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| ***� Why Acid Rain Makes Plants Go Brrr�*** ��� Conclusions |

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|  | ����������� After much experimentation and exhaustive statistical analysis of the subsequent data, we have been able to formulate two substantiated conclusions.� First, acid deposition does indeed pose a threat to the natural balance of the biosphere due to its detrimental effects on plants.� One of these effects is a dangerous slowing of plant metabolism caused by an increase in the level of soluble aluminum available for plant uptake.� High levels of soluble aluminum are toxic to plants due to the nature of aluminum.� Once it leaves the acidic growing medium in soluble form and enters the neutral interior of the plant, the aluminum is able to bond with many other molecules such as those containing phosphorus.� As it does this, the plant�s ability to absorb nutrients and utilize molecules of ATP is greatly diminished.� This lack of available resources results in a slowing of the plant�s metabolism.� With a decreased rate of activity, a plant will likely not be able to close its guard cells and stomata in time to protect itself from quickly decreasing temperatures.� As was indicated by our data, plants freeze at a significantly higher rate as they are exposed to higher levels of soluble aluminum caused by the acidification of their growth medium via acid deposition.�  ����������� Second, the treatment of plants affected by aluminum toxicity caused by acid deposition with buffering solutions is, for all intents and purposes, ineffective.� The survival rate of those plants treated with buffering solutions as well as acid rain was a mere 46%, only marginally higher than the 42% survival rate of the plants treated with only simulated acid rain.� This fact suggests that the only real solution to the problem of aluminum toxicity caused by acid deposition is to reduce the amount of acid deposition.� We must, as a society, begin to treat the source of the problem rather than the symptoms.�  ����������� Steps toward the reduction of acid deposition have been taken, albeit small ones.� In 1970, Congress issued the Clean Air Act.� This established precedent setting standards for air quality, but mainly resulted in industries sending their dirty sulfates and other such pollution elsewhere.� Many of the older, and much more harmful, coal and oil power plants were �grandfathered-in� under the legislation under the assumption that they would be replaced soon with newer and more efficient plants.� This was not the case, and many grandfathered plants remain active to date, polluting as much as ever.� In fact, such plants are responsible for 97 percent of the sulfur dioxide emissions in our country while only producing 52 percent of our electricity (Izaak).�  ����������� In 1990, Congress renewed their commitment to environmental protection with the Clean Air Act Amendments.� The primary goal of this legislation was to reduce the annual sulfur dioxide emission level to 13 million tons, down from the 23 million tons of 1980 (Carolina 3).� Under these regulations, firms were assigned allowances that permit them to emit one ton of sulfur dioxide.� They could even buy, sell, trade, or save their allowances (Carolina 3).� A secondary goal of the amendments was to reduce the NO emissions 2 million tons from the 1980 level of 21 million tons (Carolina 3).� This amended legislation also met qualified success.� The regulation only included about half of the polluters in the country, and sulfur dioxide emissions only dropped 23% with NO emissions holding steady (Carolina 3).� We have taken the first steps towards environmental protection from acid deposition, but much more needs to be done.  ����������� There are various methods of reducing the constituents of acid deposition.� To reduce nitrogen oxides, catalytic converters are installed on the exhaust systems of all automobiles, the major source of NO emission.� To reduce sulfur dioxide, power plants must clean the coal to be burned.� This removes some loosely bound sulfur, but leaves still more.� Next, a process called Fluidized Bed Combustion (FBC) is used during combustion.� It involves a bed of limestone or sandstone that is crushed and diluted with the fuel. This enables the limestone to react with sulfur dioxide and reduce emission by up to 90 percent (Phamornsuwana).  After combustion, a process known as wet flue gas de-sulfurization is used.  This process involves a web �scrubber� at the downward end of the boiler.  This process is similar to FBC.  This scrubber can be made of either limestone or sodium hydroxide.  Limestone is more commonly used (Phamornsuwana).� As sulfur dioxide enters the scrubber, it reacts with the limestone (CaCO3) in a manner shown by the equation below (Phamornsuwana).  **CaCO3 + SO2 + H2O + O2 � CaSO3 + CaSO4 + CO2 + H2O**  The sulfur dioxide being removed from the gas, it is emitted into the air from a smokestack.� The solid waste left by the �scrubbing� process is disposed of later.� These methods are widely available, but relatively rarely used.� This needs to change.  ����������� We doubt many people would disagree that the financial burden of cleaning up our air is a small price to pay for a healthier biosphere.� However, most of them would be hypocrites.� The majority of us do not do our part in the reduction of acid deposition.� We do not take advantage of carpool lanes, mass transit systems, alternative energy sources, etc.� The irony is that many of these methods of conservation are, in fact, more financially efficient than our current practices.� We are destroying our environment with our lack of foresight, our laziness, and our apathy.� The question is not whether or not we will come to realize that we are, in fact, destroying ourselves.� Rather, the question is:� When we do, will it be too late? |  |
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