A call for rain

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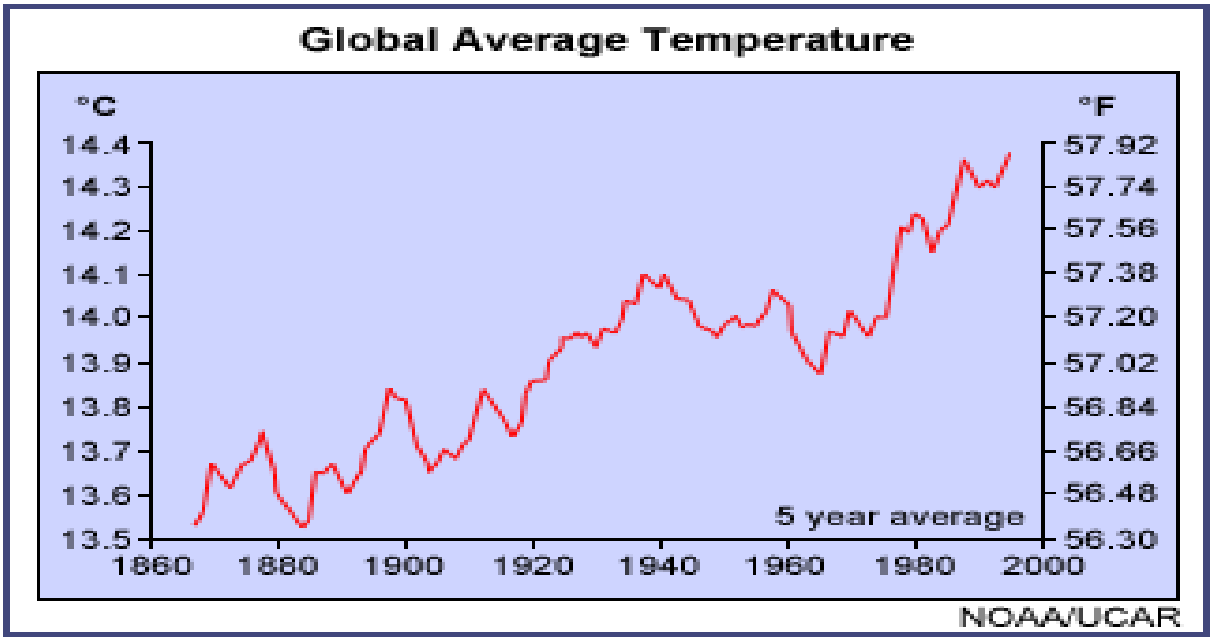
Introduction

As the focus of debate in international diplomacy shifts from world politics to the real-time threats of climate change, what comes to attention is the damage that has already been done in its wake. While the phenomenon of climate change had been rebuffed in the mainstream, the mainstream today orients itself to address this growing concern. The concept clean living is not restricted to food or healthcare anymore; rather, it now extends to the so called carbon footprint that one leaves behind. From extravagant lifestyles to greener ones, the paradigm shift comes in the form of global consciousness in the matters of energy generation, consumption of resources, and waste management. This shift in human perspective of its ecosystem has lead the writers of this paper to probe into the nature and magnitude of the consequences that have driven the entire human race to submit to the new-sprouting demands of nature; and the efficacy of the efforts taken to curb climate change, at a time when experts claim that the earth's environment has reached a point of no return...



Current [atmospheric] CO2 values are more than 100 ppm higher than at any time in the last one million years (and maybe higher than any time in the last 25 million years). This new record represents an increase of 85 ppm in the 55 years since David Keeling began making measurements at Mauna Loa. Even more disturbing than the magnitude of this change is the fact that the rate of CO2 accumulation in the atmosphere has been steadily increasing over the last few decades, meaning that future increases will happen faster. When averaged over 55 years, the increase has been about 1.55 ppm CO2 per year. However, the most recent data suggest that the annual increase is more than 2.75 ppm CO2 per year.

These increases in atmospheric CO2 are causing real, significant changes in the Earth system now, not in some distant future climate, and will continue to be felt for centuries to

come. We can study these impacts to better understand the way the Earth will respond to future changes, but unless serious actions are taken immediately, we risk the next threshold being a point of no return in mankind's unintended global-scale geoengineering experiment.

Dr. Charles Miller (Researcher),
NASA.

Such radical developments in the past few decades have reached a crescendo and have forced the law and policy makers in the Indian subcontinent to contemplate whether the issue is so grave as to adversely and directly impact the Indian economy.

