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REVIEW ARTICLE

Agriculture-Nutritious Foods: Impact of Climate Change (Temperature and Precipitation)

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ABSTRACT

Climate change is not global warming; it is only one component of climate change as defined by WMO/IPCC/UNFCCC. The two main climatic parameters that play vital role in agriculture production are temperature and precipitation. Temperature presents high seasonal and annual variations, which form irregular variations part under natural variability of climate change. Since, around the past two decades groups are polluting agriculture research under the disguise of global warming which is insignificant when compared to seasonal and annual variations. Agriculture is adopted to such vagaries. Countries like USA and Australia moving past to renewable energy but country like India, second most populous after China contributing to around 50% of thermal power production similar to USA; and USA and India contributing to around 25% of the nuclear and hydropower, respectively. The modern agriculture system from 1960, new seeds are tailored to chemical inputs and now genetically modified (GM) seeds entered India. In such scenarios, reports say that, the two major crops, namely, rice and wheat that are distributed under Public Distribution System (PDS). Reports also say that the strength and nutrition quality are reduced by 45% by now and will be reducing to 100% by 2040. According to FAO around 30% of what is produced is going as waste; but it is more than 40% for India excluding illegal exports; PDS rice entering black market. Another important factor is crops/vegetables/animals grow under polluted water: Needed experiences, best practices, and scalable solutions for the integration of biodiversity into agriculture. There are three systems according to technology. They are: Traditional Agriculture Technology-Traditional seeds under traditional organic inputs including Animal Husbandry in Agriculture system; Green Revolution Technology-Modern Seeds are tailored to chemical inputs under irrigation excluding animal husbandry in Agriculture System; GM Technology--Genetically modified seeds tailored to chemical inputs and irrigation excluding animal husbandry in Agriculture System; Moisture is the limiting factor for crop growth and production in tropical warm regions wherein most of the developing countries are located. Moisture availability varies with space and time in association with the natural variability in rainfall and snowfall that forms the principal component of the climate change. Droughts and floods are part of it. That is moisture availability varies with country to country, region to region within the country, and station to station within a region. This plays an important role in production during these two periods and are discussed. In addition, two issues related agri-foods and nutrients are discussed.

Key words: Agriculture, food and and nutrient, climate change, climate deniel, global warming, rhythmic variations, water availability

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INTRODUCTION

"Dr. Jeevananda Reddy-writes Droughts, floods, heat, and cold waves will keep threatening India.

We cannot expect the Paris Agreement to solve the crisis associated with these extreme weather events. The way was to minimize their impact is through the mechanism in which they occur by quantifying the agro-climate of the region-Ecologise.in, June 6, 2016; Precautionary measure for natural calamities: A letter to the Prime Minister" - such analysis was carried out for few countries and the summary was included in.[11,21,25,28]

FAO and CGIAR (and its 13 centers around the world) and UN Agencies including World Bank (and not NGOs) play important role to stop on thrusting agriculture systems with poor quality agrifoods on Indian farmers by Western Multinational Companies (MNCs). ICRISAT in Hyderabad is one of the CGIAR system canvasing for the MNCs. It recently organized canvassing to serve the MNCs interest forgetting their mandates--millets. The poor quality technologies entered India as Indian government and agri-scientists sub-serving MNCs and thus under this scenario it is rarely possible to get sustainable, inclusive and resilient in agrifood. Now, the MNCs are moving fast on seeds related food crops. With their poor credentials MNCs dump poor quality agrifoods.

Stan Cox in 2008 brought out a book titled "Sick Planet: The Impact of Carporate Food and Medicine." Neoliberals often point to improvements in public health and nutrition as examples of the success of globalization, but this book argues that the corporate food and medicine industries are destroying environments and ruining living conditions across the world. Scientist Stan Cox expertly draws out the strong link between Western big business and environmental destruction, and tells us of the huge damage that drug manufacturers and large food corporations are inflicting on the health of people and crops worldwide. On issues ranging from the poisoning of water supplies in South Asia to natural gas depletion, Cox shows how the demand for profits is always put above the public interest. While individual efforts to "shop for a better world" and conserve energy are laudable, Cox explains that they need to be accompanied by an economic system that is grounded in ecological sustainability if we are to find a cure for our sick planet.

The traditional agriculture was soil and climate driven farming systems that encompasses the animal husbandry.[21,22,28] It provided socio-economic, food, and nutrient security with the healthy food. Those were the "Golden Days" in the history of farming. Conventionally, farmers adapted to this based on their forefathers hundreds and thousands of years of experiences. No pollution, no worry about seeds, and fertilizer adulteration as they used good grain as seed and compost of farmyard manure and green manure as fertilizer. This system of agriculture is clouded since 1960 by the chemical inputs and later entered genetically modified (GM) seeds. Farm sizes are coming down and still around 60% of the cultivated area is at the mercy of "Rain God".

On January 30, 2024, I saw a story on strength and nutrition quality of rice and wheat that are the principal crops grown under the so-called green revolution technology. The wheat and rice are being distributed under the public distribution system (PDS). The strength and nutrition quality divided under three groups in terms of decrease (-) and increase (+). They are (i) essential nutrients such as phosphorous, calcium, sulfur, iron, zinc, and copper are negative and manganese only positive; (ii) useful items: Silicon, nickel, lithium, and vanadium are negative except the last two under rice; and (iii) dangerous items: Barium, stratum, chromium, lead, arsenic, and aluminum except lead all others under rice are positive and under wheat except 3, 4, and 5 are negative. They have been reduced by 45% and expected to reach 100% by 2040. This is unhealthy food. We are encountering innumerable health hazards. This technology indirectly creating pollution (Air and Water). Research studies also showed in green revolution seeds tailored to chemical input technology, rice, and wheat in the past 50 years zinc and iron levels, respectively, decreased by 33% and 27% and 30% and 19%. This increased the people affected by these deficiencies. GM crops are also cultivated under chemical fertilizer inputs. In rice hazardous arsenic levels increased.

To achieve food security, we need sustainable agriculture system under variable soil and climate conditions wherein the soil is static and the climate is dynamic.[21,24,25,32,33] Climate is beyond human control and thus needs to adapt to them. Climate is always changing through the natural cycles. What we are experiencing now is part of this system only. The two main climatic parameters that play vital role in agriculture are temperature and precipitation-

relative humidity, solar radiation, day length, etc., also play an important role. Groups are questioning YouTube reports relating denial of global warming but they failed to put forth to counter them instead talking of they are getting huge sums. In fact, these groups are also getting huge sums. These issues are discussed in the context of temperature issues. Also discussed rainfall and temperature issues in terms of climate change and global warming. Agricultural foods and nutrition issues are discussed in relation to biodiversity also.

CLIMATE CHANGE

Introduction

Climate change is not global warming as per the definitions given by WMO, IPCC and UNFCCC. It consists of (a) natural or rhythmic or systematic variations and (b) human induced trend. WMO[35] presented methods to separate them, one such method is "Moving Average Technique". Figure 1 presents the annual march of onset dates of southwest monsoon (SWM) over Kerala along with 10-year moving average.[5] This date is most important for agriculture planning for Kharif. This suggested 52 year cyclic pattern similar to Fortaleza rainfall in northeast Brazil.[18] Figure 2 presents the annual march of global annual average temperature anomaly along with 10, 30, and 60 years moving averages. This suggests a 60 year cyclic pattern-after removing 60-year cyclic pattern the trend is shown clearly[2] which presented around 0.6°C during 1850–2010.

Temperature

Introduction

Temperature presents high seasonal and annual variations [Table 1]-they refer to irregular variations such as intra-seasonal and intra-annual variations under systematic variations part of climate change and same is the case with rainfall. Agriculture was/is adapted[21,12] to such variations in temperatures. However, in the past two decades, groups are polluting agriculture research under the disguise of "fictitious" global warming infact they are shy of using the word "global warming" and instead using the word "climate change" which has wide implecations.[27]

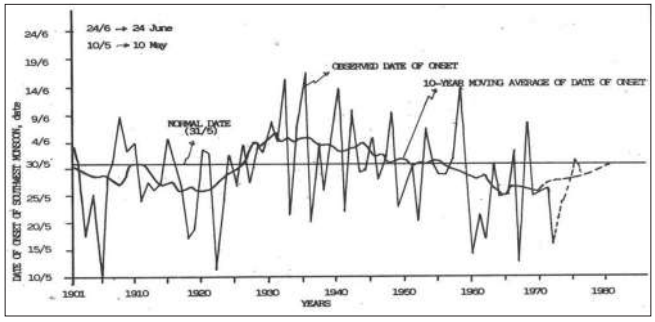

Figure 1: Annual march of date of southwest monsoon over Kerala Coast in India

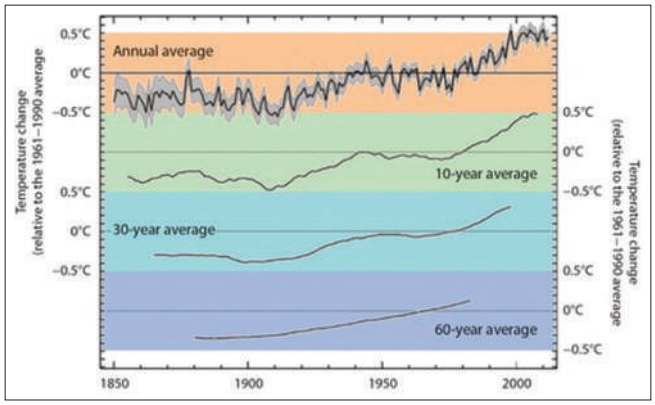

Figure 2: Global annual average temperature and moving averages for 10-, 30-, and 60-years.

Table 1: Hyderabad temperature extremes

Month	Temperature (°C)						
	Tw	Tmax	Tmin	Thm	Tlm	Th	Tl
Highest	23.7	38.7	26.2	42.4	22.5	44.4	19.4
Lowest	17.2	27.8	13.4	30.6	09.9	33.3	06.1
Range	06.5	10.9	12.8	11.8	12.6	11.1	13.3

Tw: Mean afternoon wet bulb, Tmax: Mean maximum, Tmin: Mean minimum, Thm: Highest mean, Tlm: Lowest mean, Th: Highest in a day, Tl: Lowest in a day

In conclusion, we are producing more than what is needed under growing population in quantity but we failed to achieve the quality of agrifoods.

Global warming denial issue

First, let me present global warming issues: Groups are making observations stating that the denial groups are doing this for money. Figure 3 presents 6 YouTube charts a clear shift from old Denial to New Denial. These narratives focus on discrediting climate solutions such as renewable energy projects and electric vehicles, or downplaying the harmful effects of global warming. These groups are also sharing billions of dollars.

A December survey from Pew Research Center found

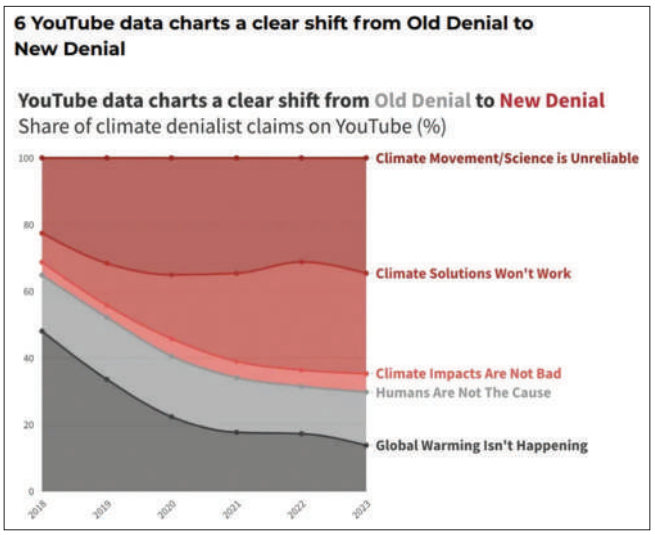

Figure 3: YouTube data charts a clear shift from old denial to New Dinial (CCDH)

YouTube to be the most widely used social media platform it analyzed among 13–17-year old, used by roughly nine in 10 of them. Even these groups have forgotten how UN agencies promoted young girls including Swedish girl Greeta Thumberg-Russian President Vladarmir Putin described her as a "kind, but poorly informed; teenager" -- for promoting "fictitious" global warming. The basic question is do they knew what is climate change-it is a vast subject unlike global warming. People are using the word "climate change" as an adjective or de-facto global warming.

