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## Global warming and health hazards to Indian farmers


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**ABSTRACT**

Under severe global warming scenario, people, especially farmers would face chronic climate torments like, sun stroke, depression, pollution induced asthma, infertility, skin disorders, chronic kidney disease etc., since their main activity comes under open field conditions. If the climate stress continues beyond threshold level, it may lead to social disturbance, mental disorders, suicides etc. Psychological treatment combined with pharmaceutical treatment would serve better to release stress from climate related disorders. Limited management solutions have been suggested against these diseases. Still, many viable solutions are available across literature and also found presently at ground level practice. This area needs further intensive team research among medical, meteorological, and social scientists. Both Central and State Governments must enact strong policy on this line, if not done earlier. In addition, action must be taken by all the global countries to reduce greenhouse gas emission as per the Paris CoP agreement,2015.



***Key words:*** Sun stroke, depression, pollution, asthma, climatic stress,


The insight from the results of global warming revealed that, the global warming is very strong now to dismantle humans' comforts life. All biotic life in the earth including humans, would be vanished slowly over decades, if global warming is not put under check / brake. It is established that, over accumulation of greenhouse gases (as per the estimates given, the concentration of all greenhouse gases including cooling aerosols reached a value of 449 ppm in $CO_2$ equivalents in the atmosphere in 2016, an increase of 4 ppm compared to 2015 and 33 ppm more than a decade ago) has happened now in the three fourth of the atmospheric mass(The total atmospheric mass is estimated to be 5.5 quadrillion tons or $5.1480 \times 10^{18}$ kg.) especially within the troposphere layer and this has hiked the atmospheric global average temperature to the present level of 1.1°C over the recorded mean temperature of pre industrial period(1850 to 1990).

Considering this alarming situation, the participated countries in the CoP 26 of Glascow,2021, reaffirmed that, the Paris agreement (CoP 21,2015) goal of limiting the increase in the global average temperature must be kept well below 2°C over the pre industrial period, and even attempts should be made to limit it to 1.5°C., with due cooperation from both the developed and developing countries in the world by making suitable mitigation and adaptation agenda in respect of their country.

Even under 1.5°C rise in temperature over the preindustrial period mean temperature, the bio-life in the earth must suffer a lot for their livelihoods and survivals. Extinction of genus and species would be continued to occur followed by injuring the comfort life of the human beings by changing Thermal Humidity Index (THI) value well above 12. The Indian farmers (93.09 million households distributed over 155.2 million hectares of cultivable area) have spread over from the latitudes of 8°4'N to 37°6'N and longitudes between 68°7'E and 97°25'E.

This geographical area comes under "Tropical Monsoon Climate" and hence, farmers would be placed under severe climate stress during the forthcoming severe global warming scenario. This expected environmental condition may affect the tempo and moods of the farmers negatively and hence farmers might go wrong with their farm decision making processes. This may lead to unsustainable agriculture over years to come. The efficiency of the agricultural laborer also would be put under stake, when the temperature goes beyond the threshold level of normality. The crop productivity as per crop simulation models study made in India, indicate that


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crop's productivity loss would occur from 10 to 30 per cent from the present-day level. These altogether would decrease food production and also on day today profits to be derived from food production by the farmers in the coming years. Under this context, the to be anticipated health problems to happen to the Indian famers and people must be addressed /understood properly by both Government of India as well as by the respective State Government for making policy decisions.

## CLIMATE STRESSES

***Heat wave / Heat stroke / Sun stroke***

The apocalypse from global warming is presently felt very heavily and this led to the present-day problems of both uncomfortable and unsustainable living conditions in respect of all bio lives. The daily newspaper "Deccan Chronicle" dt. 4.8.17, Coimbatore edition (P.7) of India, reported that, deadly heat waves may hit 1.5 billion people living in India, Pakistan, and Bangladesh within the next few decades. Scientists predicted that by the end of this century, global warming could generate severe summer heat waves in South Asia. The higher Thermal Humidity Index (THI) would be the rule under global warming scenario. At a wet bulb temperature of 35°C, the human body cannot cool itself enough to live for more than a few hours. As per Thorsten Mauritsen (2017), if the emissions continued for 15 more years, the global temperature could rise as much as to 3° C more over pre -industrial period. Even if you would stop burning fossil fuels today, then the earth would continue to warm slowly. Rising temperatures and shift in weather would lead to reduced air quality, increased food and water contamination, more infections and severe stress on mental health (https://medsocietiesforclimatehealth.org) and (Medical Society Consortium on Climate and Health ,2017. CNN Report as published by the Deccan Chronicle under Nothing we do can stop global warming. P.10: 6.8.2017).

