



Resilience and Tipping Points

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Dear Friends,

This month we shall discuss the concept of 'Resilience' and 'Tipping Points'. We shall discuss:

What is Resilience?

How is it eroded?

What is Tipping Point?

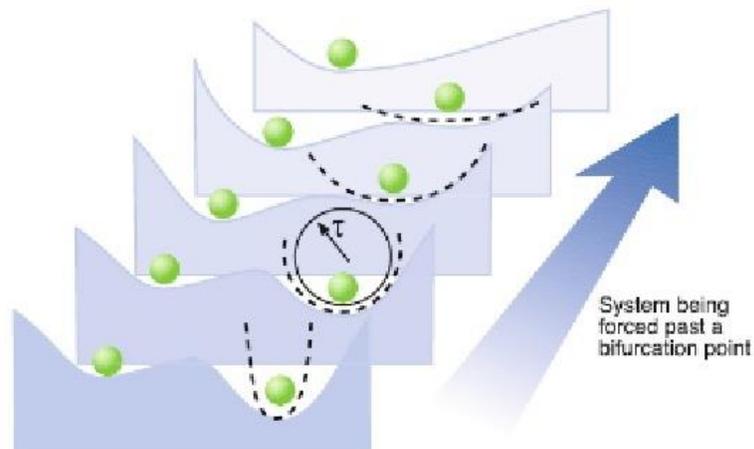
How are these concepts related to Sustainable Development?

What can we do to help rebuild Earth's resilience?

What is Resilience?

Think of a rubber band. It becomes longer if we pull it, but it returns to its original size, as soon as we stop pulling it. Think of our own body. Our heart beats much faster when we run. But soon it reverts back to its normal pace, after we stop running. A tree loses all its leaves during spring, and it looks like it is dead. But soon after the first summer showers, it starts to grow new leaves. All of these are simple examples of the resilience inherent in the rubber band, our heart and a tree. It is the same with the Earth System, but on a much larger and complex scale and level. If we disturb a part of the Earth System, it has the built in capacity to restore itself to its previous state. This capability is called 'Resilience'. Regular readers of this blog might recall the example of the citizen of Mumbai, famous for resuming normal life, the very next day after flooding that is a regular phenomenon in the rainy season.

You may think of a marble at the bottom of a 'U' shaped bowl. If you push it up and release it, it would settle back at the bottom. The figure depicts resilience with this idea.



How is it eroded?

Again think of a rubber band that has been stretched out and kept in that position for days together, perhaps to tie down the cover of a box. When you remove the rubber band from the box, it does not recover its original size, and becomes a little elongated. It has lost part of its resilience. If it

were kept in that position for too long, it might lose its complete resilience. Smoking affects both the heart and lungs of the human body and regular smoking affects the heart and lungs, such that one is not able to run for too long a period, and it takes longer time for the heart to get back to its normal state, after a run. I am observing a Neem tree at the back of my bedroom. It loses its leaves a second time when the rains continue for almost a week. After that, it struggles for a long time to get back a new set of leaves. Eventually it gets them back, but the process leaves the tree weaker, and has less foliage than other Neem tree on campus. We may conclude from these examples that the resilience of any system is finite, and if pushed too much, it gets eroded.

We human beings have been exerting increasingly higher demands on our Earth System, as you have seen in the last blog. Currently we are consuming 1.7 earths annually, and the Earth cannot revive itself back to its original abundance of resources. *We are eroding Earth's resilience continuously.*

What is Tipping Point?

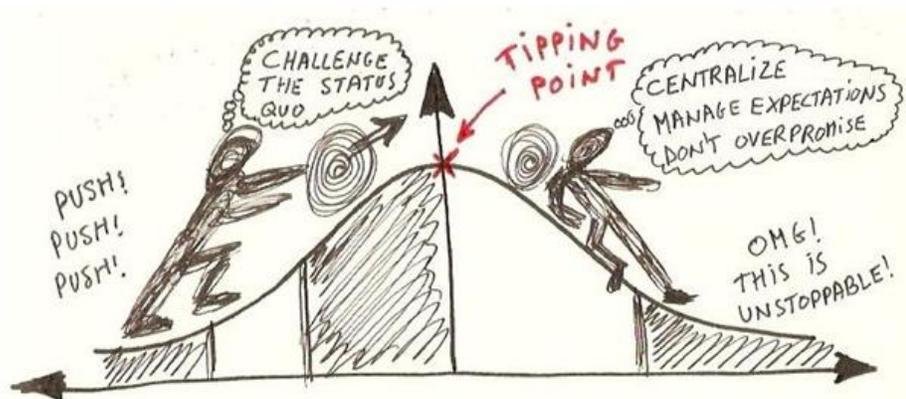
Please refer the figure above. It shows “ A stability landscape with two stable states. The valleys or basins of attraction, in the landscape represent the stable states at several different conditions, while the hilltops represent unstable conditions as the system transitions from one state to another. If the size of the basin of attraction is small, reliance is small, and even a moderate perturbation may bring the system into the alternative basin of attraction. (Scheffer 2009).”

Source: PB-MOOC Planetary Boundaries and Human Opportunities

The schematic diagram attempts to show the concept of a ‘Tipping Point’. *The green ball represents the earth system, in two potential stable states.* If the ball is disturbed from its location at the bottom of the cup, it swings back to the bottom, as soon as the disturbing forces are removed. The curvature at the bottom (shown by the dotted lines) is a measure of the Earth’s resilience.

As we exert disturbing forces on the system, its resilience goes down, schematically shown by reducing curvature. Finally, the resilience becomes so low that a small ‘Push’ takes the ‘Ball’ out into the second stable state. This is the ‘Tipping Point’. Once a system goes over a ‘Tipping Point’ the change is *irreversible*.

On a planetary scale, such changes do occur, and we have several evidences of them. Landscapes that were once green slowly turn into savannah and ultimately into desert, as we cut down the trees. At a



local scale, we have similar evidence in our Amrita University Campus at Ettimadai. It has deep

gorges, indicating water flows in the past, accompanied by rounded stones. However, today the water channels are completely dry. We have planted more than 100,000 trees on the campus, but we cannot do much with the adjoining hills, and water has become very scarce. We have no idea, when we would be able to reverse this change. It seems to be irreversible.

Links with Sustainable Development

By now it must be obvious that we do not want our Mother Earth to be pushed into some state that is not at all suitable for different forms of life to sustain themselves, be it human beings, animals, birds, fish or plants. By an understanding of the idea of resilience, we understand how our excessive exploitation of resources from Mother Earth is slowly but definitely eroding its resilience, with a potentially dark future ahead, particularly for our children and grand-children.

What can we do?

Each one of us can resolve, not to put undue pressure on our Mother Earth, by limiting our consumption of all kinds of resources as best as we can. We can also try to propagate this message to as many friends and relatives as we can. On all our FB and other social media postings, we may call attention to these urgencies. We must tell the world that the lifestyles of the rich nations are simply unsustainable for the entire world.



On a positive note, we may try to help re-build the resilience of our Mother Earth by planting more trees, rain water harvesting, vermi-culture, developing organic kitchen gardens, adopting solar energy etc. as well as campaigning for these initiatives, educating everybody around us.

Let the change begin at home. We may follow the advice of Sri Satya Sai Baba: 'To be, to do, to see and to tell'.

You may like to view a video for a different but accurate explanation of resilience:

<https://www.youtube.com/watch?v=tXLMeL5nVQk>

Wish you all a sustainable future.

Thank you.

