



# CLIMATE DETECTIVES 2022-2023

Acid rain  
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## RESEARCH QUESTION

**How is the acid rain created and what are the effects in the ecosystem?**

## SUMMARY OF PROJECT

Acid rain is a phenomenon formed when sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) are released into the atmosphere and they react with the water in clouds forming different types of sulfuric and nitric acids. This makes the acid rain have a pH of 3, which is an enormous difference considering that the average pH of the rain is 5,65. This phenomenon affects the ecosystem's equilibrium because the unusual value of pH in the rain changes the soil composition, which can damage the normal growth of the plants. The plants are eaten by animals and both are eaten by us. This can lead to alimentary intoxication or to a lack of food. Not only do we end up intoxicating ourselves, but it also breaks up the fragile equilibrium of the Spanish and European ecosystems.

In order to achieve the largest understanding of the subject, we have done a research about the effects of acid rain in all the ways we possibly can. Firstly, we have investigated the gases that take part in the creation of acid rain: where they are formed and how much of them are found in the air and the air currents in order to achieve a better knowledge of how they move. But this isn't all about the air: in second place, we have compared the satellite data with the on-ground data. Thirdly, we have analyzed the composition of the ground using satellite data and previously report's information, mostly in the mountainous parts of Madrid, and compare it to the data of the past years, in order to see how it is affected by the acid rain. Then we analyzed how the vegetation has changed in order to adapt to the altered ground composition.

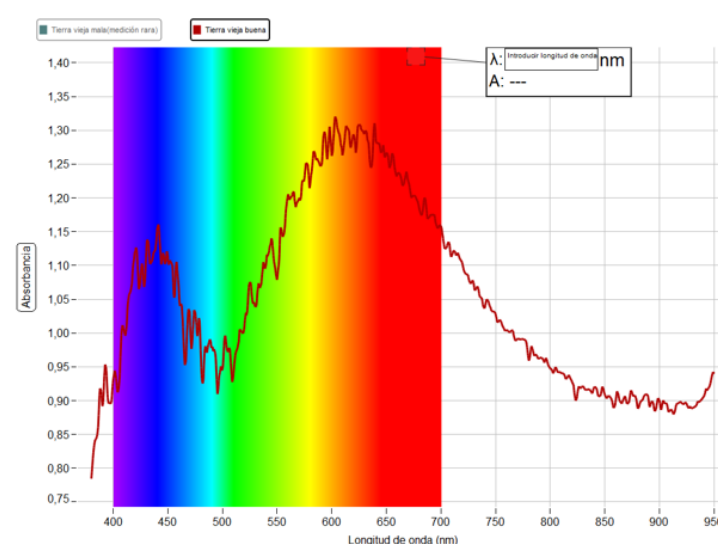


Figure 1: Emission spectrum of a sample of soil from

## MAIN RESULTS

After researching in various topics and after numerous experiments we can pose the conclusion that acid rain is a climatological phenomenon that can affect many aspects of the environment and can have a negative effect in many parts of the society, including vegetation reduction, shortage of vegetal products, disappearance of calcifying organisms, damage to infrastructures and others.

For this, acid rain should be considered as one of the important problems derived from the climate change and must be addressed with the importance it has. Acid rain is not only damaging directly by itself, but it is an indicator of the presence of NO<sub>x</sub> and SO<sub>2</sub>, both really dangerous for the human well-being.

Finally, as a conclusion, we can deduct a few results from all the data we have collected. For example, with the rain data we can deduct that the rain that falls in Madrid isn't created in Madrid. This could explain why there aren't records of damages directly related with acid rain. This can be explained by the fact that the rain that falls in Madrid and the Guadarrama mountains comes from the north of Spain, a much less contaminated area. Even if there are no recorded data that talks about damages in infrastructure or vegetation in Madrid and its surroundings, the production of contaminating gasses is prejudicial in many other ways. These gasses can cause respiratory problems to the people and animals that inhabit the zone.

We can also say that, even if there are no short terms effects of acid rain, the prolonged exposition to this type of precipitation can cause damage not only to the vegetation, but the animals and directly to the soil and the water from the swamps for human consumption.

After all, it must be noticed that the impornance of small factors which all together can damage severely the environment.