Two reports in Yahoo on February 13 and 14, 2024, come up with the so-called evidence of global warming. One report says that "More than a century of observational and experimental research shows that global warming is happening and is driven by greenhouse gases emitted by human activity." Another report observed that The Paris Climate Accords in 2015 set an ambitious (and necessary) goal of keeping global temperatures at 1.5°C above pre-industrial temps. But a new study says, we might've blown past that threshold several years ago. The former report state that "Multiple independent climate agencies have reported a long-term increase in Earth's average global temperature. It also says that scientists have also documented the consequences of this warming, including polar and glacial ice melt, sea level rise (due to ice melt and the expansion of warming seawater) and an increase in the frequency of certain extreme weather events, such as heat waves." However, Seasonal march of "Arctic Sea Ice Extent" in millions of km^2 showed no difference over years during April-May-June. There are various ways scientists know greenhouse gas emissions due to human activity cause this warming, Josh Willis, a NASA climate scientist, previously told USA TODAY". Researchers have shown that CO_2 slows the escape of heat into space and that the amount of global warming that has occurred "matches what we expect based on the increased CO_2 we've added," said Willis. "The timing of the warming matches the timing of the CO_2 increase caused by people. Not only that, the timing of global sea level rise matches the CO_2 increase." Scientists also know the excess CO_2 in the atmosphere comes from humans because it matches the amount humans have emitted and because a disproportionate amount of the accumulated carbon is the type found in fossil fuels. "Overwhelming" evidence that human greenhouse gas emissions are causing global warming. The second report observed that whatever your stance is on global warming (it's real, let's move on), it's impossible to have missed the near-ubiquitous call to action to "keep temperatures from exceeding 1.5°C compared to pre-industrial levels." Over the past few years, the somewhat bureaucratic phrase has become a rallying cry for the climate conscious. This ambitious target first surfaced following the Paris Climate Agreement, and describes a sort of climate threshold-if we pass a long-term average increase in temperature of 1.5°C, and hold at those levels for several years, we're going to do some serious damage to ourselves and our environment.

Renewable energy

Australia closing coal fired power plans and building renewable energy plants: Nick Paschal, January 27, 2024 - New Report leads to closure of massive coal power plant. Australia can close down its largest coal-fired power plant (The 2880-megawatt Eraring station is now set to close in August 2025) and the residents of New South Wales would not experience any interruption in their electricity, according to a new report. Wind energy is also picking up the slack. Squadron Energy began construction on a 414-megawatt wind farm, and the state's planning department just recommended approval of another wind farm, per the Guardian.

The three battery storage systems in the works to meet New South Wales' energy demands are fittingly being built on the sites of shuttered coal facilities, including the Eraring site-a trend sweeping the United States, as well. Numerous coal-fired plants nationwide are shutting down and being replaced with renewable energy such as wind and solar or as energy storage sites. It's a welcome trend that will improve the health of the people in these communities and help keep our planet cooler.
Attaining that goal came with an enormous 185-megawatt battery near Honolulu hummed into full operation. Hawai'i has the highest solar capacity deployed per capita. But the sun doesn't shine 24/7, so it still needs energy storage. The state also intends to run off 100% green energy by 2045, per Electrek. Projects like this battery system will help both areas. The project-called Kapolei Energy Storage-is owned and operated by Plus Power and located on the west side of Oahu, in a known industrial area. The company claims it's "the most advanced grid-scale battery energy storage system in the world."
Hawaii has the highest solar capacity deployed per capita. But the sun doesn't shine 24/7, so it still needs energy storage. The state also intends to run off 100% green energy by 2045, per Electrek. Projects like this battery system will help both areas. The project-called Kapolei Energy Storage-is owned and operated by Plus Power and located on the west side of Oahu, in a known industrial area. The company claims it's "the most advanced grid-scale battery energy storage system in the world." The Kapolei Energy Storage facility is tucked away in eight acres of industrial land about 20 miles west of Honolulu. More than anything it looks like 158 white storage sheds, each about the size of a shipping container, neatly lined up on concrete pads. These lithium iron phosphate batteries can hold 185 megawatts of power, enough to power 17% of the island of O'ahu for 3 h. These kinds of grid-scale energy storage systems are becoming increasingly common in the U.S., and are critical to shifting to ever-higher percentages of wind and solar power Hawaii is in a class by itself. The Waikoloa Solar project on island of Hawaii on the Kona coast, which opened in April of 2023. It is the largest solar + storage facility on Hawaii Island, providing just over 7% of the island's energy needs at a wholesale price of 9¢ per kilowatt hour, far less than the retail rate of 44¢. However, they are not talking on greenhouse gases versus global warming issues.
India being the second populous country after China, they have to live on coal fired thermal power. In India and USA, the thermal energy presents around 50%; and India and USA presents around 25% of hydropower and nuclear power, respectively.

Climate change: Natural variability and trend

The natural variability and trend in global annual average temperature anomaly for 1880–2010-not raw data; it is an adjusted data[24] that the natural variability followed 60-year cycle and the sine curve varied between −0.3 and +0.3°C. Linear Trend is 0.6°C per century. This trend is associated initial time series adjustment downwards. According to IPCC (i) more than half of this trend is associated with greenhouse effect; and (ii) less than half of this is due to non-greenhouse effect (changes in land use and land cover). Greenhouse effect component consists of global warming and others like volcanic erruptions dust/smoke; if we assume global warming itself is 50% in more than half; then global warming is 0.3°C per century. According to IPCC, starting year of global warming is 1951. Thus, the global warming from 1951 to 2100 is 0.45°C under linear trend. However, from IPCC reports it is seen that "climate sensitivity factor" is gradually decreasing-1.95 in AR4 and 1.55 in AR5-and thus it can be said that the trend must be non-linear and therefore global warming is insignificant. Figure 4 presents this scenario. Heating effect of carbon dioxide (CO_2) is non-linearly decreasing and this is expressed by the following equation (approximately) $\blacktriangle T = 156.52 / \sqrt{[(CO_2)^3]}$; wherein ▲T is the °C, increase in atmospheric temperature per 20 ppm increment in °C.
Sydney hottest daily maximum temperature annual march during 1896–2016 showed no trend. Even USA raw temperature data showed no trend but showed 60-year cycle. Australian annual land surface air temperature presented 80-year cycle with a trend of 1.2°C per century and Australian annual sea surface temperature anomalies presented 120 year cycle with a trend of 0.417°C for century. The trend is higher for surface air temperature by

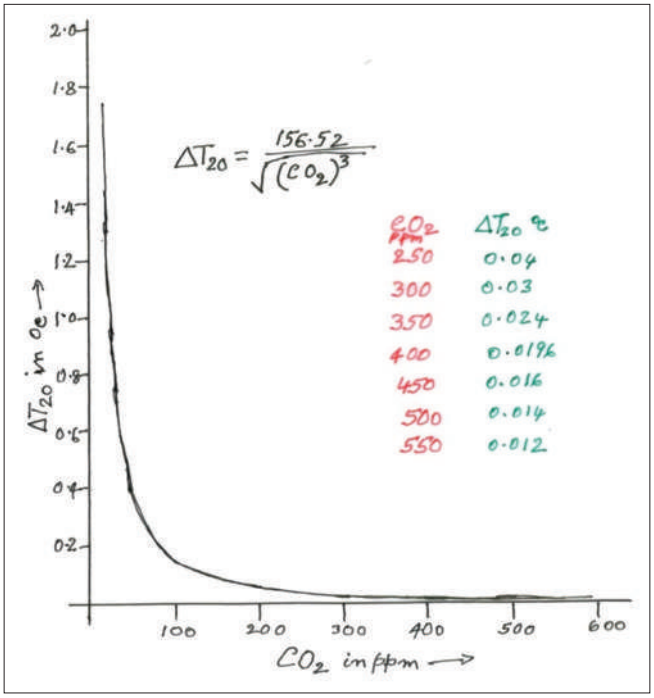

Figure 4: ▲T ln °C versus CO_2 in 20 ppm interval

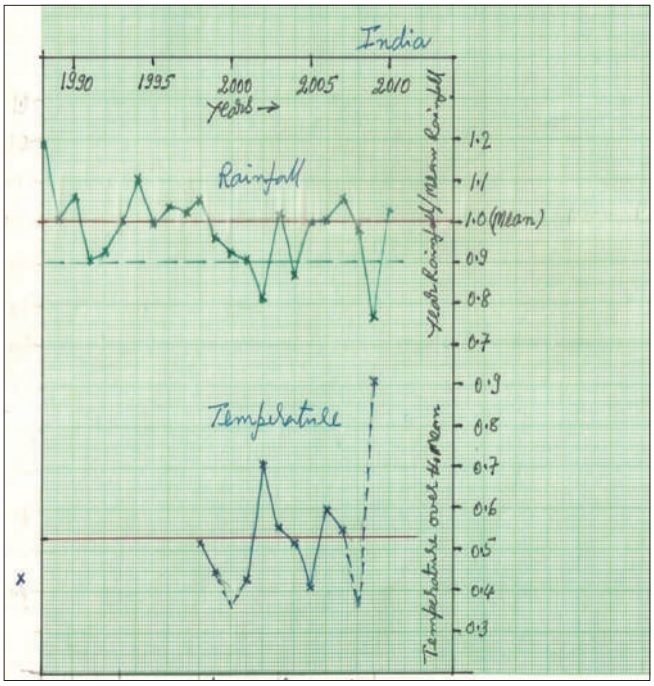

Figure 5: All-India: Annual precipitation versus annual temperature

3 times to sea surface temperature. This is different from global temperature of 60 year cycle with a trend of 0.6°C per century.

Rainfall impact on temperature

Figure 5 presents the all-India average annual rainfall versus all-India average annual temperature. Years 2002 and 2009 were drought years and the temperature raised by around 1°C. I doubt where such phenomena and renewable energy removed while computing raise in global average temperature? Furthermore, natural variability part of climate change was accounted in this.

Temperature impact on crop production

Figure 6 presents the crop progress and condition for corn in Indiana (USA) in terms of withdrawal and onset of winter season. This defines the period conducive for growth or effective growing period in which production comes down with the decreasing effective growing period. Figure 7 presents yield per hectare in India versus El Nino events in India. No systematic impact is evident on crop yield with changing El Nino temperature rise or fall.

Figure 8 presents the: (a) Changes in crop areas with fertilizer technology in Andhra Pradesh (AP) in India, (b) yield increase with chemical fertilizers in rice in AP, (c) soybean production in top five countries, (d) world corn, wheat, and rice production, (e) IPCC projection on food, water, etc. with reference to global warming levels in temperature, (f) Crop production in India in terms of inputs; and (g) USA Corn-Inputs and Outputs (Components of the yield trend). Observed yields averaged over the US Midwest between 1981 and 2017 (black dots) along with temperature-driven model estimate (gray line). The yield trend is broken into components attributable to an improvement in climate (red, 0.2 [0–0.5]) t/ha, best estimate and 95% CIs, timing adjustments (blue, 0.2 [0–0.3] t/ha per decade), and other factors improving yields (green, 0.9 [0.9–1.0] t/ha per decade). Also shown is the baseline yield referenced to 1981 (6.2 t/ha). The stacked bar on the far right side shows the total contribution, as of 2017, from each of these components and the associated 95% CIs.[8,9] presented grass production method and using that method estimated the proction for Mozambique. Reddy[13-17] presented long-term planning of agriculture including soil water balance.

