That is, industrial sulfates are the result of sulfur pollution that is turned by the scrubber during the process.

In some areas, chemical companies buy these sulfates, in order to use it as gypsum for their different building purposes. However, the purity of calcium sulfate must be high for the selling of sulfates to the industrial units. In others, landfills are the destined place for these sulfates. However, generations can be affected by the effects of Acid rain, as the continued leaching of undesirable chemicals can be stimulated by the pH level changes' effects.

INTERNATIONAL TREATIES

On the long-range transport of atmospheric pollutants, a number of international treaties have been made between different and various countries of the world. Steps are being taken, in order to reduce the cost and the adverse effects of Acid rain in the atmosphere.

Sulphur Emissions Reduction Protocol is one of the examples of international treaties that have been agreed by different bodies, and are working for the better purpose. Similarly, Convention on Long-Range Transboundary Air Pollution is another example and is one of the important treaties that have been implemented internationally by different countries of the world.

EMISSIONS TRADING

Emissions' trading is involved in even more benign regulatory scheme. In this scheme, an emissions license is given to every current polluting facility, after which, the facility becomes the part of capital equipment. Pollution control equipment can be then, installed by the operators. After that, parts of the emissions licenses can be sold by them.

In this regard, real economic incentives are given to the operators for the proper installation of pollution control equipments and technologies that are available in different parts of the world. Since, the licenses can be retired by the public interest groups by purchasing these licenses, the result is found to be very adverse. In the result, set of pollution sources is found to be decreasing continuously and diffusing at a higher level. At the same time, money is not forced to be spent by any particular operator by selling their assets commercially.

Conclusively, we have tried to discuss and understand definition, causes, factors, and conditions that are associated with the substantial problem of Acid Rain with regard to Environmental Economics. We have also tried to discuss different effects that are affecting lives of millions of different species around the world. In the end, we discussed different methods and procedures that are being taken by different and various governments and organizations for preventing acid rain from devastating our food crops, aquatic animals, human lives, buildings, and various other aspects of the life on the surface of the earth.

REFERENCES

Robert H. Boyle. (1983). Acid Rain. Schocken Books.

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Environmental Resources Limited. (1983). Acid Rain: a Review of the Phenomenon in the EEC and Europe. Unipub for the Commission of the European Communities.

James C. White. (1987). Acid Rain: the Relationship Between Sources and Receptors. Springer.

United States Congress Senate Committee on Environment and Public Works. (1982). Acid Rain: a Technical Inquiry. U. S. G. P. O.

Ger Klaassen. (1996). Acid Rain and Environmental Degradation. Edward Elgar, USA.

K. Mellanby. (1988). Air Pollution, Acid Rain, and the Environment. Springer.