The Indira Gandhi Institute of Development Research has reported that, if the predictions relating to global warming made by the Intergovernmental Panel on Climate Change come to fruition, climate-related factors could cause India's GDP to decline by up to 9%; contributing to this would be shifting growing seasons for major crops such as rice, production of which could fall by 40%. Wheat yields too, would get wiped out substantially, raising costs of grains and hitting overall GDP growth. Farmers would be hit as farm level incomes could be affected by as much as 25% if temperatures change by a mere 2-3%. While a UN report pegs the temperature change by the end of the century at 4.5%, around seven million people are projected to be displaced due to, among other factors, submersion of parts of Mumbai and Chennai, if global temperatures were to rise by a mere 2 °C (3.6 °F).

Despite having recognised the growing threat of global warming and climate change, the international scientific fraternity remains uncertain as to the form that this hazard will take in the near future, even in the face of measurable natural effects of climate change. As more studies on impact of climate change are being carried out in research centres like Indian Institute of Science, Bangalore, and National Physics Laboratory, the scenario gets scarier. Frequency of climate extremes, like droughts and heat waves, are bound to hit dry land areas of the country while precipitation, when it does occur, will only make things worse. Scientists are shy, limited by available scientific knowledge, of connecting immediate micro-level climate extremes to global warming, but are now very certain that climate change is a reality for India as it is in the West.

We are certain now of absolute data (on climate change) and its trends but we cannot yet predict with great confidence because our projection models are not so advanced.

M Rajeevan (Director),
Long Range Forecasting at the Indian Meteorological Institute, Pune.

Despite such grim concerns over the course of climate change, philosopher George Santanaya's famous words, *"Those who cannot learn from history are doomed to repeat it."* come to mind when one comes across the events that unfolded at the 2016 Paris Climate Talks, where an ocular rift between India and a select group of world powers unfurled. The rift develops through the construction of a deeply flawed narrative that risks repositioning India and other emerging countries in global climate politics. It is based on two misleading premises. The first, a sleight of hand that obscures the past, asserted that the only thing that

mattered in Paris is where individual countries are heading, not how the world ended up with global warming in the first place. The second premise builds on this to suggest that the global future is alarming because of India's plans to significantly step up the use of coal to develop its economy and bring basics such as electricity to all its people, at a time when the world is struggling to find a way to kick its fossil fuel habit.

How this is relevant to the issue of climate change is that such political tactics risk obscuring the fundamental impacts that have been occurring world over by invalidating their factorisation in legislature as well as research studies and are ultimately detrimental in the global collaboration for the mitigation of climate change. This paper endeavours to analyse the present impacts of climate change in an Indian context and directs the analysis to the strata of Indian society that are statistically affected the worst by them.

Poverty

The 2015 Climate Change and Poverty Conference of the World Bank outlines what is extremely relatable to India's situation- the disproportionate impact on the more than 400 million that make up India's poor. This is because so many depend on natural resources for their food, shelter and income. More than 56% of people in India work in agriculture, while many others earn their living in coastal areas. Some key points of the conference were:

- *Climate change is only one of many determinants of poverty outcomes, but climate impacts will represent an obstacle to the sustained eradication of poverty*
- *Climate change will add an additional complexity to the already stressful decision processes of poor people. The most visible climate change impacts may be ex-post, but ex-ante impacts on investment decisions are just as important.*
- *Climate change and poverty both evolve in a dynamic and interlinked process and we need to not only focus on poor people but also those that are vulnerable to fall into poverty.*
- *Good climate policies can benefit the poor, but bad policies are damaging: The devil is in the design, and the extent to which polices are accompanied with social protection measures.*
- *The agricultural context of developing countries makes them inherently more exposed and vulnerable to climate-related changes in the agricultural, forestry, and land-use sectors.*
- *Food prices represent a main channel through which poor rural and urban households could be affected.*
- *Countries need to also take a system-wide perspective in their energy-food-water nexus.*
- *Natural disasters pose significant human and economic costs globally, with associated impacts increasing in recent decades and expected to worsen due to climatic changes. At the macro-scale, populations in low-income countries are most exposed; at the micro-scale, the urban poor are Climate Change and Poverty*

Conference February 9-10, 2015 7 disproportionately exposed, particularly to floods. These trends are likely to continue.

- *Beyond exposure and vulnerability, poor people have less ability to cope with a disaster given low incomes and savings. Poor people currently also have less access to social protection. This will need to change: adaptation must be fostered through better and more social protection, and low-cost infrastructure.*
- *This dependency on ecosystem-based livelihoods, makes poor people in rural areas who have little other resources to cope extremely vulnerable to the double-exposure of resource degradation and climate change.*
- *Go beyond impacts on poor people and move towards an understanding of structural inequalities.*
- *When poor households do migrate, it is generally internal, towards urban areas, and usually a last resort choice. Without a policy response in destination sites, migrants may further face risks in cities, or a "migration trap".*
- *Addressing climate change and poverty will require a set of complementary, cross-sectoral polices that address non-climate related challenges which exacerbate the impacts on poor and vulnerable people.*

POVERTY NUMBERS, OLD & NEW (in million)

