

<b>Forum:</b>	UNESCO
<b>Issue:</b>	Pollution effects on world heritage and monuments
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## INTRODUCTION

The public opinion has already realized the risk of valuable historical monuments being devastated. Pollution is the key factor in the degradation of buildings and monuments. The negative impact of pollutants emitted into the atmosphere on materials is enormous and often irreversible. Corrosion caused by chemicals and soiling caused by particles can lead to economic losses but, more importantly, to the destruction of our cultural heritage, an important component of our individual and collective identity.

This issue touches monuments from all around the world and the situation is becoming alarming as the conditions are worsening month by month. World cultural heritage is set to wreck and there is an urgent need for a solution. The cultural and aesthetic value of monument is beyond price.

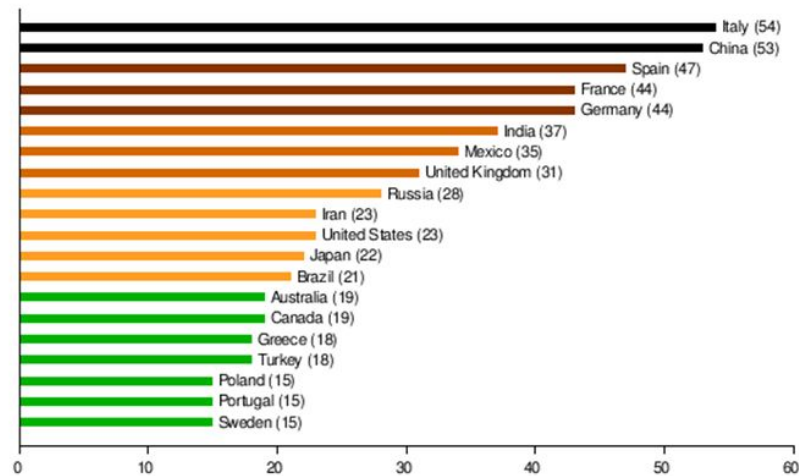
## DEFINITION OF KEY TERMS

- **AIR POLLUTION**  
Various gases, finely divided solids, or finely dispersed liquid aerosols released into the atmosphere. This exceeds the natural capacity of the environment to dissipate and dilute or absorb them. These substances may reach concentrations in the air that cause undesirable health, economic, or aesthetic effects.
- **ACID RAIN**  
Results from air pollution. Term includes any form of precipitation that contains acidic components, such as sulfuric acid or nitric acid. The definition includes dust, gasses, rain, snow, fog and hail. Its pH is usually lower than 5.2. It has harmful effects on plants, animals, monuments and infrastructure.
- **CORROSION**  
The degradation of metals due to an electrochemical process. The formation of rust on iron, tarnish on silver, and the blue-green patina that develops on copper are all examples of corrosion.
- **WORLD HERITAGE SITE**  
A landmark or area which is selected by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as having cultural, historical, scientific or other form of significance, and is legally protected by international treaties. The sites are judged important to the collective interests of humanity.

## BACKGROUND INFORMATION

The damage due to air pollution on materials is a really serious concern, for the service life of buildings is remarkably reduced. More important, the effects of soiling, degradation, corrosion and erosion caused by sulphur dioxide are alarming. Our industrial development has left us with a legacy of faceless statues and blackened buildings that will take many years to repair and conserve, even when pollution levels are sufficiently reduced to make it sensible to do so.

The situation is more complex in cases like Italy, China, France, Japan, India, Russia or other countries with a very large number of monuments concentrated in the area.



Most of the research studies reveal that the effect of acid deposition on modern structures is significantly less than the effect on ancient monuments. The condition of a monument is a very important aspect when it comes to damage: a monument whose material is fragile, because it's been weakened over the time, will be a lot more vulnerable than a monument that's much better preserved. Almost all heritage structures are built with limestone and calcareous stones, which are most vulnerable to corrosion. Hence, continuous renovation and retrofitting is a must to protect our heritage.

The historic structures all around the world are affected by acid rain. There is another concern that lies with the temperature and global warming. Heat acts as a catalyst, speeding the rate of occurring chemical reactions. The beautiful monuments built centuries ago are slowly being eroded away by the smoke, smog and waste materials we are encouraging in our daily lives. The properties of rain water are also responsible for decomposition of historical monuments: penetration of water into the pores and walls, climatic changes, microscopic creatures, the effect of animal excrements on the facade of the building, damages due to wind along with dust. And during the recent years, most countries have found out that the global architectural heritage is perishing

One of the more destructive forms of pollution is above mentioned acid rain. Acid rain occurs when fossil fuel emissions containing sulfur dioxide combine with moisture in the air to form acidic precipitation. When acid rain falls on historical monuments of limestone or marble, a chemical reaction takes place which has a corrosive effect on these structures. The reaction dissolves the material, leading to permanent damage. Acid rain causes marks in various marble structures, thereby souring their appearance. The marble columns of the Capitol building in Washington D.C have developed such marks. Fading and tarnishing of color are ones of the most common effects of acid rain. The brilliant white marble exterior of the Taj Mahal tomb has been reducing to a brownish-yellow shade over the years. And it is

the deposition of carbon and dust particles from excessive burning of fuels, garbage, and biomass that left this monument in such a state.

Corrosion causing acids may attack the material both in wet and dry forms. Some of the pollutants in the gaseous form may fall close to the source of emissions causing direct damage. Sulphur dioxide frequently falls as dry deposition within 30 km of its source. Wet deposition of acids occurs when the pollutants are released in atmosphere. They react with water vapor present in clouds to form dilute acids. Sulphur dioxide, nitrogen dioxide and carbon dioxide are the most responsible pollutants causing damage to the material. The intensity of damage caused by sulphur dioxide is more compared to the other pollutants. Sulphuric acid mist in the atmosphere causes deterioration of structural materials such as marble sculptures, and buildings have suffered damage in the last 30 years as a result of increased sulphur dioxide content in the atmosphere.

A recent study led by the Italian Institute for Environmental Protection and Research (ISPRA) and the Institute for Conservation and Restoration of Heritage (ISCR) shows that in Rome about 3600 cultural heritage made of calcareous stone (limestone) and 60 cultural heritage objects made of bronze are at risk of deterioration. As a response to this threat, Italy has been engaged in the development of strategies and technologies to safeguard cultural heritage assets for many years.



## POSSIBLE SOLUTION

Suggested solutions to stop manmade acid rain are to regulate the emissions coming from vehicles and buildings . This could be a radical step according to the EPA. Possible acts to make it done would be restricting the use of fossil fuels and focusing on more sustainable energy sources such as solar and wind power.

Each person can do their part as well. By reducing vehicle use, using public transportation, walking, riding a bike or carpooling . People can also reduce use of electricity, which is widely created with fossil fuels, or switch to a solar plan. Many electricity companies offer solar packages to their customers that require no installation and low costs.

Cleaning and crust removal is a necessary step for maintenance of the monuments, and should be considered an important form of preventive conservation.

## SOURCES AND USEFUL LINKS

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