Needs yield increase

Few days back north Indian farmers went on strike demanding raise in Minimum Support Price (MSP). Farmers' agitations in India almost always about

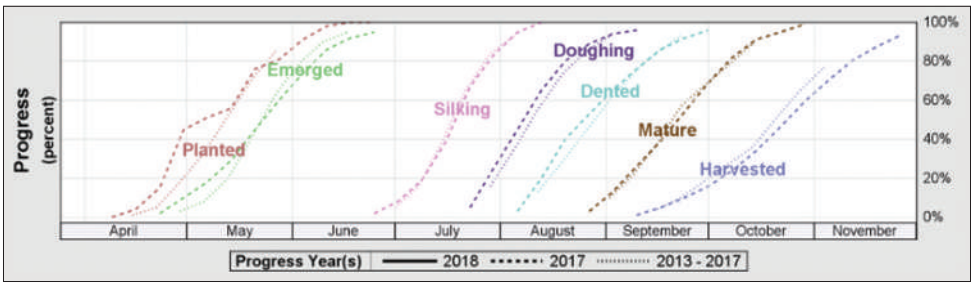

Figure 6: Crop progress and condition for corn in Indiana

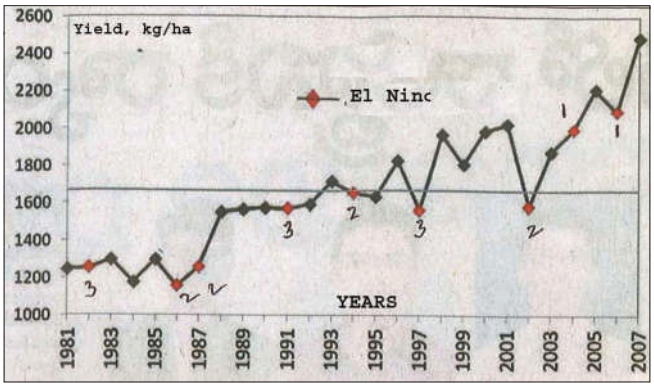

Figure 7: Yield per hectare in India versus El Nino events
El Nino years with 1 = weak, 2 = moderate and 3 = Strong

higher price for their output (crops) and lower price for their inputs (example seed and fertilizer). Reports state that in the last decade, profit as a percentage of cost has fallen steeply for most crops: profit margin as % of input + farm labor ([A2 + FL]*Cost for paddy during 2011–12, 59% and 2021–22, 42%; for cotton they are 95% and 30%; etc. Hiking prices to levels demanded by farmers will raise domestic prices way higher. Given restrictions on trade in agricultural commodities, Indians often end up paying more for some commodities that could have been imported and sold at a cheaper rate. Better way to raise farmer income is to move out of farmers. Agriculture contributes little over 17% to India's economy while it employs nearly half of the workforce. Only a fraction of people in advanced economies work in agriculture sector. To earn more farmers need to increase yield on major crops, India's yields are lower than global average, except for groundnut. Compared with world's highest we are far behind. To overcome the MSP problem, governments encourage research to improve seed for high yields like in the case of ground. Paddy yields stagnated from 1963 to 1984 but increased irrigation facilities and free power. Scientists have not break the ice to create new seed varieties that yield more with the same level of chemical fertilizers. And the 2nd issue is bring down cost of fertilizers. Paddy is the most heavily subsidized crop followed by wheat, sugarcane and cotton. Here government must encourage progressive farmers technologies under non-chemical fertilizers and use of genetically modified seeds. Hiking MSP means it is a deathnell to ordinary citizen. Shifting people from villages to cities create more problems including health hazards; and instead help food processing units based on local foods.

Precipitation/Rainfall

Introduction

Moisture is the limiting factor for crop growth in tropical warm regions wherein most of the developing countries are located. Moisture availability varies with the climate change expressed by the natural variability in rainfall and snowfall. In rainfall, there is no trend except abrupt shifts due to modifications in the local terrain/land use.

All over the world, rainfall presents clear cut rhythmic variations and showed variations with latitude, coast to inland, etc.[18-21,29] However, they varied with national, regional and local level with the climate system and general circulation patterns. May 3, 2019, by Jessica Murzdorf, NASA Goddard Space Flight (GISS) in New York" states that human generated greenhouse gases and atmospheric particles were affecting global drought risk as back as the early 20th century. This is a false theory. Let me present from my study in 1986 as FAO Expert: Recently both national and international media made big hue and cry on Sofala-Beira cyclone and Cape Town and Brazil Droughts. Even the Secretary General of WMO made such statements attributing to global warming. I sent mail to him referring to my book of 1993 available in WMO Library. Durban

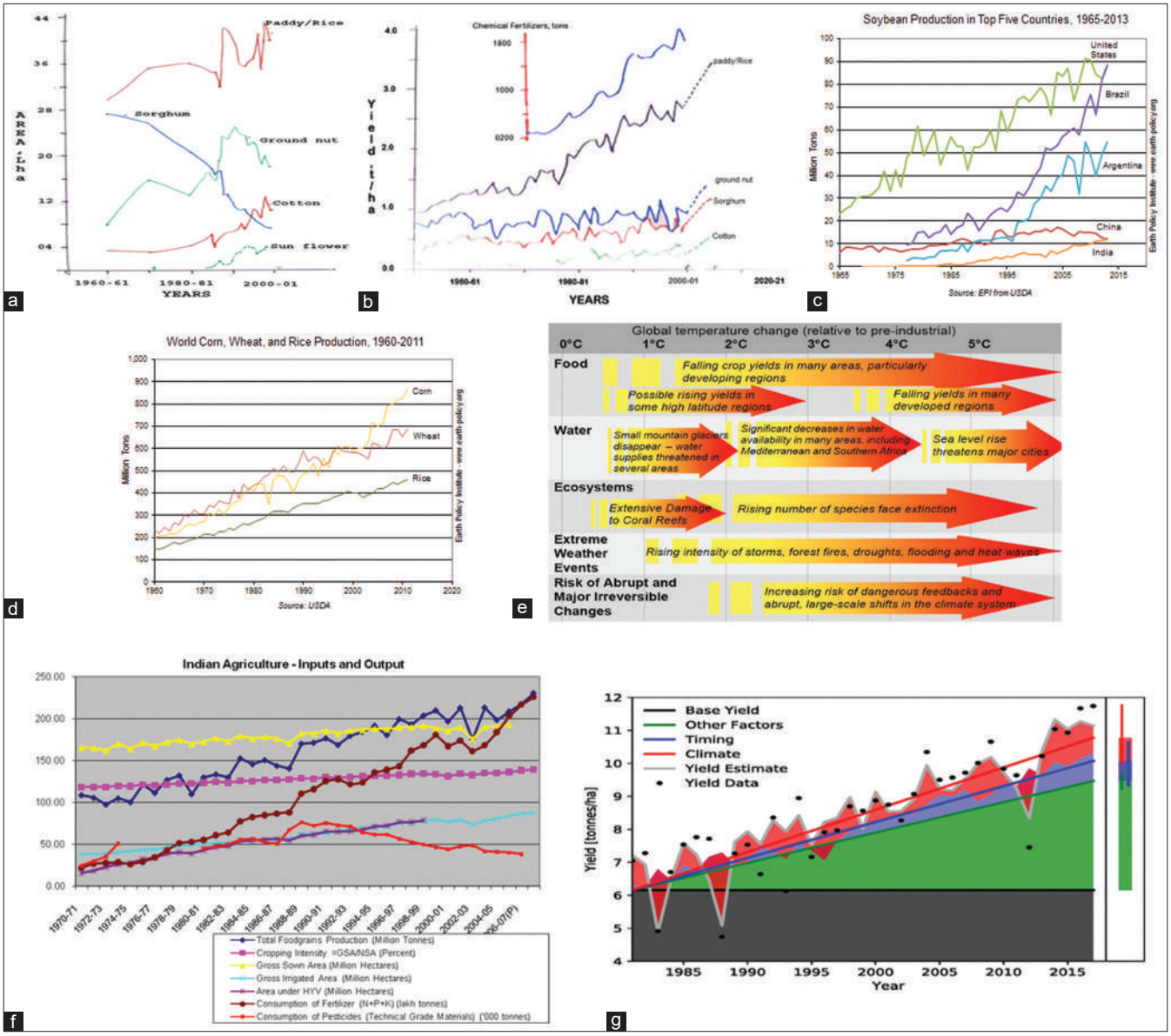

Figure 8: Few examples of crop production. (a) Changes in Crop Areas with Chemical fertilizer technology in AP. (b) Yield increase with chemical fertilizers in Rice in in AP. (c) Soybean production in top five countries. (d) World Corn, Wheat, and Rice Production. (e) IPCC projection on food, water, etc., on temperature. (f) Crop production in India in terms of inputs. (g) USA Corn-inputs and outputs

in South Africa presented 66/22 years cycles and Beira in Mozambique presented 54/18 years cycles. The integrated predictive patterns were presented in a book of 1986 submitted to Mozambique government. According to this, 2012–22 in Beira is wet period with more than 1480 mm and 2010–23 Durban is a dry period with <1050 mm;[19]

It is common to researchers and planners use truncated data series with Natural Variability. This type of selection leads to misleading conclusions or lead to biased inferences. For example, let me present few cases in this direction wherein the data series present rhythmic variations at national, state, and station levels.

Indian rainfall

National level rainfall

Figure 9 presents the annual march of all-India annual rainfall (June-May) from 1871-72 to 2014-15.[22,30] It presents a 60-year cycle. Two cycles were completed and the above average 30-year part of third cycle was completed. Now, we are in the below the average 30-year part of the third cycle. This followed Indian Astrological cycle and Chinese 60 year Astrological

cycle with three years lag to Indian Astrological cycle. Few examples related to river water and truncated data use implications are discussed below. Godavari River annual water availability (Bachawat Tribunal Award data of 1880-1946-with 1 year data missing) follows the pattern of 60-year cycle as shown in Figure 9. The difference between the means of 30 year below and above the average periods is 650 tmc ft; With reference to a question raised in the Parliament, IMD/IITM scientists prepared a report and submitted to the concerned minister, who in turn informed the parliament that the Indian rainfall is decreasing. Here they used the data set of 1930–1960 [Figure 9] - if they would have used the data set of 1960–1990, it would have shown increasing trend. This is the fallacy of random selection in a rhythmic data series. The frequency of occurrence of high magnitude floods in few northwest Indian Rivers (Chenab, Ravi and Beas). It showed that during below the average period the frequency is around one in 10 years; and during above the average period it is around one in 3 years; CWC used the data of high annual rainfall period 30 years 1985-86 to 2014-15 [Figure 9] and estimated annual water availability in Indian rivers. This overestimated as they used the above the average part of the cycle [Figure 9]. In addition, the method adapted in the runoff estimation overestimates the water availability.

State level rainfall (State of AP)

Parthasarathy *et al*.[4] brought out monthly and seasonal rainfall series for all-India homogeneous regions and meteorogical sub-divisions. AP rainfall is covered under three met sub-divisions (CA-Coastal Andhra, R-Rayalaseema, T-Telangana). Using this data series Reddy[22] studied cyclic nature of the data. Table 2 presents rainfall in % years with >90% of average for each 28 year periods for both SWM and northeast monsoon (NEM) and for the three met subdivisions (AP, TS and RS); and also presented Cyclonic activity in Bay of Bengal Statistics. Both SWM and NEM rainfall presented 56 years cycles but they are in opposite phase. This table also presents cyclones in each 28 years periods-above the average and below the average 28 years periods. Using rainfall for the available period to me at that time, namely, 1870–2000 was used. The annual average rainfall for the 1870–2000 presented[26] in Figure 10a and from the two Krishna tribunal awards annual water availability in Krishna River are presented in Figure 10b. Rainfall presents 132 year cycle [Figure 10a] and same was seen in water availability in Krishna River [Figure 10b]. Figure 11 depicts photo of severe drought impact in Bangalore people during 1876-78-British Memoires. During below the average 66 years 24 years were deficit years and 12 years were surplus years. During above the average 66 years 24 years were surplus years and 12 years were deficit years.

Drought Condition (Kurnool station; district level in Maharashtra; and National level-India): For agriculture planning in real time, we need to study the time variation in rainfall and agro-climatic parameters.[21,25] Figure 12 presents one such an example for Kurnool in AP state. S and G in the figure refer to week of commencement time of planting rains and G is the available effective rainy

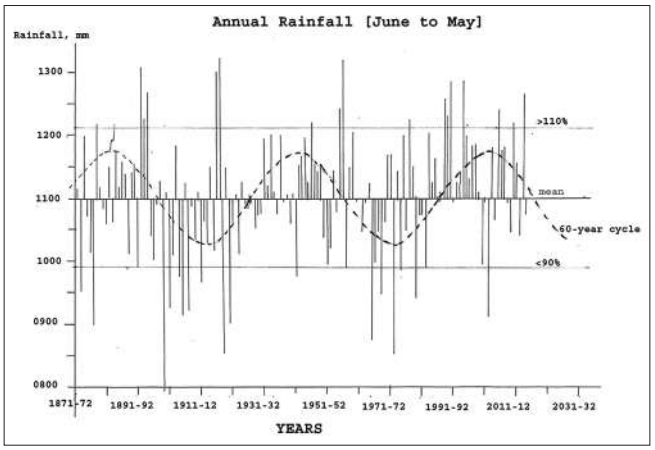

Figure 9: Annual march of all India annual rainfall (Observed, vertical lines and Predicted, dotted curve)

Table 2: SWM and NEM rainfall % years with >90% of average and cyclonic activity in bay of Bengal statistics

Period of average	Rainfall (% years with <90% 28 year periods)						Cyclones in Bay of Bengal
	SWM			NEM			(May to November) $
	CA	R	T	CA	R	T	Number
1861-1888*	72	61	72	33	28	66	<10
1889-1916	53	43	46	60	71	71	>10
1917-1944	75	78	68	46	50	60	<10
1945-1972	43	43	32	64	60	46	>10 (10–16)
1973-2000**	54	54	54	41	45	41	<10 (0–8)
2001-2027							>10

*1871-1888, **1973-1994, average cyclones 10, SWM: Southwest monsoon, NEM: Northeast monsoon, CA: Coastal Andhra, R: Rayalaseema, and T: Telangana met sub-divisions, $: Joint typhoon warning center-bay of Bengal region cyclones per year during 1945-2000 (May-November)-Reddy[24] page. 160

period from S. This figure presents the pattern of 56-year cycle in which the drought risk is 45% of the years on an average. During below the average 28 year period, drought risk is 70% and during above the average 28 year period it is 30%.