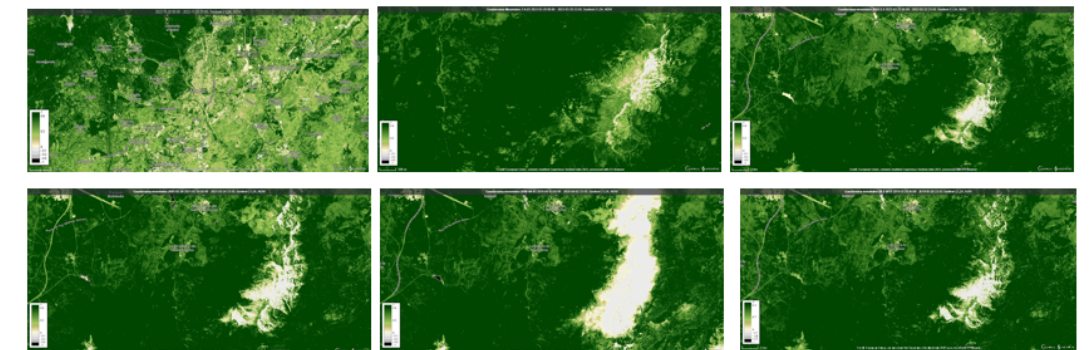
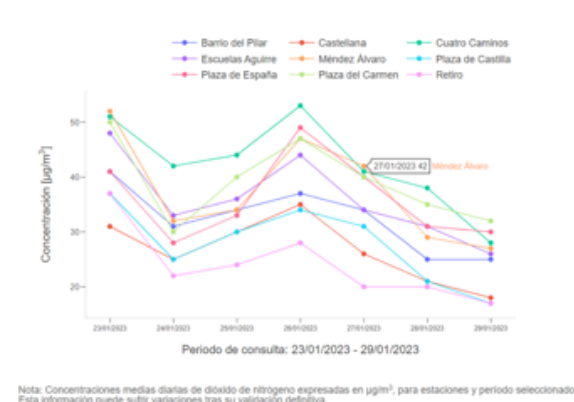
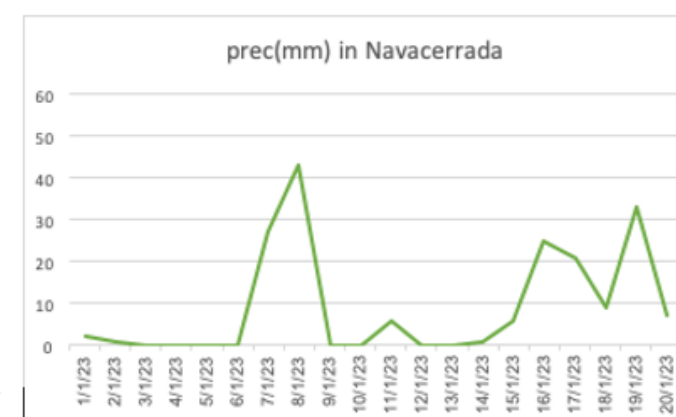


Figure 2: EO browser images

## ACTIONS TO HELP LESSEN THE PROBLEM



Nota: Concentraciones medias diarias de dióxido de nitrógeno expresadas en µg/m³ para estaciones y periodo seleccionados. Esta información puede sufrir variaciones tras su validación definitiva.



To solve the problem of acid rain is important to take uniform measurements in all the world at the same time, because, even if only a country produces acidic gases and, included, acid rain, those gases can travel freely around the world, affecting all the rest of the countries.

It is true that not all the countries can take the effort to build the infrastructure and government system needed to reduce the level of acidic gases. Although this will affect the other countries, is important that the developed countries take the lead in reducing the industries and cars that emit harmful gases.

That is a challenge for the global conservation that all the countries should be committed to address. There are some small factors that can widely affect the global well-being of all the living being in the Earth that should be legislated and controlled.

After researching about the topic, some actions should take place for the conservation of the ecosystem and the environment.

The first one of our proposals to stop as much as possible acid rain and the negative effects that it has is to reduce the use of fossil fuels and increase the number of renewable energies that are supplied to the public. This is an important measurement because most of the harmful gasses that create acid rain comes from burning fossil fuels. Together with the previous one, an important action that should be taken is replace the traditional petrol cars by electrical cars, which will reduce considerably the usage of fossil fuels. In addition, loading should be progressively implemented.

Finally, a legislation should be created in order to establish a legal limit for the emission of harmful gases for companies and sanction them if they do not comply with it.

With these measurements we hope the problem of acid rain and their effects could be reduced.