



## Aerosol Loading

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Dear Friends,

Let me begin this note wishing you all a very happy New Year and Happy Pongal. This is the last on the series dealing with Planetary Boundaries: atmospheric aerosol loading. We would try to understand:

What are Aerosols and Aerosol Loading?

Why should this be considered as a Planetary Boundary?

What can we do to reduce Aerosol Loading?

### What are Aerosols and Aerosol Loading?

We are all familiar with smoke, fog and the mist or haze we see in a cold winter morning. These are examples of aerosols. These are very small liquid or solid particles hanging in the atmosphere. How are these generated? There both human and natural processes that give rise to aerosols. The ocean waves are a natural source of aerosols, when the fine water particles evaporate, leaving behind very fine salt particles in the atmosphere. Volcanoes also emit smoke into the atmosphere, causing aerosol loading, meaning addition of aerosols into the atmosphere. Human industrial activities and the entire transportation system (air / land and water) contributes significantly to aerosol loading. These are all called primary aerosols, as they are emitted directly as aerosols into the atmosphere. Another set of aerosols take birth in the atmosphere as a result of some chemical reactions. These are called secondary aerosols. Here again, we have both natural as well as man-made sources.

Aerosols		
	Primary	Secondary
Natural	Ocean	Vegetation
Man-made	Fuels	CFCs

All vegetation and plankton emit organic gases that promote formation of (secondary) aerosols in the atmosphere. Similarly, human activities also do the same, a familiar example is the case of CFCs (now banned). The reaction between the CFCs and ozone actually happened on the surfaces of polar clouds that are essentially aerosols.

## Why should this be considered a Planetary Boundary?

Scientists have discovered that the aerosols play very vital roles in the atmosphere, influencing Earth's temperature through a process called 'radiative forcing'. There are two types of radiative forcing, causing heating (positive) and cooling (negative). Cooling happens when the aerosols help in reflecting back solar heat into the outer space. Global warming due to greenhouse gases is an example of heating. These effects are taken care of in the boundary for climate change. But aerosols have more roles to play. They influence the amounts of cloud formation and rainfall. The entire Asian Monsoon system is endangered by atmospheric pollution, causing very large brown clouds hanging all over South Asia. Developing countries in particular suffer from very high death rates from diseases (of lungs and heart) traced directly to the presence of smoke and other pollutants like fine dust in the atmosphere. When dark particles like soot deposit on ice sheets or glaciers, they help in their faster melting, that has serious consequences. Deforestation affects the aerosol formations and the rainfall over these areas.

Scientists have not been able to arrive at a specific boundary for aerosols, because of the complexities involved in their measurement and the atmospheric movements that take place. However, there are enough evidence to flag them as a potential planetary boundary.

## What can we do to reduce Aerosol Loading?

We can certainly do our little bit by not unnecessarily burning waste materials, and by spreading awareness about this around us. In fact scientific recycling of waste can reduce substantially, human additions to aerosols. Protecting trees and planting more trees is yet another possibility. Replacing the traditional 'Chulha' or stove for cooking with LPG or 'smokeless chulha' could be another contribution.

Source: PB MOOC | 5.2.1 | Aerosol Loading by Prof. Sarah Cornell of Stockholm Resilience Center.

<https://www.youtube.com/watch?v=Hag3OI01lhc&list=PLExYXELRcSgGsOBrE2GCdLggbuR4yopxq&index=32>