Heat stroke as a result of prolonged exposure to high temperature, usually in combination with dehydration would be a very critical to health problem of all bio-lives. As per webmd. com (http://www.webmd.com), the heat stroke is the most serious form of heat injury and is considered as a medical emergency. Heat stroke can kill or cause damage to the brain and internal organs. Medical definition goes to say that it is a core body temperature greater than 104°F with complications to happen in the central nervous system, which occurs after exposing to higher temperature. As per the Wikipedia report (https:// en.wikipedia.org), it is a type of hyperthermia and is a distinct from fever, where there is a physiological increase in temperature set point. It mainly affects people of more than 50 years old. Heat stroke often occurs as a progression from milder heat related illness such as heat cramps, heat syncope and heat exhaustion. But it can strike even if you have no previous signs of heat injury

As per India Meteorological Department, this heat wave occurs in a region, where the ruling temperature is more than 5°C over the normal maximum temperature of 40°C or less of that region (Table1).

**Table 1:** Criteria for heat wave occurrence *

| | |
|---|---|
| Normal | (-)1to + 1°C |
| Above normal | +2°C |
| Appreciably above normal | +3 to 4°C |
| Moderate heat wave | +5 to 6°C |
| Severe heat wave | +7°C and above |

*When the normal maximum temperature of the area is 40°C or less

In India this type of high temperature is normally seen during summer months (March-May) in Northern parts and now this becomes a new scenario in South India in the past 5 to 6 years. In the years to come, the ruling temperature during summer and other monsoon months would be more than 40° C, over all parts of India under global warming context. In India the annual average human death due to the heat stroke is around 2500. This will tend to increase beyond imagination under forthcoming global warming scenario.

The risk factors that trigger heat stroke under high temperature environment are, high humidity, certain drugs like diuretics, alcohol, heart diseases, skin diseases, etc.,

***Symptoms for heat stroke:*** The hall mark symptoms for the heat stroke are; body temperature would be > 104° F with fainting sign, throbbing head ache, dizziness and light headiness, lack of sweat despite the heat, red hot and dry skin, muscle weakness and cramps, nausea and vomiting, increased heartbeat, rapid and shallow breathing, behavioral changes like confusion, disorientation and staggering, seizures, and unconsciousness.

***Management for heat stroke:*** The following management strategies may be considered for managing heat stroke

a. Drinking sufficient water / fluids

b. Avoid excessive heat

c. Spraying the affected person with water using a fan

d. Putting the affected person in ice water

e. Giving cold intravenous fluids

f. Provide ice packs around the person.

g. Wearing loose cotton clothes and light-colored hat when go out

h. Avoid exercise during hot weather

i. Stay indoor with adequate ventilation

j. Avoid alcohol and caffeine

k. Prefer foods like mint mixed cool drinks, celery, water melon, snow peas, cucumber, tomatoes, pomegranate, kiwi fruits, pine apple, hot pepper, hot tea to induce sweating(www.activebeat. com).

***Role of the Government*:** The Government must consider the following

a. Making awareness on the symptoms and prevention methods with the public
b. Subsidized cost for food items like cucumber, pineapple, watermelon, pomegranate, kiwi and celery
c. Developing mint mixed fruit juice and supply through single window
d. Increasing the availability of cold intravenous fluids at all types of hospitals from rural to urban
e. Ban on alcohol and caffeine drinks during summer months
f. Ban on diuretics drugs during summer

***Depression***

Depression is the most untreated and undertreated mental health malady. If untreated in time nearly 15 per cent people might develop suicidal tendencies at a later stage (Gilvester Assary ,2017). Depression especially is easily identifiable among the people of adolescent age and middle-aged persons. The monitoring mechanisms must be put on effectively for the middle-aged women, men, adolescents, and children against the initiation of mental depressions.

Though the State Kerala witnessed a noticeable dip in suicide rate over the past one and half decades from 28.8 in 2001 to 24.9 in 2016, the mental health of Kerala community continues to face a host of challenges and that must be addressed on priority (Gilvester Assary ,2017).

Global warming also takes a significant toll on mental health according to new report released by American Psychological Association and eco-America entitles", Mental health and our changing climate; impacts: implications and guidance" (www.apa.org). According to the report, global warming induced weather and its related natural disasters, have the most immediate effects on mental health in the form of trauma and shock, loss of loved ones, damage to or loss of personal property or even loss of livelihoods.

Global warming does not just affect people's physical health by exacerbating problems like asthma but also cause mental problems like anxiety and depression(https://www.time.com/). The mental health disorder may lead to the destabilization of community. In agricultural community, global warming would disturb their livelihoods. In indigenous community, these threats would threaten cultural heritage. In some cases, forcing community to relocate from their natural lands, which can in turn lead to mental health issues.