Regions/ countries	By 2005 PPP ($1.25 line)	By 2011 PPP ($1.25 line*)
Developing world	1,215	567.3
Sub-Saharan Africa	413.7	299.8
South Asia	506.8	134.2
East Asia and Pacific	250.9	105.9
India	400.2	98.9
Nigeria	107.7	76.3
Latin America and Caribbean	32.3	26.8
Europe and Central Asia	3.2	2.6
Middle East and North Africa	8	2

*The authors have used the existing poverty line drawn on the basis of the 2005 PPP index for the new 2011 PPP index
Source: Laurence Chandy and Homi Kharas, Brookings Institution, 2014

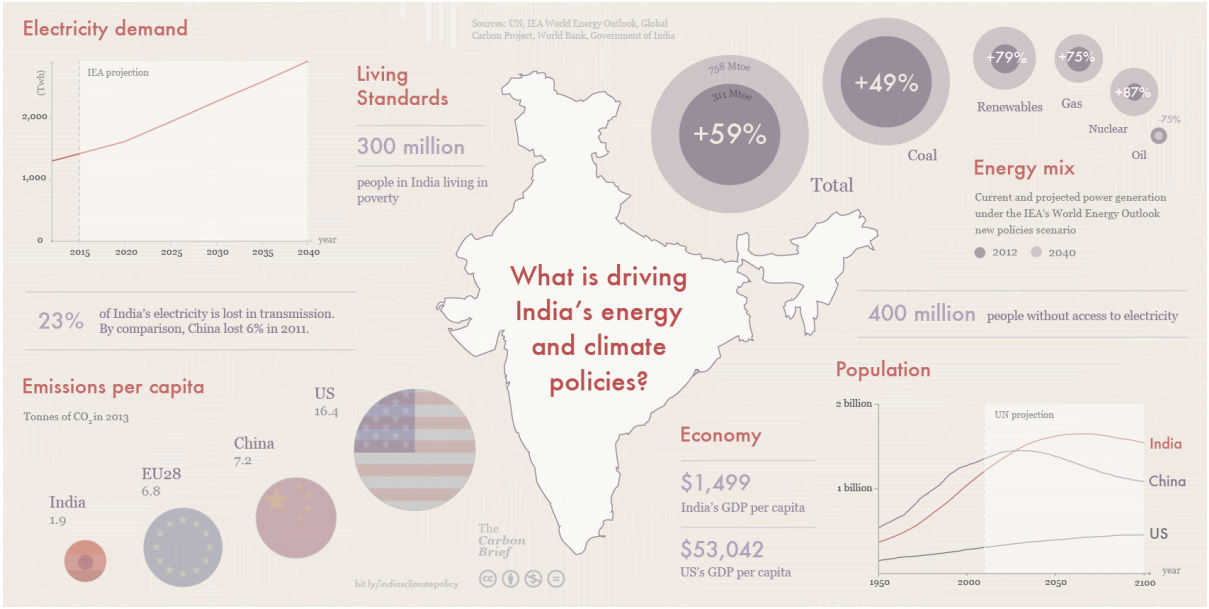
The auxiliary measures in managing and mitigating the effects of climate change as proposed by the Conference, as well as India's position on world pollution find resonance in its 2014 Briefing Paper for UNFCCC COP 20 Lima, Peru. It refers to a high level advisory group on climate change constituted in June 2007 and reconstituted in November 2014 with the following objectives:

- *Coordinate national action plans for assessment, adaptation and mitigation of climate change.*

- *Advise government on pro-active measures that can be taken by India to deal with the challenge of climate change.*
- *Facilitate inter-ministerial coordination and guide policy in relevant areas.*

It goes on to describe the commissions, initiatives, missions and bilateral cooperation put in place to initiate or intensify domestic preparations for their Intended Nationally Determined Contributions (INDC). Further, NRDC's India Initiative on Climate Change and Clean Energy, launched in 2009, works with partners in India to help build a low-carbon, sustainable economy. NRDC is working on the ground with a premier Indian health organization to develop a climate-health preparedness plan in a major Indian city, focused on preventing heat-related deaths and illnesses. They working to assess the vulnerabilities of local communities to extreme heat events and to develop municipal strategies for preparing and responding to climate emergencies.

Through such organised efforts, ministries with lead responsibility for each of the missions are directed to develop objectives, implementation strategies, timelines, and monitoring and evaluation criteria, to be submitted to the Prime Minister's Council on Climate Change. The Council will also be responsible for periodically reviewing and reporting on each mission's progress. To be able to quantify progress, appropriate indicators and methodologies will be developed to assess both avoided emissions and adaptation benefits.