Figure 13a presents the average drought risk in the semi-arid tropics in India and using the same procedure Annand *et al*.[1] presented for Maharashtra [Figure 13b]. This clearly shows the impact of climate system[26]-here it is Western Ghats – on rainfall and thus drought proneness.

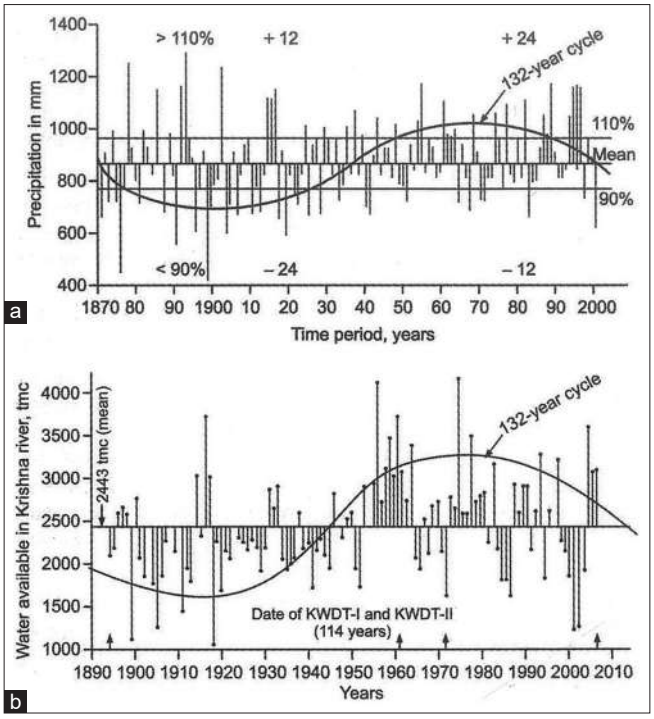

Figure 10: (a) Annual rainfall of AP and (b) Annual water availability in Krishna River

Figure 11: 1876-78 severe drought impacts on Bengaluru

Mozambique rainfall at station level and national level

Table 3 presents the estimated periodicities (Sine Curves), amplitudes and phase angles for Malawi (Chileka), Mozambique (Catuane), and South Africa (Durban). Using the periodicities, amplitudes, and phase angles [Table 4] estimated periods under three cycles for Catuane, Maputo and Beira in Mozambique and for Durban in South Africa. They are presented in Table 4. It represents the predicted patterns based on the observed cyclic patterns for Catuane, Maputo, and Beira in Mozambique 54 and 18 years integrated pattern under low, medium, and high rainfall amounts and Durban in South Africa under medium rainfall 66 and 22 years integrated pattern.

Figure 14a presents starting years of below the average part of the integrated cycles of 54 and 18 years in Mozambique and Zimbabwe rainfall stations and 40-year cycle of Malawi and Mozambique rainfall stations Figure 14b presents special distribution of stations used in Figure 14a. To define climatic fluctuations it is important to have the long time series of precipitation data and appropriate methodology to analyze such data series. In the case of Mozambique, the precipitation

Table 3: Estimated periodicities, amplitudes, and phase angles in the precipitation data

Station	Periodicity (years)	Amplitude (mm)	Phase angle (degrees)
Chileka	40	250	000.0
Catuane	54	200	086.7
	18	300	100.0
Durban	66	250	185.8
	22	350	180.0

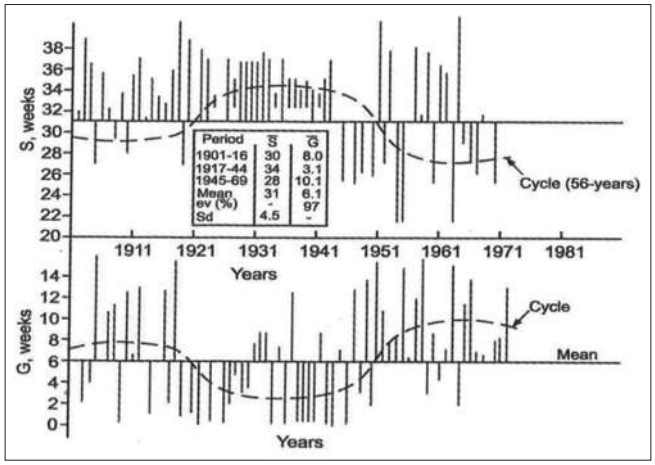

Figure 12: Annual march of agro climatic variables: G and S

Table 4: Catuane, Maputo, Beira, and Durban information on cycles (predicted)

Station	Average	Rainfall (mm)	Cycle 1	Cycle 2 (periods)	Cycle 3
Catuane	low	(620)	1943-1996	1997-2050	2051-2104
Maputo	medium	(900)	1925-1978	1979-2032	2033-2086
Beira	high	(1480)	1931-1984	1985-2038*	2039-2092
Cycle 2 of Beira [54 & 18 years cycles integrated output]:					
W=			1985-1995(-)	1996-2000(+)	2001-2011(-)
M=			2012-2022(+)	2023-2027(-)	2028-2038(+)
Durban	Medium	(1050)	1876-1942	1943-2009	2010-2075*
Cycle 3 of Durban [66 & 22 years cycles integrated output]:					
W=			2010-2023(-)	2024-2028(+)	2029-2042(-)
M=			2043-2056(+)	2057-2061(-)	2062-2075(+)

+ Above the average and - below the average

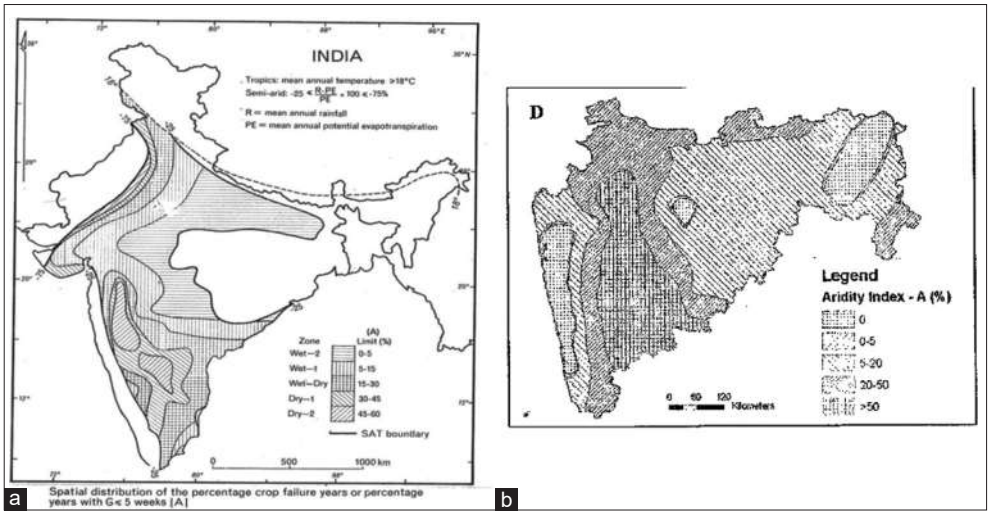

Figure 13: Drought Risk (a) India by[21] and (b) Maharashtra by Annand *et al*.[1]

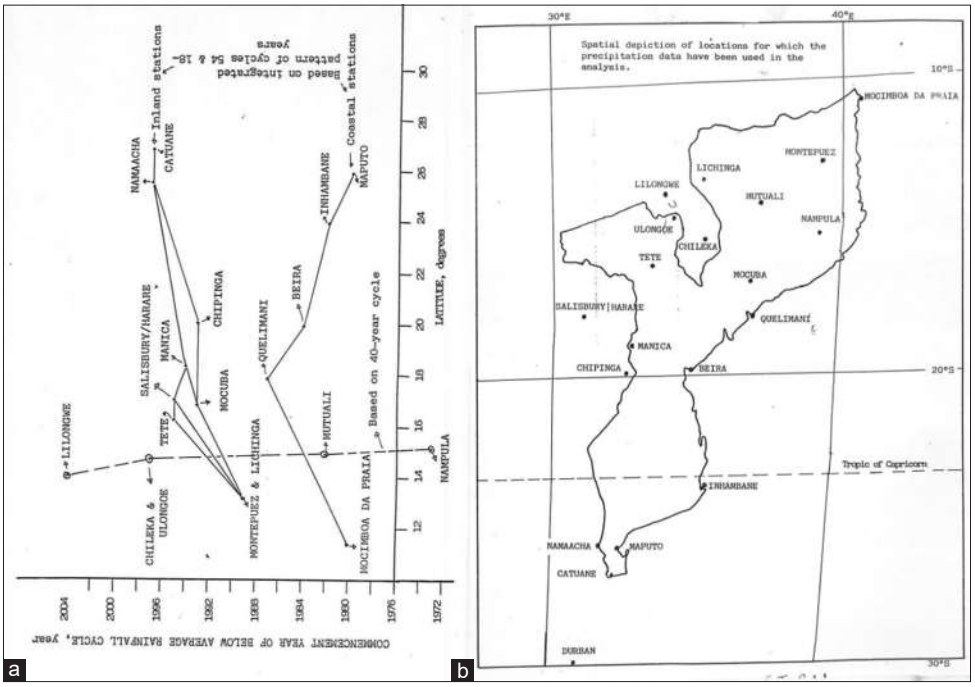

Figure 14: (a) The patterns of expected year of the commencement of the next below the average annual rainfall cycle Mozambique, Malawi, and Zimbabwe-Source: Reddy[19] (b) Spatial depiction of locations in Mozambique, Malawi, and Zimbabwe used in the analysis [used in Figure 12a]-Source: Reddy[19]

data in general are not long enough to apply any sophisticated methodology like power spectrum analysis[10] to define the expected cycles in the precipitation data. The predicted patterns derived using simple technique for Mozambique present consistency with the predicted patterns of those stations with the long series of data.

To characterize the climate cycles in the precipitation data of Mozambique the annual rainfall data of 15 stations well distributed over the country were used. In addition, annual rainfall data of five stations from neighboring countries (Zimbabwe and Malawi) were also used in this study. An iterative auto-regression technique was used to derive climatic cycles and their associated amplitudes and phase angles in the annual rainfall data series. Figure 14a presents the distribution of these station.

The iterative auto-regression technique was used to derive climate cycles and their associated amplitudes and phase angles in the annual rainfall series. This analysis revealed 66 and 22 years cycles in Durban annual rainfall data; 54 and 18 years cycles in Catuane annual rainfall data and 40 year cycle in Chileka annual rainfall data.

The precipitation data of Mozambique presented two different cycles, namely, 54 and 18 and 40 years. The majority of the regions in Mozambique followed the former pattern [Figure 14b]. Considerable differences are seen in phase angles for these two patterns. The former present a phase shift with latitude[3] also observed reversal of phase with latitude on one-hand and inland to coast,[18] on the other hand. In the case of inland regions a delay in phase angles is observed. Aound Beira sea is encroached inland and this showed phase shift.

Ethiopia rainfall at national level and station level

Figure 15a presents the orography/altitude pattern of Ethiopia and Figure 15b presents the natural cycles pattern in rainfall and rainfall in Ethiopia. The cycles range from 22, 26, 36, 38, 40, and 52 years. Maximum area is covered by 38 years cycle and next in order is covered by 28 year cycle.