From research information, the results indicate that, extreme weather events such as large storms, floods, droughts, and heat waves are likely to become more frequent or more intense with climate change (http://www/psychiatry.org). Hurricane Katrina met the criteria of Post-Traumatic Stress Disorder (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3276074/). It is experienced that, the disorders from climate and weather, can cause significant stress and distress for many people including farmers and this may lead to more serious mental health issues. (http://www/psychiatry.org)

A recent report from the Lancet Commission on Health and Climate Change (http://climatehealthcommission.org) indicates specific mental health impacts, namely "anxiety-related responses, and later chronic and severe mental health disorders." for example, both flooding and prolonged droughts have been associated with elevated levels of anxiety, depression, and post-traumatic stress disorders (U.S. Global Change Research Program.). The trauma and losses from a disaster, such as losing a home or job and being disconnected from neighborhood and community, can contribute to depression and anxiety.

Exposure to extreme heat has been associated with increased use of alcohol and this in turn increases the hospital and emergency room admissions for people with mental health or psychiatric conditions, and increase in suicide to happen. Extreme weather events have also been associated with increase in aggressive behavior and domestic violence (U.S. Global Change Research Program).

The children, the elderly, the chronically ill, people with mobility impairments, pregnant and post-delivery women, and people with mental illness, lower socioeconomic status, migrants, refugees and the homeless may be more vulnerable to depressions. In adult depression, the affected person might send out suicidal notes to close friends and relatives.

The studies from heat-wave related deaths indicate that the people with mental illness had a three times greater risk for death as compared to those without mental illness(http://www/psychiatry.org). In addition, people living with mental illness are also more likely to live in poverty or to have co-occurring substance use disorders, which make it harder for them to cope or adapt to changes.

According to the United Nations High Commissioner for Refugees, population migration is linked to global warming and this brings mental depression over time. Each year since 2008, an average of more than 20 million people is forced to move because of weather-related events, such as floods, storms, wildfires, or extreme temperature. Many others are leaving their homes because of occurrence of slower moving events, like, droughts or coastal erosion or sea level rise.

Mental health problem might come with food scarcity or food quality issues, potential increases in diseases transmitted by insects (such as Lyme disease and malaria) and air pollution (http://health2016.globalchange.gov).

Meera Senthilingam (2017) based on their review, showed that higher levels of depression, anxiety and PTSD had prevailed with flood victims, heat waves was linked to greater potential for aggression and droughts led to some farmers to commit suicide after suffering losses.

***Depression management:*** The Governments of both Central and State should identify both drought and flood prone areas and enhancing infrastructure facilities and improving the adaptation capacity against migration.

The Government must announce the minimum support price for all crops and this includes the cost of cultivation of the crops concerned + 30 per cent of cost of cultivation and this should

be announced before the sowing season

The Government must establish a separate Division of Consultancy and Confidence Building for mental depressed patients at each hospitals including primary health centers of both rural and urban to meet the challenges from mentally depressed people. One 30 minutes chat with those people could bring down their suicidal tendency. All hospitals may be prepared to meet the challenges from mentally affected people and farmers.

Encouraging social activities and social festivals among villagers. The concept of Joint Family System may be encouraged again against the present-day tendency of establishing nucleus family. People and farmers may be advised for keeping themselves not to be alone in their homes. Social mixing and frequent chatting are suggested.

***Other stresses***

Increased temperature under global warming would increase ground level ozone and this cause airway inflammation in the human respiratory system and damages lung tissues (http:/ www.ncbi.nim.nih.gov/pmc/articles/PMC 3598823/pdf/2049-6958-8-12pdf -visit). This ground level ozone is due to the chemical reaction between nitrous oxide and organic compounds when exposed to sunlight. Warmer temperature also causes flowers to bloom earlier and increase the concentration of pollen in the air (http:/www.epa.gov/research/gems/scinews aeroallergens.htm) and thus brings people find difficult for their breathing. Individuals who have allergic asthma are also at a greater risk of allergy symptoms as a result of global warming.

Air pollution due to frequent occurrence of extreme weather events causes asthma and cardiovascular diseases (https:/ www.aafa.org/climate-and health/). The increase in global temperatures along with increase in $CO_2$ and ozone levels would increase levels of pollution and allergens in the atmosphere, which will increase the common prevalence of asthma. Asthma is a chronic lung disease that can sometimes make it hard to breathe. People with asthma may have coughing, wheezing, chest tightness and troubled breathing. Burning fossil fuels releases carbon pollution in the air through particulate matter (PM) and this will be harmful to health. High and hotter temperatures combined with drought led to more frequent and intense wildfires as well as it prolongs the wildfire season. Wildfires produce smoke that contains particle pollution (tiny air particles that can reach far into the lungs and enter the blood stream), which can cause asthma attacks. In this context straw / crop residues burning activity at the State of Punjab must be replaced with new technology.