Rainfall patterns and drought

The monsoon, which provides 80 per cent of the total rainfall in the subcontinent and on which India is completely dependent for its agriculture, is witnessing disturbing changes. There has been a decline in the average total seasonal rain during the period 1980-2011, according to a new study. The study was carried out by Stanford Woods Institute for the

Environment, the Stanford University's hub of environment research, and published in the latest issue of Nature Climate Change. It also found changes in the atmosphere like winds and moisture which are likely to be responsible for changes in wet and dry spells. After studying trends of monsoon rains over 60 years, the researchers have warned of extreme weather conditions in future. The South Asian summer monsoon is an annual wind-driven weather pattern that is responsible for 85 percent of India's annual precipitation and is vital for the country's agricultural sector. The monsoon season starts in June and lasts through September.

Deepti Singh, the lead author of the study, said that rainfall extremes during the months of the monsoon season can be as important as how much total water is received. For example, during critical crop growth stages, too many days without rain can reduce yields or lead to crop failure, which can reverberate through India's agriculture-dependent economy. At the same time, short periods of very heavy rainfall can create humanitarian disasters, such as in 2005, when massive flooding killed thousands of people in Mumbai. Because such extreme events are rare, it can be difficult to study them objectively. For the new study, tests were conducted to determine whether the pattern of extreme wet and dry "spells" during the monsoon season had changed in recent decades. Wet and dry spells were defined as three or more consecutive days of extremely high or low rainfall, respectively.

The team compared rainfall data gathered by the Indian Meteorological Department and other sources over a 60-year period. They used rigorous statistical methods to compare peak monsoon rainfall patterns during two time periods: from 1951 to 1980, and from 1981 to 2011. The team looked specifically at rainfall during the months of July and August, which is the peak of the South Asian summer monsoon. The analysis focused on central India, which is the core of the monsoon region and has extremely high population densities.

When the team members analysed the Indian monsoon data using their statistical methods, they discovered that although the average total rainfall during the monsoon season has declined, the variability of rainfall during the peak monsoon months has increased. In particular, the researchers observed increases in the intensity of wet spells and in the frequency of dry spells. According to Singh, the statistical techniques show that the changes in these characteristics are robust and that these changes are unlikely to happen purely by chance. The team's findings match stories told by Indian farmers in recent decades, said Singh, whose family lives in the region of the country affected by the monsoon. The team also found changes in the atmosphere – such as winds and moisture –that are likely responsible for the changes in wet and dry spells.

> *My grandfather grew up in a village that is primarily dependent on agriculture, and the farmers that live there say that the monsoon rainfall pattern has changed. They've noticed over the last decade that rainfall occurs in heavy bursts and comes earlier in the monsoon season, and that the dry spells last longer.*

The 2006 National Climate Centre research report also examines trends in the rainfall pattern in India. In this report, nationwide monthly, seasonal and annual rainfall series were constructed based on the area weighted rainfall of all the 36 meteorological subdivisions of the country. The conclusions of the report have been collated and tabulated after extensive on ground data collection from 1,476 rain-gauge stations across 458 districts during the monsoon. Some key findings of the report were:

- *Mean (1901-2003) rainfall of July is 286.5 mm, which is the highest and contributes 24.2 % of annual rainfall (1182.8 mm).*
- *The August rainfall is slightly lower and it contributes 21.2% of annual rainfall.*
- *June and September rainfall are almost similar and they contribute 13.8 % and 14.2 % of annual rainfall respectively.*
- *The mean south-west monsoon rainfall (877.2 mm) contributes 74.2 % of annual rainfall (1182.8 mm).*
- *Contribution of pre-monsoon rainfall and post-monsoon rainfall in annual rainfall is mostly the same (11%).*
- *Coefficient of variation is higher during the months of November, December, January and February.*

Decadal mean (% departure from normal), frequency of drought and flood years

DECADE	Decadal mean Per cent departure from normal	Freq. of Deficient year	Freq. of Excess year
1901-10	-2.2	3	0
1911-20	-2.5	4	3
1921-30	-0.4	1	0
1931-40	1.7	1	1
1941-50	3.3	1	1
1951-60	2.5	1	3
1961-70	-0.1	2	1
1971-80	-0.8	3	1
1981-90	-0.3	2	2
1991-2000	0.6	0	1
2001-2003	-5.9	1	0