AGRI-NUTRI-FOOD

Experiences, Best Practices, and Scalable Solutions for the Integration of Biodiversity into Agriculture

Seed versus agriculture systems

In India, there are three major systems of agriculture are in use. The 2nd and 3rd are under the control of MNCs. And three farming system practices are practiced. They are in brief:

- Traditional Agriculture Technology-Traditional seeds under traditional organic inputs including Animal Husbandry in Agriculture system;
- Green Revolution Technology-Modern Seeds are tailored to chemical inputs under irrigation excluding animal husbandry in Agriculture System;
- GM Technology-Genetically modified seeds tailored to chemical inputs and irrigation excluding animal husbandry in Agriculture System;

Three farming system practices are also in use. They are:

- Cooperative agriculture system under traditional agriculture;

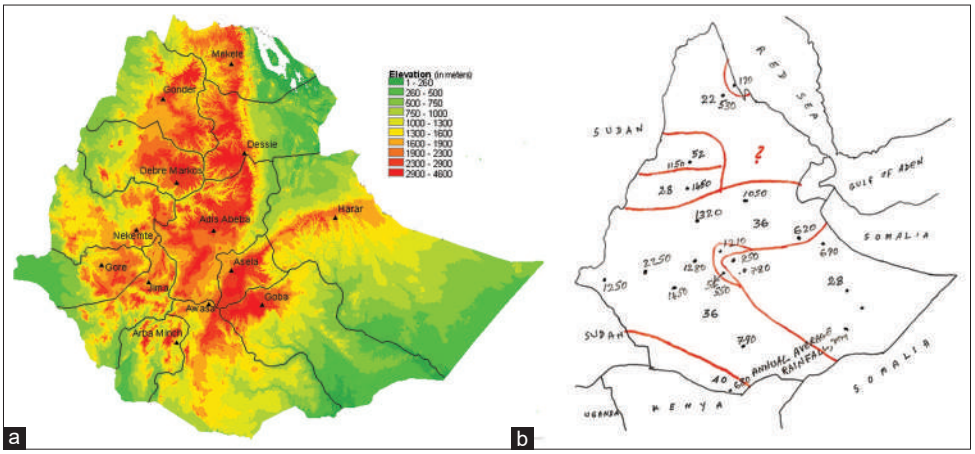

Figure 15: (a) Altitude zones of Ethiopia. (b) Cycles and annual rainfall in Ethiopia

- Corporate and Contract agriculture systems under Green Revolution Technology or Genetically Modified seed Technology.

Discussion

Governance of agrifood systems transformation to make them more sustainable, inclusive and resilient

1. Biodiversity is a term used to describe the enormous variety of life on the Earth. It can be used more specifically to refer to all of the species in one region or ecosystem. Biodiversity refers to every living thing, including plants, bacteria, animals, and humans. It is defined as the variety of all living things; the different plants, animals and microorganisms, the genetic information they contain and the ecosystems they form. In other words, it refers to the variety and variability among all forms of life within a given ecosystem or region. It is usually explored at three levels - genetic diversity, species diversity and ecosystem diversity. Some areas in the world, such as areas of Mexico, South Africa, Brazil, the southwestern United States, and Madagascar, have more biodiversity than others. Areas with extremely high levels of biodiversity are called hotspots. Endemic species – species that are only found in one particular location – are also found in hotspots.
2. All of the Earth's species work together to survive and maintain their ecosystems; for example the grass in pastures feeds cattle. Cattle then produce manure that returns nutrients to the soil, which helps to grow more grass. This manure can also be used to fertilize cropland. Many species provide important benefits to humans, including food, clothing, and medicine. Much of the Earth's biodiversity, however, is in jeopardy due to human consumption and other activities that disturb and even destroy ecosystems by Pollution, climate change (natural variability), and population growth. India has the second largest population on 2.3% of world land area. All these are threats to biodiversity. These threats have caused an unprecedented rise in the rate of species extinction. Some scientists estimated that half of all species on Earth will be wiped out within the next century. Conservation efforts are necessary to preserve biodiversity and protect endangered species and their habitats. However, it may be an impossible task with the rapid urbanization or population growth with poor quality governances. For example, more than one-third of Telangana state's population lives in Hyderabad City.
3. Biodiversity is the basis of Agriculture. Its maintenance is essential for the production of food and other agricultural goods and the benefits these provide to humanity, including food security, nutrition, and livelihoods. It is the origin of all crops and domesticated livestock and the variety within them. It supports the livelihoods of food producers while also reducing negative impacts on the environment. By providing important ecosystem services, such as pest control and nutrient cycling, it reduces the need for costly and harmful external inputs. Traditional Agriculture practices form best practices that provide a scalable solution for the integration of biodiversity into agriculture. Now this can be achieved with organic farming under cooperative agriculture.
4. Polyculture leads to the greatest genetic diversity whereas monoculture leads to the least diversity. Industrialized agriculture utilizes genetically modified organisms but helps multinational seed giants to amass wealth at the cost of farmers. In 13 years Bt-Cotton seed that entered India illegally and cultivated commercially illegally (entered during 2002-03) it was a failure. Conventinally, government agencies and progressive farmers were behind seed production but with the entry of GM seeds the multinational seed giants collected germplasm from developing countries destroyed the local availability of such seed banks and created new seeds and monopolized seed industry. Here CGIAR and FAO played major role.
5. Biodiversity plays a crucial role in maintaining ecosystem functions and services such as pollination, pest control, and soil formation. However, with the seeds tailored to chemical inputs technology caused severe damages to environment. Biodiversity is important because

it provides humans with many resources. The food we eat comes from plants and animals that have evolved over millions of years to meet our needs. Without biodiversity, we would not have food or shelter. Other resources provided by biodiversity include clean air and water, medicines to treat disease, clothing fibers, fuel sources such as biofuels and biomass energy, and more. The loss of biodiversity could have serious implications for human health, food security, economies, livelihoods, cultures, and much more. Biodiversity also helps reduce environmental risks such as climate change-natural variability, pollution, and natural disasters. It is the case even under chemical inputs with the irrigation mono crop system that includes green revolution technology and GM technology.

6. There are three broad agricultural systems. (a) In India, AP state prior to 2004 tried corporate agriculture at Kuppam wherein farmers' lands were taken and hand them over to a private company with government finances. Here farmers were asked to work as laborers in their own farms. It was a failure. (b) The present Prime Minister of India brought out three agri. bills on contract farming with the opposition to this form of agriculture system government withdrew them. (c) I proposed organic inputs based cooperative farming wherein the biodiversity fits into agriculture. Government of AP asked a consultant to prepare the plan of action. Unfortunately he put the heading cooperative farming but inside the text contains corporate farming. On my complaint to the government that was withdrawn.
7. Seed is the basic and most critical input for sustainable agriculture. The response of all other inputs depends on quality of seeds to a large extent. Indian plant breeders and geneticists have developed a large number of improved crop varieties (conventional varieties and hybrids) that have played pivotal role in enhancing crop production. However, this has not in real terms improved the yield potential of seeds as well improved the yields in the farmers' fields comparable to scientists farm yields with the existing seed varieties.[21,23] The hidden costs are beyond the farmers economics. To reduce this burden governments have been providing huge subsidies.
8. The Economic Times, Editorial of March 3, 2010, states that - "It is surprising to see senior ministers of the government getting drawn into a bout of shadow-boxing over GM foods." Environment minister Jairam Ramesh's decision to put a moratorium on Bt-Brinjal has got the goat of not just some GM businesses, but of some of his ministerial colleagues as well. All that has been called into question is the integrity of the approval process for GM foods. True, the apex body for approval of GM crops, the Genetic Engineering Approval Committee (GEAC), had given its nod for commercial cultivation of Bt-Brinjal. But this was not a unanimous decision. India must develop the capability to carry out rigorous and independent testing of all GM crops as these have short life-span, for all foreseeable negative fallouts. Here, rather difficult in an area where people with the requisite expertise also tend to have research links with the GM industry. At Paris meet in 2015 December (COP21) MNC lobbied and negated the proposals by people like Pope and few other heads of states.
9. Farm expert, M S Swaminathan (few days back Government of India honored him with "Bharat Rathna," the highest honor in India) wrote: "Bt-brinjal need not be banned, but there should be caution that one or two hybrids do not replace hundreds of native varieties which all have distinct quality characters." Besides, he suggested that studies should be carried out on the chronic effects of consuming Bt-brinjal throughout one's life. He also argued for putting in place a system of testing environmental and health aspects of the GM products of the kind that exists in the US. That country has three different public agencies to examine transgenic crops against any adverse impact on human health, biodiversity, and the environment. When you are doing research, but until you are cleared by the committee you are not supposed to produce the seed or grow the crops knowing fully-well that

such acts severely affect the environment. This is exactly what is happening in AP, Karnataka, Gujarat, Maharashtra, etc. states in India. Rarely concerned officials question the people behind such bizarre acts? In fact they are covering under farmers' federation/farmers organizations, who are working as agents of the GM seed companies. If the seed companies are open, such things will not happen at all. Also they control seed market-local varieties with good yields were not allowed in to seed market. After the Bt-Cotton's effectiveness has comedown drastically, the seed company introduced (Bolgaurd=BG) BG-II and BG-III illegally. Seed is produced illegally and cultivated commercially illegally. The seed company has not even applied for government's approval. This shows the ethical standards of seed companies (producing and selling illegally) and poor governance (even after knowing the fact that it is illegal, no action was taken but on the contrary allowed growing such seed whose technology was banned even by UN). With such cotton seeds, seed oil is produced sold in the market.

10. India is home for several crops native land races (Genetic Resources), which are in the Gene Banks of the MNCs/FAO to monopolize seed industry in India, elsewhere in developing countries. When central health minister under NDA government spoke openly on health hazards issue of GM crops, he was removed from the Minister ship. When AP Agriculture Minister spoke on the poor performance of Bt Cotton in AP, he was side lined by government.[6,7]
11. The negative impacts created by chemical inputs on environment were not accounted in production costs-air, water (both groundwater and surface-water) pollution, soil degradation, food contamination and thus health hazards (new diseases, hitherto unknown-drug companies, hospitals, and more pollution). The chemical fertilizer technology works only with irrigation. Government and as well farmers invested lakhs of crores of rupees on this every year, but the beneficiaries are chemical fertilizer companies that created pollution as gift. Has anybody told us these catastrophes while introducing in to Indian agriculture? Same is the case with GM crops as they also work under the same conditions but in addition creates more hazards.
12. In fact progressive farmers with traditional wisdom developed technologies and achieved far higher yields than the research station yields and received national and international awards/rewards and recognition but neither the government nor the scientists showed any interest to stabilize that technology and provide packages to farmers to achieve environmental friendly progress in agriculture. Why? Basically because our agriculture ministers are working under the MNCs and thus they are appointing their agents as advisors or chairmen of different committees to run Indian agriculture under the guidance of MNCs. It is great shame!!! Instead of wasting the time and money on environmental disaster technology like GM why the government did not care to spend time and money on improving the traditional wisdom based environmental friendly technologies? I presented scientific papers on GM issues,[6,7] but the committee was asked not to send invitation in future to me. This was told to me by the organizers.
13. We are better placed on sustainable food security but we are lacking its' distribution mechanism with bad policies of government and corruption ruling the roots of the nation and lacking quality. Now, farmers of AP self-declared crop holiday as they could not get MSP for their produce. Around 50% of the production is going as waste-recently even Supreme Court pointed on rotting of grain in FCI go-downs and this was also noted by the Finance Minister in his budget presentation. That is, we are producing more than what we needed even in drought years or flood years without quality trait. This is happening basically because we don't have sufficient storage facilities, we don't have better post-harvest technologies, and we don't have timely transport facilities. In fact large part of government subsidy and human effort and energy is wasted. Why not we go in to organic farming through cooperative farming concept so that we can better utilize our resources and at the

same time protect environment and our health and produce more than the need. During 2022-23 Rabi season, Telangana state government advised farmers not to grow rice as large quantity of Kharif output is still rotting. This shows scant respect for farmers. Here government has to procure paddy.