According to the United Nations (Harry Fisch *et al.* ,2003), global human fertility has declined in the last century as reflected by a decline in birth rates. Using bivariate and multiple regression analysis, yearly birth rates from 19 industrialized countries to global air temperatures was done from 1900 to 1994. In general, birth rates declined markedly throughout the century except during the baby boom period of approximately 1940 to 1964. An inverse relationship was found between changes in global temperatures and birth rates in all the 19 countries. Controlling for the linear yearly decline in birth rates over time, this relationship remained statistically significant for all the 19 countries in aggregate and in seven countries individually ($p<0.05$).

The fertility is reduced because, heat stress can damage both the oocyte and early embryo (Hansen, 2013). The oocyte can be compromised by heat stress as early as 105 days before ovulation (Torres-Júnior *et al*., 2008) and as late as the peri-ovulatory period (Putney *et al.,* 1989).

Under warmer conditions, a greater prevalence of cutaneous infections would occur on the human skin, including bacterial infections such as impetigo, cellulitis, and boils. Chronic exposure to solar UVR is the most important cause for Non-Melanoma Skin Cancer (NMSCs). The two common types of NMSC are Basal Cell Carcinoma (BCC) and Squamous Cell Carcinoma (BCC). BCC accounts for about 80 per cent of all NMSC(Diffey,1991).

A large body of literature suggests that climate change is a risk factor for the development of both non- communicable and communicable kidney diseases. In the context of non- communicable diseases, both nephro- lithiasis and Acute Kidney Injury (AKI) are associated with higher ambient temperatures. An increased frequency of renal diseases, including urolithiasis, acute kidney injury and urinary tract infections, are predicted with increasing temperatures. These results have clinical and public health implications for the management of renal diseases and demand tailored health services. (Borg *et al*.2017)

The worldwide increase in temperature has resulted in a marked increase in heat waves (heat extremes) that carries a markedly increased risk for morbidity and mortality. The kidney has a unique role not only in protecting the host from heat and dehydration but also is an important site of heat-associated disease. High temperatures can result in increased core temperatures, dehydration, and blood hyperosmolality. Heatstroke (both clinical and subclinical whole-body hyperthermia) may have a major role in causing both acute kidney disease, leading to increased risk of acute kidney injury from rhabdomyolysis, or heat-induced inflammatory injury to the kidney. Recurrent heat and dehydration can result in chronic kidney disease (CKD) in animals and theoretically plays a role in epidemics of CKD developing in hot regions of the world where workers and farmers are exposed to extreme heat. Heat stress and dehydration also have a role in kidney stone formation, and poor hydration habits may increase the risk for recurrent urinary tract infections. The resultant social and economic consequences include disability and loss of productivity and employment. (Richard J Johnson *et al*. 2019)

***Management of other stresses:*** Timely management of forest fires must be undertaken by the Forest Department and Department of Fire Management at the respective State. The Department of Pollution must develop strategies to minimize air pollution. Changing the microclimate of the crops and trees through sound agronomic and meteorological interventions for timely flowering. Honey bee management strategy is very important to reduce the free pollen transfer to air especially for the cross-pollinated crops. In respect of self-pollinated crops this problem seems to be very

negligible.

Timely geospatial analysis of available public health data could be useful in the prediction and control of potential outbreaks in the district (Joanna Sara Valson and Biju Soman,.2015). Health education and making awareness would reduce the problems from skin (Sanjiv Grover and Rajeshwari,2009) Research must be taken to enhance the fertility rate under natural conditions though many fertility hospitals have come with commercial trick. The Nephrology department of all hospitals must be strengthened so as meet the challenges expected / anticipated. Establishing Yoga and Meditation centers to keep lungs free from asthma and other related diseases.

## CONCLUSION

With global warming, people especially farmers would face severe distress from sun stroke, depression, suicides, asthma, infertility, skin disorder, chronic kidney disease etc., since their activity involves in- open field. Psychological treatment with pharmaceutical treatment would serve better to release from climate related mental disorders. The major action would be reducing the emission of greenhouse gases through, mass tree planting, using public transport, walking, or cycling for short distance, using renewable energy where ever possible. Drinking quality drinking water enough to meet the physiological needs would minimize the problem to a greater level. But the availability of good quality drinking water is a big question to be seen during global warming scenario. Health education and making awareness with public including farmers would empower them to meet the health challenges from global warming. The Government must establish a separate Division of Consultancy and Confidence Building for mental depressed patients at each hospitals including primary and urban health centers to meet the challenges from mentally depressed people. Government must enact strong policy on this line now, if not done earlier. This area needs more team research from medical, meteorological, and social sciences.

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