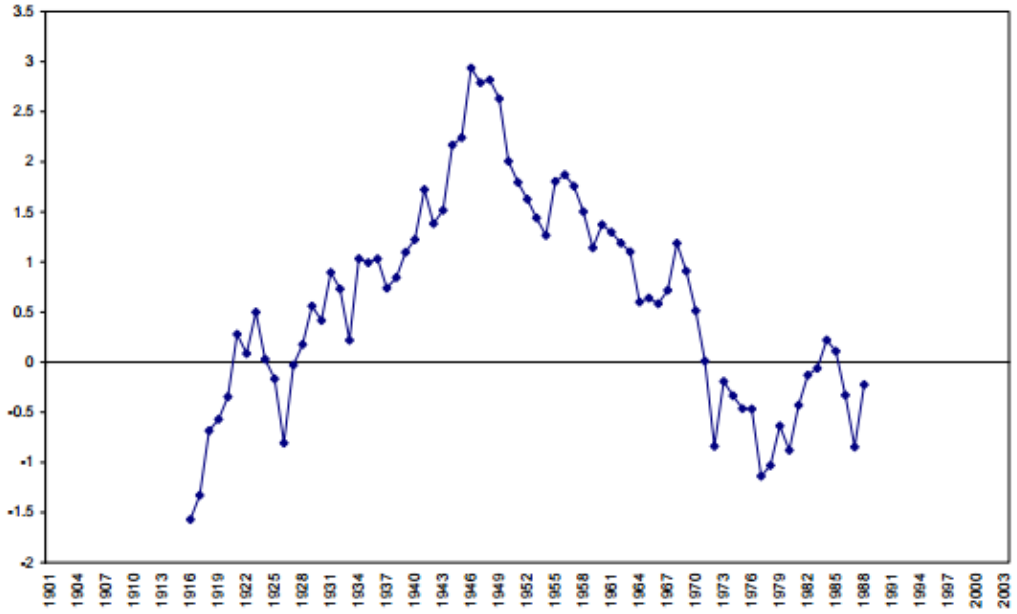
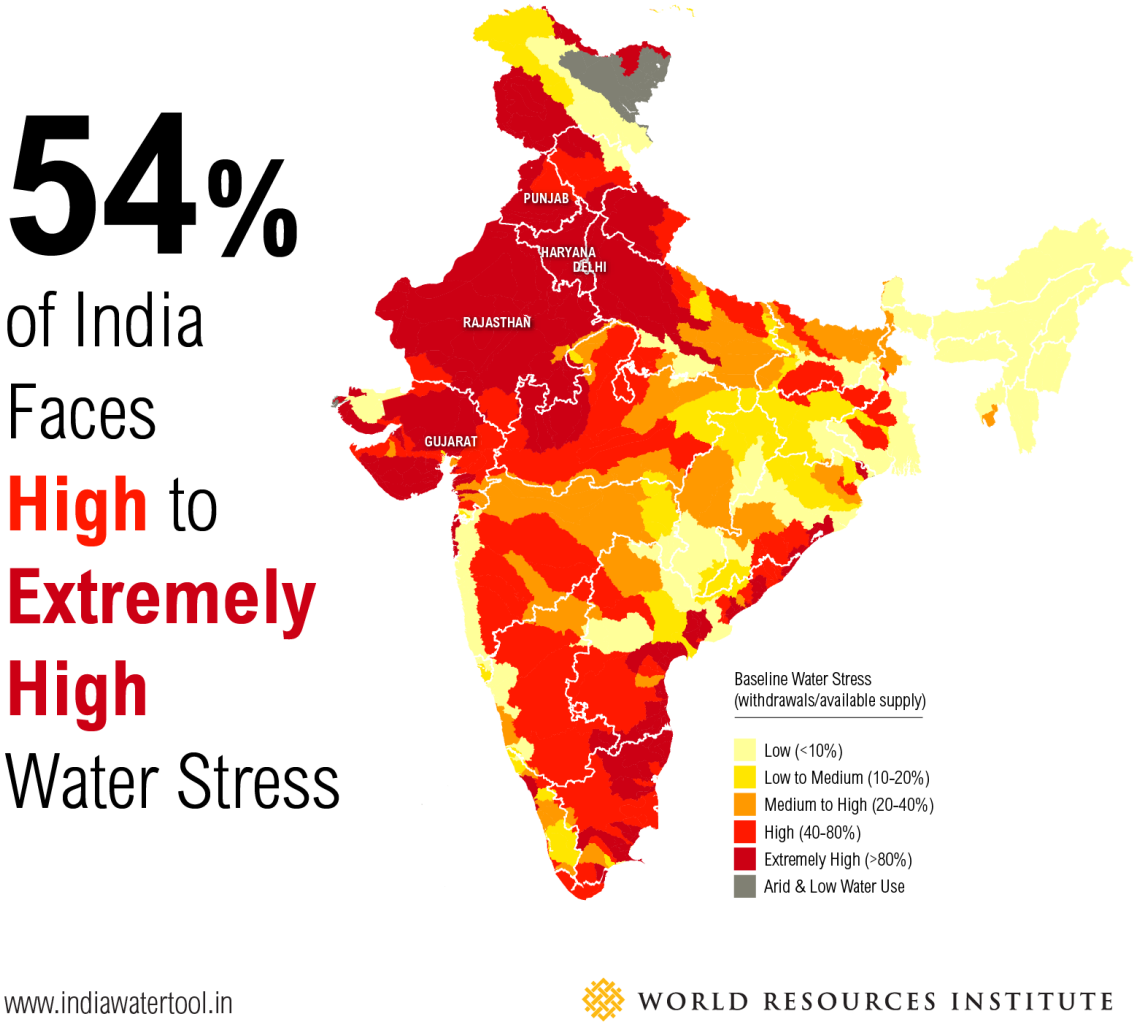
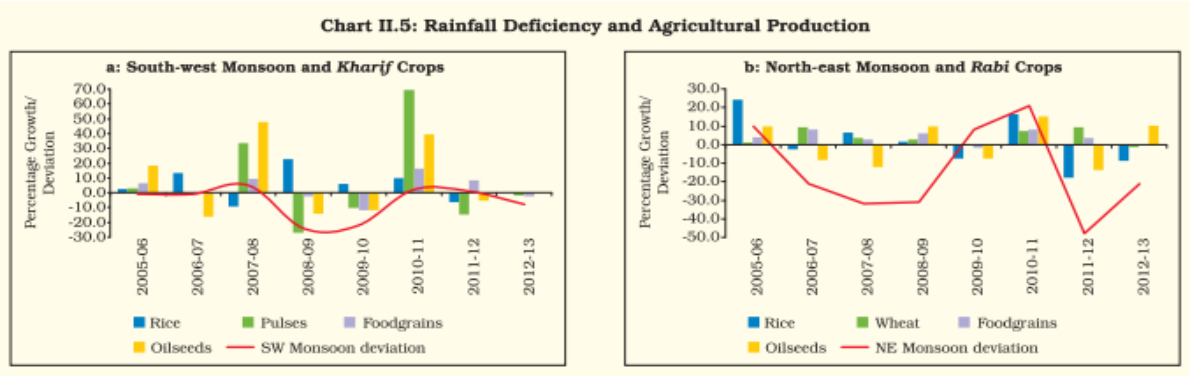