14. A tiny country like Nepal, the farmers showed a way to double the rice production with System of Rice Intensification method of paddy cultivation. Under this system the seed requirement is very less over the traditional system, less water and less than 50% of fertilizer. Here young plants of 8–10 days are transplanted one by one at 20 cm apart allowing the roots to spread out further. Although it requires more hands to weed, it is compensated more than enough by greater harvest. But, we don't learn from that but harping on Western GM technology. Now a days, everything goes with "you scratch my back and I scratch your back" concept. You all know on IPCC and Al Gore Climate Change goof-ups after they receiving the Nobel Prize and they withdraw their goof-up conclusions by saying regrets but did not returned their Nobel Prize.
15. In India most of GM research is manipulation like global warming by manipulating data, without taking into account environmental/ climate change impacts. If GM has a logic and science why the seeds are illegally produced? Why the crops are produced illegally in India? How many of the Public Relations farmers federations and farmers organizations have knowledge on wider aspects of agriculture and environment under global climate conditions? You are talking of spectacular results in Bt-cotton. Do you know the fact, when Bt-cotton was brought in, we said its' life is short. It has come true. Third generation seeds are over with high toxicity but these yields are no different from non-Bt-cotton yields as most of the Bt Varieties are nothing but generally grown non-Bt varieties of the region. Last year one MNC in a press release openly agreed Bt-cotton failed.
16. The words such as "efficient, inclusive, resilient and sustainable" have rarely achieved under modern systems of agriculture as here diverse people with vested interests, on the one hand, and weather-climate, on the other hand, are involved. The farming is a profit driven system and in the later it is beyond human control need to adapt to them. In the later also entered vested groups for profit diverting the basic science, for example, climate change. The profit driven systems are misusing the word "climate change" as an adjective or as a de-facto global warming. International scientific community entered time-pass computer simulation modeling wasting huge quantity of power. Natural variability forms the principle component of climate change wherein both temperature and rainfall presented systematic/cyclic variations. For example, all-India average annual rainfall presents 60-year cycle. This pattern was later seen in 700 years tree ring data in Bramhaputra River catchment area. AP in the southeast with two monsoon systems presented 132 year cycle. Here, cyclonic activity also plays important role with 56 year cycle.
17. Here let me give a case of a farmer, Hemadri Reddy holding 40 acres of land invented by chance "Aundu Korra" that 1 time seeding gives 4 time harvests. Two years back (2022) for the 1st time planted in 5 acres. Each crop gave 10 quintals/acre. First time it fetched Rs, 5000/quintal. Second harvest fetched Rs. 7500/quintal. 2nd year in Kharif season added 15 more acres. Third yield sold at Rs. 9500/quintal and 4th harvest will take some more time. The investment per acre is around Rs. 20,000. He applied 3 times irrigation for a crop. By giving more number of irrigations the yield will go down. BY growing "Janumu" and mixing that in the soil and through ploughing the land germinated Aundu Korra fetched Rs. 15,000/quintals. Here, the cost for tractor services got from fodder selling. Goat and Sheep rearing manure in his farm is a cheap way of better fertilizing system. This year he wanted extend two other crops, namely Korralu and Aaricalu-all these are minor millets cultivated prior to profit driven green revolution technology which is a mono crop system, fodder

is not suitable for animal feed and thus the traditional animal husbandry disappeared. The food is not nutritious and new diseases playing the major role. With this the cost of health care going up and up. Like this several hidden costs. In the case of millets, the cost of labor, etc., is minimal. Such innovations are aplenty in India but governments failed encourage spreading such innovations.

18. Madhya Pradesh (MP) government formed a separate "Agriculture Cabinet" and passed a comprehensive "organic policy" to make MP an organic state. However, this does not translate into action as the government is subsidizing (90%) to hybrid maize seed distribution programs involving the US based seed giant Monsanto and two other biotech companies under "Project Sunshine." This is named as "Yellow revolution" and also it is being implemented in Gujarat, Odisha, Rajasthan, and among others. That means, government is telling something and doing something else due to the pressure from MNCs!!!, Encouraging production of polluted food. Monsanto, meanwhile, is looking for an alternative site to the Pusa trials that were stopped. A spokesperson for the company says, "This unfortunate decision to stop the trials will be a setback for research and delay access of high-income-generating crop technologies to Indian farmers." Nitish Kumar, Chief Minister of Bihar begs to disagree. He says maize, which is a major crop in Bihar, is doing very well. Productivity is higher than the national average and the state turns out 1.7 million tons, contributing more than 60% of the country's Rabi production. As for the claimed advantages of GM maize, it has no relevance for Bihar. Over a year after bio-piracy complaint against Monsanto with regard to Bt-brinjal which case is still pending, the application of Monsanto to use Indian Onion strains for hybrid research the authorities promptly forwarded. In fact, India has been an exporter of Onions. While NBA failed to demonstrate urgency in dealing with the complaint has wasted no time in processing its application against whom the complaint is still pending. In the case of Bt-brinjal, NBA has decided to take action against Mahyco and Monsanto for use of India varieties of vegetable without monitory permission.

With Bihar, MP, and Kerala-later Chhattisgarh joined the three states-raising concerns over field trial of GM crops without permission, the GEAC has issued new guidelines for GM seed companies to obtain prior approval from the state governments. The apex regulator that gives approval to field trials of GM crops has also asked the company conducting the trial to provide the latitude and longitude of the field to ensure they are not close to any ecologically fragile zone or a water body, etc.

According to FAO world population reach 900 crores (9 billion) by 2050 and food output has to be increased by 70% by then. Again all this is false statement. FAO in a report stated that around 30% of the food produced is going as waste. Present population is 700 crores and by 2050 it is 900 crores that mean the increase in population is <30% but he state that food requirement will increase by 70%. In fact by reducing the 30% loss in food as stated by FAO will suffice to meet the food needs of 900 crores population by 2050 - in India the waste is 40–50%. The MNCs and their lobbying agencies are using the media in this fashion to push their commodities in developing world. Supreme Court Bench in India on 19-1-2010 asked "In other parts of the world, when they frame a rule, it is strictly adhered! But, here the rules are only in the book. Hence, you detail as how mechanism is being implemented." We raised the same questions in our PIL in AP High Court in 2002 on Bt-cotton!!!

19. Everybody talks on for the nation's food security GM crops are the solution like a man on the street or like child in cradle. Is there any proof on this? Dr. Norman Bourlogh sent a letter to some Indian scientists closely associated with MNCs. The letter was planted in a Telugu daily newspaper "Vaartha, 2002 December 10" as Bt-cotton is being produced illegally in AP at that time to infuse confidence to Bt-crops. My reply countering his arguments on food security was published on March 17, 2003.

From around 2010 to around 2050, there is a high possibility of occurrence of droughts more frequently compared to around 1990 to around the year 2010? Food security will not be achieved

through GM crops, as it is highly weather sensitive; but it is achieved only through utilizing all sources of water. Thus, the research priorities of our agriculture institutions must change from Western-MNCs mind set to Indian-traditional mind set then only we can combat the impending droughts and thus food security.

20. In view of weather and soil conditions prevailing in India; with the prevailing extensive biodiversity regime with the poor control mechanism under the powerful hands of MNCs; the government of India, to safeguard life forms and biodiversity, should put a blanket ban on "GM" more particularly food crops (cotton is also comes under this as seed oil is a food item). The government of India must put more thrust on indigenous technologies that were showing excellent results under progressive farmers' fields to feed healthy food for ever increasing population that may cross China very shortly!!!

Biodiversity can be used in agriculture in many ways:

- To improve crop yields through improved soil quality.
- To make better use of water resources.
- To help reduce the use of chemicals in agriculture.

Which biodiversity affects agriculture? Here are some:

- Biodiversity provides food for people-for example, through the cultivation of crops and livestock farming.
- Biodiversity provides raw materials for manufacturing, for example, through the cultivation of cotton or timber production.
- Biodiversity provides ecosystem services such as pollination and pests that enable production to continue without major problems (e.g., weeds or pests).

How does biodiversity affect agriculture?

21. FAO on December 7, 2018, approved India's proposal to observe an International Year of Millets. FAO proposed Year 2023 as an International year of Millets. Millets consists of Jowar (Sorghum), Bajra (Pearl Millet), Ragi (Finger Millet), and minor millets together termed as nutria-Cereals. Although it is a good initiative, yet it is to be seen how far these are going to be implemented in the back-drop of MNCs!!!
22. Animal husbandry played key role in household food and nutrient security in rural India under traditional agriculture. This system has been affected severely with the green revolution under chemical inputs and irrigation technology with poor quality fodder under mono-crop system. Same is the case with GM food crops.
23. This increased hidden costs. The unhealthy food of rice and wheat produced under huge government subsidy is supplied again under huge subsidy in PDS. This affected severely the millet based dry-land crops area and consumption of millet based healthy diet for human and animal (fodder). As a result, the native land races of these crops are in great threat. There is procurement system for rice, wheat, and cotton that are grown under high subsidies. No such system exists for millets/minor millets. Fragmentation of holdings is one of the main causes of low agricultural productivity lot of times; and labor is wasted in moving seeds, fertilizers, implements, cattle, etc. In 1970-71, the average size was 2.28 ha; this was 1.41 in 1990-91; and 1.08 in 2015-16. Cooperative farming/agriculture system overcomes the problem of smaller farm holdings.
24. Cooperatives though not new to India, in agriculture there are few isolated cases only. Anand Dairy Milk (White Revolution) cooperative was highly successful in Gujarat. Private dairies are flourishing in the state of AP. Sugarcane/Sugar cooperative in Maharashtra also showed the success path. Cooperative form of agriculture is the only solution under the present volatile political and climate conditions to achieve near sustainable production at farmers' level and thereby strengthen their economic conditions and as well nation's economy.

Here, farmers come together and cultivate the land without disturbing the boundaries by better utilization of the natural resources available in an effective way. Furthermore, plan and store and sell the produce through cooperatives joining together. At present middlemen are profiting. By including organic farming that includes components of traditional agriculture, namely, animal husbandry,

cropping system, crop rotation under cooperative agriculture system provide economic-food-nutrient security and as well provide employment. Organic agriculture is nothing but a traditional agriculture system wherein the later fertilizer is farmyard manure/green manure and for the former fertilizer is compost-several types. With chemical input technology in 1950-60s with mono crop based farming killed the animal husbandry based farming and thus nutrition based food security. To overcome the non-availability of farmyard manure, techniques were devised to create compost-on farm and off-farm (under traditional system). Here, progressive farmers' innovation techniques can be incorporated.

25. In Conclusion, the best system of agriculture that protects the biodiversity of the region/eco-system, particularly in developing countries, is the traditional farm of agriculture, such as organic inputs based "co-operative farming." This includes crops and animal husbandry that provides nutritious food and positive economy to farmers. Government assistance/subsidies directly go into the co-operatives kitty. Farmers' children get better education and health-care facilities. Research studies showed in green revolution seeds tailored to chemical input technology, rice, and wheat in the past 50 years zinc and iron levels respectively decreased by 33% and 27% and 30% and 19%. This increased the people affected by these deficiencies. GM crops are also cultivated under chemical fertilizer inputs. In rice hazardous arsenic levels increased.

FAO must see the germplasm from their gene bank not go in to the hands of MNCs with commercial interests. Furthermore, FAO must see the quality trait of the seeds developed in terms of quality by those MNCs. FAO must encourage national governments to develop millet based research and animal husbandry wherein FAO can provide financial and technical support. FAO must interact with governments of states on these issues to produce nutrifood to improve the health of humans.

Experiences, best practices, and scalable solutions for the integration of biodiversity into agriculture

In India, AP state prior to 2004 tried corporate agriculture at Kuppam wherein farmers' lands were taken on lease (with the deep ploughing effected the soil strength) and hand over to a private company with government finances. Here, farmers were asked to work as laborers in their own farms. It was a failure (baby corn crop). The present Prime Minister of India brought out three agriculture bills on contract farming with the opposition to this farm of agriculture, government withdrew them (I wrote open letter to PM, my observations were sent to a committee appointed by Supreme Court of India and published an article on this). I proposed organic inputs based cooperative farming wherein the biodiversity fits to agriculture. Government of AP asked a consultant to prepare the plan of action. Unfortunately, he put the heading cooperative farming but inside the text contains corporate farming. On my complaint to the government that was withdrawn.

