



Planetary Boundaries

By

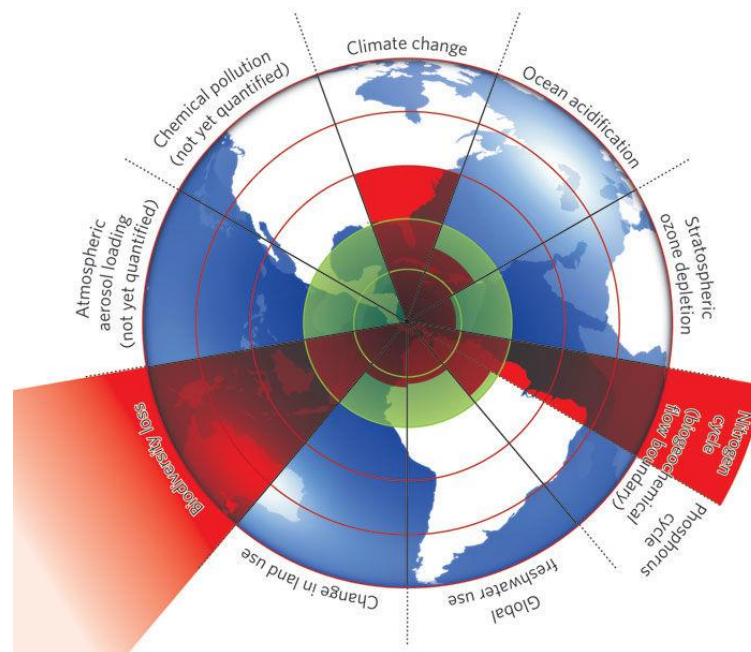
Dr. Sanjay Banerji

Founder Director/Dean of Amrita School of Business



Dear Friends,

This month, we shall talk about the Planetary Boundaries. We started this series with a reference to the Anthropocene, the age of the human beings, when we, humans have occupied the driver's seat, and gained enough capabilities to steer the future course of Mother Earth. Next, we discussed the evolution of life on Earth. The continuation of these very life forms is threatened now, and the scientists posed a question to Mother Earth, "How far can we push you, O Mother Earth, beyond which, you would change irreversibly into completely new states, unknown to us, and to all forms of life that flourished in the Holocene period?" Environmental scientists across the globe joined hands to find an answer to this question, and published their scientific findings first in 2009 and revised it in 2015. In these articles, they reported their findings on nine Planetary Boundaries, as we shall briefly discuss here today. The following figure represents these nine boundaries. The inner green circle represents the safe region, and the red segments indicate the estimates of current status with respect to each one of the boundaries. The nine boundaries are: 1. Climate change, 2. Ocean acidification, 3. Stratospheric ozone depletion, 4. Nitrogen and Phosphorous cycle, 5. Global freshwater use, 6. Changes in land use, 7. Bio-diversity loss, 8. Atmospheric aerosol loading, and 9. Chemical pollution, now renamed as 'Novel entities'. Owing to the complexities involved, science has not been able to define the boundaries for the last two, although their impact on our ecological system are well documented and must be addressed.



On a positive note, humanity has been able to reverse the trend in stratospheric ozone depletion, through the Montreal Protocol banning the use of chlorofluorocarbons (CFCs) as refrigerants, and

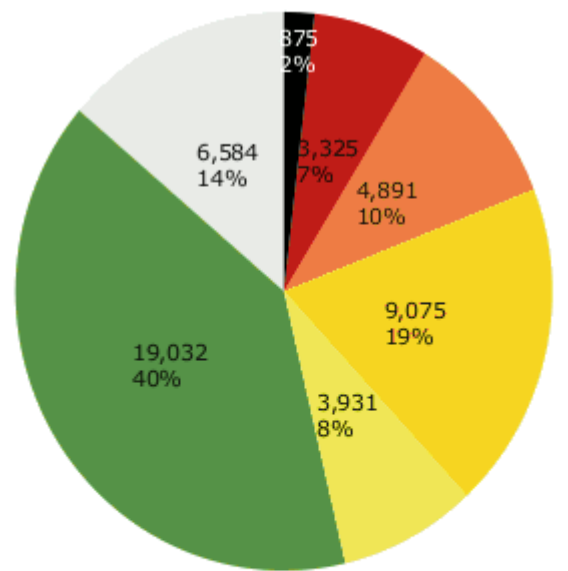
the satellite pictures show that the ozone hole is gradually closing itself. This shows that humanity has the capability to take positive action to arrest these adverse effects. But the immediate challenge before all of us is to arrest and reverse the trends on three boundaries where we have already crossed the limits: climate change, Nitrogen cycle and bio-diversity loss. Let us discuss briefly, the nature of these 3 boundaries.

Out of these 3, climate change is the one that has been discussed most widely, and the common man is aware of it through the Paris Agreement of December 2015. Accumulation of different Green House Gases (GHGs) is its root cause. The GHGs are Carbon dioxide, Methane, Nitrous oxide, and many more in smaller amounts. Carbon dioxide (the main component) is generated by burning fossil fuel used to generate electricity and to drive our air, land and water transportation systems. Another major source comes from cement manufacturing process. We can draw one immediate conclusion from this: we must conserve energy in all forms, and try to switch over to renewable sources that do not emit as much CO₂. (Source:

<https://www.nature.com/articles/461472a/figures/1>)

Our use of chemical fertilizers (N,P,K) for our food production is the root cause for excessive introduction of reactive Nitrogen into our lakes, rivers, coastal waters, land and atmosphere (as nitrous oxide) leading to GHG accumulation and lack of oxygen in these waters, making it inhospitable for fish and other marine lives to survive. Scientists have suggested that human conversion of atmospheric inert Nitrogen into reactive forms be reduced to one-fourth of the current amount, but it is a difficult task, the report agrees.

Perhaps the most significant boundary we have crossed is bio-diversity loss. Different species of life on earth are becoming extinct at rates 100 to 1000 times faster than what is normal, and at this rate, *“Up to 30% of all mammal, bird and amphibian species will be threatened with extinction this century”* reports Nature. (<https://www.nature.com/articles/461472a>)



Bio-diversity Status

The primary driver for this is our continuous grabbing of land for agriculture and human settlements, thereby destroying species habitats in existing ecosystems. We are the root cause for this sixth massive extinction of species on Earth, the earlier five were due to natural causes. Science is warning us that our activities are threatening the survival of life on Earth. Our lives are intrinsically linked with the survival of these diverse forms of life, like the pollination function of the bees. We shall come back to each one of them in some more details later.