Fig.4. The 31 year moving averages of all India south-west monsoon seasonal rainfall

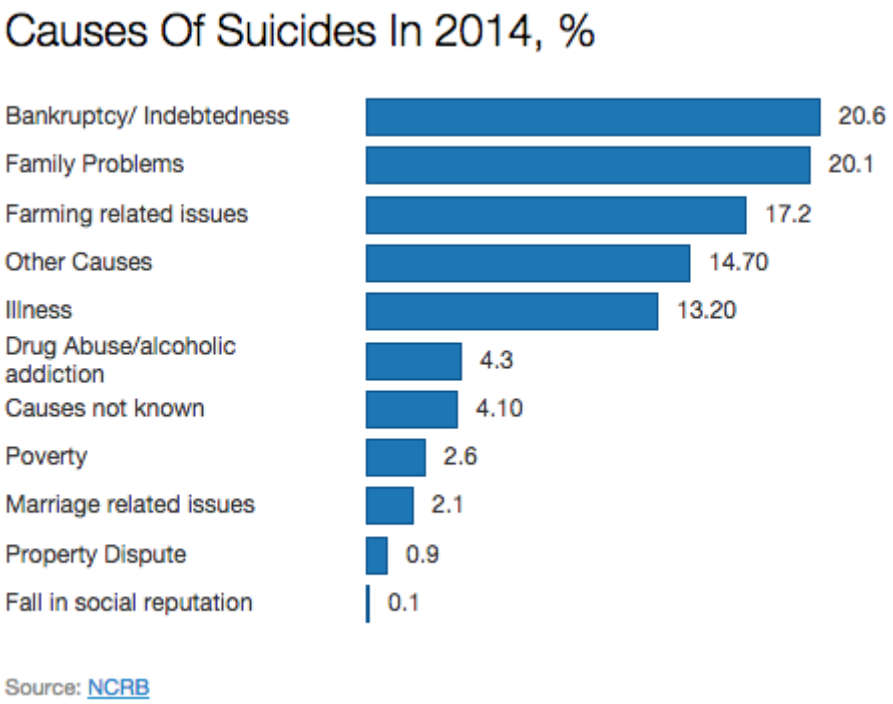
With the aim of supporting countries towards developing proactive and risk-based national drought management policies, a UN-Water initiative was launched on “Capacity Development to support National Drought Management Policies" in March 2013. In 2014, the Country Report submitted by India to the Regional Workshop for Asia Pacific assessed the drought conditions in the country as detailed in the Reserve Bank of India Annual Report 12’-13’. According to the report, approximately 16 per cent of India’s geographic area, mostly arid, semi-arid and sub-humid is drought-prone. Due to high temporal and spatial variability in rainfall and wide variations in physiographic and climatic conditions in the country, droughts are experienced in varying intensities (moderate or severe) almost every year irrespective of a good monsoon. Since 2001, the country has experienced three major droughts, in the years 2002, 2004 and 2009, severely affecting the various sectors and overall economic development of the country. The National Commission on Agriculture classifies droughts as meteorological, agricultural and hydrological based on the concept of its utilization. While it is difficult to demarcate the onset and end of drought, the impacts can be severe affecting the poorest and most deprived sections of the society. India is primarily an agrarian economy and while the sector’s contribution to the national Gross Domestic Products (GDP) is gradually declining- from 51.9 per cent in 1950-51 to 13.7 per cent in 2012-13 at 2004-05 prices- it employs over 50% of the population. Adding to the vulnerability is the fact that approximately 56 per cent of the total cropped area is rain-fed.