Before the green Revolution Technology entered in to Indian Agriculture System, farmers used to use good grain of his or his fellow farmers as seed. With the Green Revolution Technology at the start of 60's, farmers are now depending upon the seed companies and retailers. In the case of cash crops, MNCs are doing a brisk- business by monopolizing certain seeds. This created problem to farmers in terms of retail out-lets black marketing and pumping adulterated-spurious seeds in to the markets; not allowing to sell the non-GM seeds in the market. Although scientists and economists argue that this facilitated the Indian farmers to access the best seed and planting material available anywhere in the world; this is a false propaganda, this created more problems to Indian farmers but MNCs monopolized the seed industry and thereby putting farmers at the mercy of officials and retailers. However, this has not in real terms improved the yield potential of seeds as well improved the yields in the farmers' fields comparable to scientists farm yields with the existing seed varieties.[22,23] The hidden costs are beyond the farmers economics. To reduce, this burden governments have been providing huge subsidies.

Seed is the basic and most critical input for sustainable agriculture. The response of all other inputs depends on quality of seeds to a large extent. It is estimated that the direct contribution of quality seed alone to the total production is about 15–20% depending upon the crop and it can be further raised up to 45% with efficient management of other inputs. Indian plant breeders and geneticists have

developed a large number of improved crop varieties (conventional varieties and hybrids) that have played pivotal role in enhancing crop production. Reddy[12] presented the weather impact on phenophases of sorghum crop. Reddy[21] discussed the crop versus weather/climate.

Here, rather difficult in an area where people with the requisite expertise also tend to have research links with the GM industry. At Paris meet in 2015 December (COP21) MNC lobbied and negated the proposals by people such as Pope and few other heads of states. Farm expert, M S Swaminathan (few days back Government of India honored him with "Bharat Rathna," the highest honor in India) wrote: "Bt-brinjal need not be banned, but there should be caution that one or two hybrids do not replace hundreds of native varieties which all have distinct quality characters." Besides, he suggested that studies should be carried out on the chronic effects of consuming Bt-brinjal throughout one's life. He also argued for putting in place a system of testing environmental and health aspects of the GM products of the kind that exists in the US. That country has three different public agencies to examine transgenic crops against any adverse impact on human health, biodiversity and the environment. India is home for several crops native land races (Genetic Resources), which are in the Gene Banks of those MNCs; to monopolize seed industry in India, elsewhere in developing countries.[6,7,24,25] After the Bt-Cotton's effectiveness has comedown drastically, the seed company introduced (Bolgaurd=BG) BG-II and BG-III illegally. Seed is produced illegally and cultivated commercially illegally. The seed company has not even applied for government's approval. This shows the ethical standards of seed companies (producing and selling illegally) and poor governance (even after knowing the fact that it is illegal, no action was taken but on the contrary allowed growing such seed whose technology was banned even by UN). With such cotton seeds, seed oil is produced sold in the market. Unfortunately, these new technologies least bothered on linking with weather/climate/climate change issues.

In fact progressive farmers with traditional wisdom developed technologies and achieved far higher yields than the research station yields and received national and international awards/ rewards and recognition but neither the government nor the scientists showed any interest to stabilize that technology and provide packages to farmers to achieve environmental friendly progress in agriculture. Why? Basically because our agriculture ministers are working under the MNCs and thus they are appointing their agents as advisors or chairmen of different committees to run Indian agriculture under the guidance of MNCs. It is great shame!!! Instead of wasting the time and money on environmental disaster technology like GM why the government did not care to spend time and money on improving the traditional wisdom based environmental friendly technologies? I presented scientific papers on GM issues,[6,7] but the committee was asked not to send invitation in future to me. This was told to me by the organizers.

The words such as "efficient, inclusive, resilient and sustainable" have rarely achieved under modern systems as here diverse people with vested interests on the one hand and weather-climate on the other are involved. The forming is a profit driven system and in the later it is beyond human control need to adapt to them. In the later also entered vested groups for profit diverting the basic science. For example: climate change. The profit driven systems are misusing the word "climate change" as an adjective or as a de-facto global warming. International scientific community entered time-pass computer simulation modeling wasting huge quantity of power. Natural variability forms the principle component of climate change wherein both temperature and rainfall presented systematic/ cyclic variations.

According to FAO world population reach 900 crores (9 billion) by 2050 and food output has to be increased by 70% by then. Again all this is false statement. FAO in a report stated that around 30% of the food produced is going as waste. Present population is 700 crores and by 2050 it is 900 crores that mean the increase in population is less than 30% but he state that food requirement will increase by 70%. In fact by reducing the 30% loss in food as stated by FAO will suffice to meet the food needs of 900 crores population by 2050-in India the waste is 40–50%. The MNCs and their lobbying agencies are using the media in this fashion to push their commodities in developing world.

Supreme Court Bench on January 19, 2010, asked "In other parts of the world, when they frame a rule,

it is strictly adhered! But, here the rules are only in the book. Hence, you detail as how mechanism is being implemented." We raised the same questions in our PIL in AP High Court in 2002 on Bt-cotton!!!
Everybody talks on for the nation's food security GM crops are the solution like a man on the street or like child in cradle. Is there any proof on this? Dr. Norman Bourlogh sent a letter to some Indian scientists closely associated with MNCs. The letter was planted in a Telugu daily newspaper "Vaartha, 2002 December 10" as Bt-cotton is being produced illegally in AP at that time to infuse confidence to Bt-crops. My reply countering his arguments on food security was published on March 17, 2003.
Like NGOs, ICAR Dy. D.G. (Crop Science) Dr. Swapan Kumar Datta at a conference in Hyderabad stated that around 300 million people are starving for food and around 300 million are suffering from nutrient deficiency and suggests modern technology as solution to food security-I don't know where from he got this data but one thing can be said that through feeding the poor with "chemical free rain-fed cereal food crops" in place of "chemical infested rice-wheat" (in PDS system) it is possible to arrest nutrient deficiency and not by modern technology that creates more health hazards. We are wasting 30–50% what we are producing.
Even after 70 years of Independence, in India still around 60% of the cultivated area is at the mercy of "Rain God." In addition, government is giving step-motherly treatment to dry-land agriculture in all aspects that provide nutritious food, for example, in terms of government subsidies components, inclusion under low price PDS system but irrigated crops like rice-wheat are enjoining all benefits. Although, Food Security and Nutrients bill passed to include Sorghum, Pearl Millet and Finger Millet they were not sold under PDS.
In view of weather and soil conditions prevailing in India; with the prevailing extensive biodiversity regime with the poor control mechanism under the powerful hands of MNCs; the government of India, to safeguard life forms and biodiversity, should put a blanket ban on "GM" more particularly food crops (cotton is also comes under this as seed oil is a food item). The government of India must put more thrust on indigenous technologies that were showing excellent results under progressive farmers' fields to feed healthy food for ever increasing population that may cross China very shortly!!!
Biodiversity is the key to making agriculture more productive, sustainable, and profitable. Agriculture is a complex system that requires careful management to make sure we're using our resources in the best way possible. To do this, we need to be able to identify what works and what doesn't. That is why biodiversity is so important for agriculture-because diversity allows us to better manage our resources and protect against pests or disease outbreaks by helping us maintain a healthy ecosystem with a variety of different species living within it.
FAO on December 7, 2018, approved India's proposal to observe an International Year of Millets. FAO proposed Year 2023 as an International year of Millets. Millets consists of Jowar (Sorghum), Bajra (Pearl Millet), Ragi (Finger Millet), and minor millets together termed as nutria-Cereals. Though it is a good initiative, yet it is to be seen how far these are going to be implemented in the back-drop of MNCs!!!
Cooperatives though not new to India, in agriculture there are few isolated cases only. Anand Dairy Milk (*White Revolution*) cooperative was highly successful in Gujarat. Private dairies are flourishing in the state of AP. Sugarcane/Sugar cooperative in Maharashtra also showed the success path. Cooperative form of agriculture is the only solution under the present volatile political and climate conditions to achieve near sustainable production at farmers' level and thereby strengthen their economic conditions and as well nation's economy.
Here, farmers come together and cultivate the land without disturbing the boundaries by better utilization of the natural resources available in an effective way. Furthermore, plan and store and sell the produce through cooperatives joining together. At present, middlemen are profiting. By including organic farming that includes components of traditional agriculture, namely, animal husbandry, cropping system, and crop rotation. under cooperative agriculture system provide economic-food-nutrient security and as well provide employment. Organic agriculture is nothing but a traditional agriculture system wherein the later fertilizer is farmyard manure/green manure and for the former fertilizer is compost-several types. With chemical input technology in 1950-60s with mono crop based

farming killed the animal husbandry based farming and thus nutrition based food security. To overcome the non-availability of farmyard manure, techniques were devised to create compost-on farm and off-farm (under traditional system). Here, progressive farmers' innovation techniques can be incorporated.

Some regenerative farming practices to improve biodiversity

Cover crops

Cover crops are plants grown specifically for their ability to protect and improve soil health through nitrogen fixation (when a plant takes nitrogen from the air into its roots). They can also provide ground cover which prevents soil erosion as well as provide seeds for birds and insects during winter months when there is little natural food available for them. For example legumes such as clover fix nitrogen into nodules on their roots so that it becomes available. Cover crops also build up nitrogen levels in soils by fixing nitrogen from the air into organic compounds that plants can use as fertilizer. This reduces the need for synthetic fertilizers that pollute waterways when they wash off fields during rainstorms or irrigation events. Regenerative farmers plant cover crops between seasons to reduce erosion, increase organic matter in soils, and provide food for beneficial insects. Cover crops provide shelter for many types of wildlife, including small mammals such as rabbits, voles, and mice, which use them as nurseries for their pups or dens while they are away hunting during the day.

Reduced tillage

Regenerative farmers use less tillage than conventional farmers, because it disturbs soil structure, reduces organic matter in the soil, increases erosion, and disrupts soil organisms such as earthworms. Regenerative farmers leave crop residues on the surface of the field to protect against erosion and increase organic matter in the soil.

Crop rotation

Rotating crops each year helps prevent pests from becoming resistant to herbicides or pesticides. This also allows for different plants to be grown on your farm which provides more habitats for beneficial insects and birds. Shorter rotations (2 years) will allow you to plant many different types of crops in one field at once.

Rotational grazing

Regenerative farmers rotate their livestock through different pastures or paddocks so that each area gets time to rest from grazing pressure before being grazed again. This strategy promotes biodiversity by allowing weeds and native plants to regenerate after being grazed down. Rotating livestock through paddocks allows grasses to grow taller, which improves soil health and fertility by increasing organic matter in the soil and improving soil structure. Animals also deposit manure on the land, which provides nutrients for plants as well as carbon sequestration. Rotational grazing helps keep pastures healthy and reduces weed growth by reducing bare spots in the pasture where weeds thrive.

Hedges and buffer strips

Planting hedges and buffer strips help in protecting water sources from runoff, erosion, and pollution by increasing habitat for pollinators, birds, and beneficial insects.

Land conservation

Land conservation is also a key component of regenerative farming practices, which have been shown to improve biodiversity and carbon sequestration in agriculture landscapes. Land conservation practices are one way to help maintain biodiversity by protecting natural habitats, native plants, and animals from destruction or extinction. They can also help to improve soil quality through sustainable agriculture practices that reduce erosion and promote nutrient retention.

Conservation tillage

Conservation tillage is a type of farming practice where land is left undisturbed after planting seeds so that crops can grow with minimal disruption from mechanical equipment like tractors and plows. Conservation tillage can help control weeds by reducing their access to light so they cannot grow as easily. It also helps keep moisture in soils so they

do not dry out too quickly during heat waves which can cause more evaporation from soil surfaces during hot weather periods (e.g., summer months). Conservation tillage preserves organic matter in soils.

In Conclusion, the best system of agriculture that protects the biodiversity of the region/eco-system, particularly in developing countries, is the traditional farm of agriculture, such as organic inputs based "co-operative farming." This includes crops and animal husbandry that provides nutritious food and positive economy to farmers. Government assistance/subsidies directly go into the co-operatives kitty. Farmers' children get better education and health care facilities. Research studies showed in green revolution seeds tailored to chemical input technology, rice and wheat in the past 50 years zinc and iron levels respectively decreased by 33% and 27% and 30% and 19%. This increased the people affected by these deficiencies. GM crops are also cultivated under chemical fertilizer inputs. In rice hazardous arsenic levels increased.

The hidden costs and benefits of agri-food systems be effectively incorporated into decision-making for transformation

In such issues, however, climate change/weather rarely taken in to account and as a result huge losses have to be incurred by farmers and government towards compensation to the losses incurred by farmer under unusual weather events. Here the basic issue is "threat of hidden costs and benefits in agri-food systems must effectively incorporated in to decision making for transformation." It varies with country to country; state to state within the country, etc. and primarily depending on weather and climate change-natural variability. The issues such as adulterated-polluted foods cause health hazards. In India, people spend huge sums toward health hazards. This is the major threat of hidden costs.