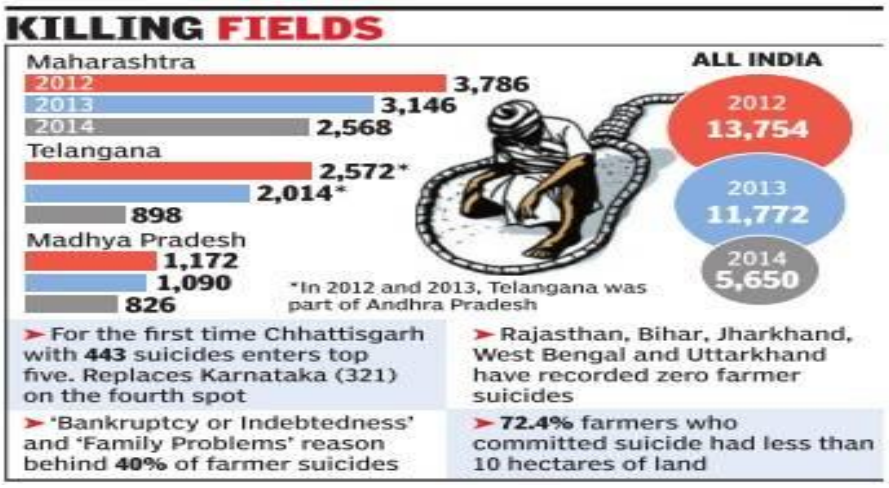
The performance of agriculture during 2012- 13 showed that even though the sector in recent years has become more resilient, the whimsical monsoon still affects its output. Only 45.0 per cent (2009-10) of the total cropped area is under irrigation, while around 16 per cent of the country's geographic area, mostly arid, semi-arid and sub-humid, and is drought-prone. Rain-fed agriculture accounts for around 56 per cent of the total cropped area, with 77 per cent of pulses, 66 per cent of oilseeds and 45 per cent of cereals grown under rain-fed conditions. Consequently, if there is a shortfall in rainfall, crop production is adversely affected.



Farmer Suicides and Agrarian Distress



Over the last two decades, one predicament has become of national importance due to the exponential acceleration with which its occurrence has amplified, which is that of farmer suicides in the country. What had gained infamy in mainstream media and the cultural bedrock of the Indian society as a social evil first is now fast becoming a demographic abomination. With the number of deaths already in the thousands, the unprecedented impact of such a mass event on the moral fabric of the nation is now taking on an inhuman form. The repercussions that are felt as an onslaught of the ensuing tragedy reinstate the gravity of the fact that the livelihood and synthetic ecosystem of India irrevocably revolve around farmers. The narrative of the events has turned such a horrendous tune that reinstating the status quo to sustainable standards will require in its entirety, institutional amends from the nation as a whole.



Emphasising the primary causes of farmer suicides in the country, an article from Indira Gandhi Institute of Development Research titled 'Risks, Farmers' Suicides and Agrarian Crisis in India: Is There A Way Out?' published in 2007, illustrates the factors influencing this tragic manifestation. Some of them are as follows:

The suicide mortality rate (SMR, suicide death for 100,000 persons) for male farmers in India increased from 12.3 in 1996 to 19.2 in 2004 and then reduced to 18.2 in 2005 whereas SMR for male non-farmers increased from 11.9 in 1996 to a peak of 14.2 in 2000 and thereafter declined to 13.4 in 2005. During 2001-05, there were 86,922 farmers' suicides, of which, 86 per cent were males. Across major states, the states where SMR for male farmers is higher that of the national average of 17.5 and SMR for male non-farmers in that state are Kerala, Maharashtra, Chhattisgarh, Karnataka, 7 Tamil Nadu and Andhra Pradesh. Among smaller states/union territories the incidences are high in Pondicherry, Dadra & Nagar Haveli, Delhi, Goa and Sikkim.

What is intriguing is that the relatively higher incidence of farmers' suicides in Chhattisgarh and Tamil Nadu seems to have gone unnoticed. Chhattisgarh scenario is worrying because cultivators form nearly 45 per cent of its workers, as per 2001 census. Tamil Nadu situation is serious because some recent studies based on verbal autopsies point out that suicides as per police records are underestimated.

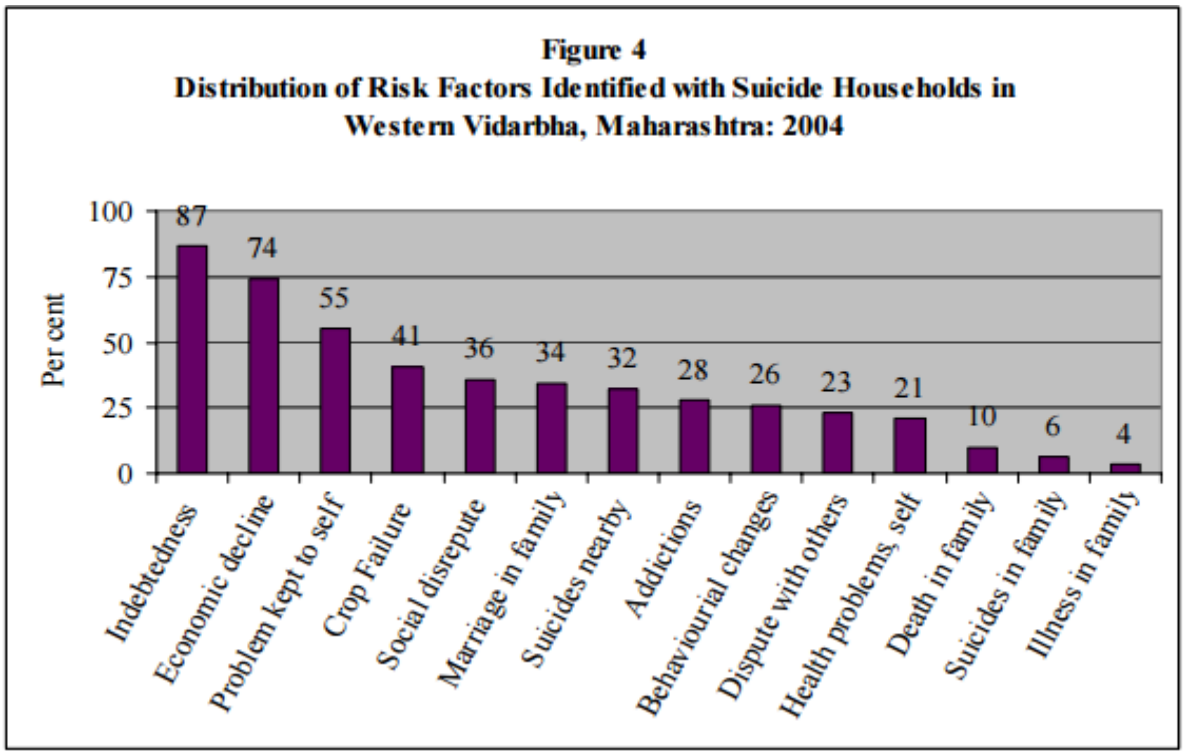
The most common reason was discovered to be indebtedness (96 out of 111 cases, 87 per cent). From all those indebted, 44 per cent were harassed for repayment of loan and in 33 per cent of cases the creditor insisted on immediate repayment. Next in importance is fall in economic position (74 per cent). Indebtedness per se need not lead to economic downfall, but when repayment is difficult, households may resort to sale of assets. Similarly, a fall in economic position can also lead greater reliance on credit, and thereby increasing the debt burden. Not discussing one's problem with others (55 per cent) leads to closing an avenue for letting out ones pent up feelings and frustration.

Crop failure is mentioned in 40 per cent of the cases and most of these also mentioned about loss in second or third sowing due to delay in rainfall. Crop loss can also happen due to excessive untimely rain, say, during the time of harvest. Crop failure can lead to economic downfall and make it difficult to repay existing loans. This will also increase the need for additional credit.

Change in social status was identified in 36 per cent of the cases. This can be associated with a fall in economic position. Harassment by creditors or their agents due to non-payment of loans can also lead to a loss of face in the community.

A socially important role of a brother/father is to get one's sister/daughter married. Communities have norms in terms of age and expenditure. A farmer is largely dependent on a good return from his produce to fulfil this obligation. Thus, crop failure, greater credit burden or a fall in his economic position can come in his way of fulfilling this obligation. Recent marriage of a sister/daughter or inability to get one's sister/daughter married has been identified as a risk factor in 34 per cent of the cases.

Personal health problem of the deceased was identified in 21 per cent of the cases. From these, 26 per cent (6 cases) were those with some mental health problem. Illness gets aggravated due to poor economic condition because it makes care seeking difficult. Similarly, ill health can lead to a loan to meet medical expenses and also reduce the ability to work aggravating the economic condition. If the sick person is some other member (3 per cent of the cases) then the breadwinner has the added frustration and helplessness in not being able to provide appropriate care for an ailing parent/spouse/child. Other factors in the list can be found in the graph below.



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