People are accustomed to polluted wheat and rice, particularly supplied under PDS at subsidized price. FAO on December 7, 2018, approved India's proposal to observe an International Year of Millets. FAO proposed Year 2023 as an International year of Millets. Millets consists of Jowar (Sorghum), Bajra (Pearl Millet), Ragi (Finger Millet), and minor millets together termed as nutria-Cereals. Although it is a good initiative, yet it is to be seen how far these are going to be implemented in the back-drop of MNCs!!!

Animal husbandry played vital role in household food and nutrient security in rural India under traditional agriculture. This system has been affected severely with the green revolution under chemical inputs and irrigation technology with poor quality fodder under mono-crop system. Same is the case with GM food crops. This increased hidden costs. The unhealthy food of rice and wheat produced under huge government subsidy is supplied again under huge subsidy in PDS. This affected severely the millet based dry-land crops area and consumption of millet based healthy diet for human and animal (fodder). As a result, the native land races of these crops are in great threat. There is procurement system for rice, wheat, and cotton that are grown under high subsidies. No such system exists for millets/minor millets. Fragmentation of holdings is one of the main causes of low agricultural productivity lot of times; and labor is wasted in moving seeds, fertilizers, implements, and cattle, etc. In 1970-71 the average size was 2.28 ha; this was 1.41 in 1990-91; and 1.08 in 2015-16. Cooperative farming/agriculture system overcomes the problem of smaller farm holdings.

Cooperative form of agriculture is the only solution under the present volatile political and climate conditions to achieve near sustainable production at farmers' level and thereby strengthen their economic conditions and as well nation's economy. Here, farmers come together and cultivate the land without disturbing the boundaries by better utilization of the natural resources available in an effective way. Furthermore, plan and store and sell the produce through cooperatives joining together. At present middlemen are profiting. By including organic farming that includes components of traditional agriculture, namely, animal husbandry, cropping system, and crop rotation under cooperative agriculture system provide economic-food-nutrient security and as well provide employment. Organic agriculture is nothing but a traditional agriculture system wherein the later fertilizer is farmyard manure/green manure and for the former fertilizer is compost-several types. With chemical input technology in 1960s with mono crop based farming killed the animal husbandry based

farming and thus nutrition based food security. To overcome the non-availability of farmyard manure, techniques were devised to create compost-on farm and off-farm (under traditional system). Here, progressive farmers' innovation techniques can be incorporated.

Now people of developing countries are severely affected by the adulterated food including milk. Fruits are treated with chemicals. Chemicals are used to ripening of mango fruits. Oil is extracted from dead animals and mixed with others. Bt-cotton seed oil is produced illegally. Even though this is a major hazard the people of India are facing, the rulers are looking at real estate business at the cost of destruction of environment. Poor ethics and poor governance are ruling the roots of the nation. UN agencies can do something on such issues. Whenever rulers change then nobody knows the changed government's plans?

In conclusion, as long as soil and water pollution play the role in agriculture, we may achieve production in quantity but not in quality; as long as, we follow chemical input-mono crop agriculture system we rarely achieve the nutrition security; The foods supplied through market chain are unhealthy food excluding organic foods, whatever may be claims of the suppliers; UN agencies and agencies like World Bank must work and help in the eradication of role of pollution in agriculture instead of wasting money on issues like "global warming and carbon credits."

The two natural resources that are vital for agriculture are soil and climate. Soil is static while climate is dynamic. Climate is beyond human control and thus needs to adapt to it. The two main climatic parameters that play key role in agriculture are temperature and precipitation. In addition, the production is a function of agriculture technology and availability of sustainable irrigation facilities.

The author presented pros and cons on three agri bills brought out by the Indian government, in which contact farming formed the main component. However, later the government withdrew the three agri-bills. I submitted my comments to PM of India and Supreme Court appointed Committee later published in a journal.[31] Before 2004 the ruling party started implementing corporate agriculture at Kuppam in AP with government money but failed. Here farmers whose land was used became laborers in their own land with deep ploughing that affected soil nutrients capacity. I proposed cooperative farming, after 2004 the government assigned the task to prepare the plan of action to an Advisor. But the Advisor under the title cooperative farming included corporate farming that was failed. This I brought to the notice of states Chief minister of the AP State. He cancelled the program. Unfortunately, he died in helicopter crash later.

The total subsidies (food and fertilizer) have increased from Rs. 12,158 crore in 1990-91 to Rs. 1,29,243 crore in 2008-09, an increase by 10.6 times and as a percentage of GDP, the total subsidies represent an increase from 0.85% in 1990-91 to 1.52% in 2008-09; The fertilizer subsidy has increased from Rs. 4389 crore in 1990-91 to Rs. 75,849 crore in 2008-09 representing an increase of over 17 times and the fertilizer subsidy in India as percentage of the GDP varied from 0.47 in 2002-03 to 1.52 percent in 2008-09; The total food subsidy has jumped to Rs. 43,627 crore in 2008-09 from 2450 crores in 1990-91, about 18-fold increase in less than two decades in absolute terms. But if one looks at the percentage of GDP, then the burden of food subsidies in India is much less than that of many other developing countries. The food subsidy in India as percentage of the GDP has varied from 0.41 in 1992-93 to 1.02 in 2002-03, and on an average remained at 0.66% over the last 19 years; During the nineties (1990-91 to 2000-01), fertilizer subsidy accounted for about 47% of the total subsidies and share of food subsidy was 35.1%. In the 2000s (2001-02 to 2008-09), food subsidy became dominant, accounting for 49.1% of the total subsidy while fertilizer subsidy accounted for 39.5%. However, during the past 3 years, fertilizer subsidy has taken the largest share and accounted for 58.7% of total subsidies in 2008-09. Year 2023 these have further increased in percentage with more area coming under irrigation and population growth. With all these farmers are producing unhealthy polluted foods.

There was a debate about whether the fertilizer subsidy benefits the farmers or the fertilizer industry. Furthermore, the benefits of fertilizer subsidy are heavily tilted to large farmers growing water-intensive crops such as rice, sugarcane, wheat, cotton, and in a handful of states. It also states that

the share of farmer in the fertilizer subsidy increased from 24.54% in the triennium average ending (TE) 1983-84 to 75.62% in TE 1995-96 with an average share of 67.5% for the period 1981-82 to 2000-01 and the rest goes to the fertilizer industry. More than 30% items subsidized by government goes in to black market; food items under PDS and chemical fertilizers. This is under implementation and central government so far saved around one lakh crores. However this has to be implemented in all the states in India. At present, the fertilizer purchased in black market goes to manufacturers of illicit liquor and fish/prawns ponds.

In AP water-rich districts of East and West Godavari, Krishna and Nellore farmers declared crop holiday in 3 lakh hectares. They expressed that national food security is not important to them but it is the farmers' financial security important. Overflow stocks from the Rabi crop, nobody there to lift neither these stocks nor the farmers getting MSP but government is helping millers-business lobby to export rice and amass wealth at the cost of farmers. In Telangana, the state government declared crop holiday for Rabi paddy cultivation.

Under FCI, food is rotting in the godowns; Government must encourage adapting traditional farming systems centered approach with organic inputs (that includes animal husbandry) in place of crop centered chemical input technology approach; government must collect traditional inventions of progressive farmers and strengthen these with research and then transfer to farmers with which we can bring down chemical input use and thus air, water, soil and food pollution and achieve good quality better yields/food; government must establish commodity boards/extension services and strengthen government based seed development corporations-at present these are infested with private sector seed companies-Government must strengthen the NPM in place of chemical pesticides, insecticides, fungicides, etc. Most important issue to be tackled is: UN Agencies and world Bank must look at controlling MNCs thereby we can bring down unhealthy food, destruction of soil, cost of production, etc. Governments must also control adulterated food circulation with high health hazards.

SUMMARY AND CONCLUSIONS

Global Warming Denial

The issues pertaining to global warming three groups raised the issue of denial groups put forth their arguments. Denial groups changed with time, in terms of tactics, shifting emissions, pushing for solar, wind power, etc. Countering denial groups YouTube data they arrived their inferences but failed to show their data to counter YouTube reports. They are trying to argue that big money is behind these reports forgetting the fact even the UN Agencies collecting billions/trillions for giving hype by giving importance to global warming. They also argued young children are engaging in propagating denial complain through YouTube's. This is not new for campaigning using young children like Swedish girl. Here they failed to realistic relationship between greenhouse gases and global warming. Satellites detected no real climate benefit of forest carbon offset in California. Australia and USA presented considerable renewable energy additions or under production. India being the second largest populous country after China, India, and USA producing around 50% of the energy share through coal based thermal power; and India and USA producing around 25% of Hydropower and Nuclear power, respectively. We are harping on renewable energy to counter "fictitious" global warming. Nobody is showing the realistic estimates. To cover this lacunae they invariably use the word "climate change" in place of "fictitious global warming."

Climate Change and Agriculture

Soil and climate are the two natural resources that are vital for agriculture. Soil is static but climate is dynamic. Climate change was there in the past and people adapted to it; climate change will be there in future needs develop adaptive measures. However, climate change varies with space and time. Too generalization is too dangerous; scientific institutions must change from copycat mode to real science mode. In fact the word climate change is used as de-facto "global warming and carbon credits" to get a share in green fund. Many a time climate change is used as an adjective and media uses to get hype. However, man on the street to

editors of technical magazines/media along with governments, research institutes, UN agencies attribute every unusual event to global warming as it cannot defend against such onslaughts. Weather events are commonly used as climate and climate change. These events were invariably goes in to the computation of global warming though it is linked to greenhouse gases.

Agriculture Point

Global warming has no impact as it is insignificant when compared to annual and seasonal variations wherein agriculture is adapted to them. Climate change in terms of natural variability impacts agriculture as the cyclic variations comprises of droughts and floods.

Natural Variability in Rainfall at Different Space Scales

The natural variability or rhythmic variations in rainfall data series may differ at different scales of studies in space, such as national, state and station level. Climate change is modified at local and regional levels by "climate system and general circulation patterns." It is common to researchers and planners use truncated data set of a natural variability series. This type of selection leads to misleading conclusions or lead to biased inferences. (a) India: The study of Annual and SWM rainfall showed a 60-year cycle and the frequency of occurrence of high magnitude floods in the northwest Indian rivers followed this pattern. Furthermore, water availability in Godavari River followed this pattern only. Tree Rings study of 7 centuries data in Bramhaputra Riven valley supported the 60-year cycle in all India rainfall wherein the 30 year below the average pattern in all India Rainfall matched with the dry periods in tree rings. The knowledge of such variations plays key role in broad long-term agriculture planning to minimize weather related risks; (b) Mozambique and Ethiopia: In the case of Mozambique 54 and 18 year cycles are prominent with differing phase angles. Zimbabwe stations followed 54 and 18 year cycles and Malawi stations followed 40 years cycle along with three stations from Mozambique; (c) State level (AP): Annual rainfall showed 132-year cyclic pattern. Water availability in Krishna River followed this cyclic pattern. This plays major role in water availability planning. However, AP receives rainfall in SWM and NEM and from pre-monsoon with the sporadic cyclonic activity. The three met sub-divisions in AP followed 56-year cycle in SWM and NEM rainfalls but in reverse order. Cyclonic activity in the Bay of Bengal followed the SWM rainfall pattern Coastal AP. This is not the same with other states; and (d) Station level-Kurnool: He yearly effective moisture availability periods followed the SWM rainfall's 56 year cyclic pattern, in which it showed average drought proneness as 45% of the years; and during above and below the average cyclic parts of 28 years they are, respectively, 30% and 60% of the years. This helps planning of farming system.

Agri-Nutri-Food Security

Three agriculture systems are in use, namely traditional agriculture system that includes animal husbandry that provides economic and nutrient security to farmers and his family; seed tailored chemical inputs so-called green revolution system under irrigation that provide unhealthy diet at huge costs (subsidies); and genetically modified technology that works under green revolution technology with GM seeds. The last two systems are under control of MNCs-chemical fertilizers, GM seeds with dangerous traits. The government must encourage cooperative organic farming that provides the healthy diet. Even though this is included in food security Bill/PDS, governments are not implementing this as it antagonizes the MNCs.

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