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Climate Change through the Gender Lens

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Abstract

Changes in weather patterns, freak-weather phenomena, warming up of oceans, and melting of polar caps are just the larger impacts of climate change. They are a reflection of a serious imbalance in our ecosystem that can change the global agricultural pattern, forest cover and impact natural resources, and can severely impact existing human settlements. And although human beings are responsible for this catastrophe, climate change seems to be disproportionately impacting half the global population more. Women have been on the receiving end of the impacts of climate change for a long time. With its exponentially increasing impact, the hard-hit section of the population has been the one more dependent on natural resources, with lower means and almost non-existent skill to respond to natural disasters. In India, the predominantly patriarchal nature of the society has kept women issues like education, healthcare, and skill development on the back-burner. Especially in rural India, women belong to the low-income, aggrieved strata of the society, with a heavy dependence on resources. This dependence has led to systemic health and lifestyle issues prevalent across the board. This study is an attempt to discern the severity of the impact that climate change has on factors like proneness to chronic health issues, livelihood opportunities, and other socio-economic issues. Case studies have been used to demonstrate how women-led climate-resilient models of change have been important success stories in the fight against climate change. Recommendations suggested can be used to include gender vulnerability in climate adaptation and its mitigation strategies.

Key Words: *Climate Change, Gender, Inequality, Health & Lifestyle, Women, Rural India*

1.0 Introduction

The impact of Climate change on the health and sustainability of human beings is one of the most pertinent discussions that transcends economic, ethnic and geographic boundaries to affect everyone simultaneously. Despite this, the United Nations Framework Convention on Climate Change (UNFCCC) notes that women bear a greater brunt of the impact of climate change (UNFCCC, n.d). The complexity increases when we study the impact of environmental degradation in economies heavily reliant on natural resources and agricultural production, such as India. Such economies tend to follow patterns of unplanned industrialisation, greenfield urbanisation and expansion of cities, exponentially increasing their risk of localised impacts of climate change.

The report, Assessment of Climate Change over the Indian Region prepared by the Union Ministry of Earth Sciences (MoES) warns that the rapid changes in the temperature would mean increasing stress on India's natural ecosystems, agricultural output, and freshwater resources, while also causing escalating damage to infrastructure. This ultimately translates into severe impacts on the 'country's biodiversity, food, water and energy security, and public health' (Aggarwal, 2020). Additionally, economies like ours also tend to have a larger population residing in rural areas, where lack of awareness, low levels of income and literacy further impact the health and lifestyle of their residents.

To establish the connection between climate change and the impact it creates on rural communities, it is important to understand that the world's poorest population consists of women. Globally, a total of 1.3 billion people in low and middle-income countries live below the poverty line, 70% of whom are female (WHO, 2002). According to recent reports, out of the total population living in the rural parts of India, 48% of which is female (Raghavan, 2016), 25.7% is living below the poverty line (*Poverty Estimation in India*, 2019).

Decoding the Indian context of gender disparities as of 2019, India stands at 131 among the 162 countries of the world in terms of the Gender Inequality Index (GII). GII is a composite measure reflecting inequalities between women and men in three dimensions: reproductive health, empowerment and the labour market (UNDP, n.d). As per National Sample Survey (NSS) 75th Round (July 2017- June 2018), only 8.3% of the females aged 15 years & above have successfully completed graduation and above level of courses, compared to 12.8 % of males. Average wage/salary earnings received by female workers are still lagging behind the average earnings of males. There has also been a large decline in female labour force participation from 34% to 27%. The inequality goes ahead in every aspect be it - education, health, labour force participation, participation in decision making and several other grounds.

Climate change acts as a risk-multiplier for gender-based disparities. Droughts affect the water availability, cyclones and floods displace communities, and shifting temperature and rainfall patterns ultimately affect crops and create food security issues. These changes often affect the availability of basic resources, exert socio-economic pressure on households, lead to loss of land, home, and livelihood.

While exploring these underlying factors, the study aims to determine the link between climate change and women residing in rural India. The study also proposes actionable recommendations that can help counter the impact of climate change on women's health and lifestyle and decrease the pace of localised environmental degradation.

2.0 Methodology

The study began with setting the parameters of climate change, both natural and man-made. The consequences of these factors (water scarcity, food security, air quality, socio-economic factors and disaster impact) were then put together to act as indicators of the impact on women's health and lifestyle. After understanding these factors in detail, a case-study based qualitative analysis was conducted on secondary data from journals, research papers and reports. The outcomes were considered both individually and cumulatively to draw conclusions and suggest recommendations.

3.0 Hypothesis

To Study and assess the impact of and correlation between climate change and, health and lifestyle of women.

4.0 Visible Factors of Climate Change

UNFCCC describes 'Climate Change' as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods (UNFCCC, 1992). This change in global atmosphere composition is attributed to the increase in atmospheric gases like carbon dioxide (CO_2), methane (CO_4), nitrous oxide (N_2O) and ozone (O_3), commonly known as greenhouse gases.

With excessive heat-trapping, greenhouse gases result in increased global temperatures, which directly impacts sea levels and sea-water temperature. This sets off a cycle of changing precipitation patterns that cause increased droughts and floods, tropical weather storms like hurricanes, typhoons and cyclones and increased heat waves. According to the Fifth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC), this is the result of only the last 50 years of human activity. (NASA, n.d)

4.1 Human Factors

A direct consequence of increased economic activity and societal development is the exploitation of natural resources like forests, land, water bodies, minerals and metals, oil, petroleum, stone and sand.

4.1.1 Deforestation

Deforestation implies the long-term or permanent loss of forest cover for transformation into another land use, i.e, the direct human-induced conversion of forested land to non-forested land (UNFCCC, 2001). According to the Food and Agriculture Organisation's (FAO) Global Forest Resource Assessment 2020, the world has lost 178 million hectares (439 million acres) of forest cover over the past 20 years, which is equated to 'about the size of Libya' (Crothers, 2020).

But the picture is not all bad. The rate of forest loss in 2015-2020 declined to an estimated 10 million hectares (MHA), down from 12 million hectares (MHA) in 2010-2015, according to the Global Forest Resources Assessment 2020 (FRA 2020). India has managed to further increase its forest cover by 3% within the last decade. But the challenge continues concerning the quality of these forests.

4.1.2 Forest Degradation

As per FAO's 2020 assessment, this gain in forest cover is predominantly in the category of open forests (OFs) which account for 3,04,499 sq km (9.26 per cent). The area under 'OF' increased by 5.7 per cent this decade, while the area under MDF (Moderately Dense Forests) decreased by 3.8 per cent. The category of 'very dense forest' — defined as a canopy cover over 70 per cent — is an important indicator of the quality of a forest. But the increase in VDFs has been a mere 1.14 per cent between 2017 and 2019. Forests act as carbon sinks, i.e., they absorb more carbon dioxide than they release through photosynthesis, making them critical to efforts at reducing greenhouse gases in the atmosphere. Apart from oceans and seas, VDFs or very dense forests are the most ideal carbon sinks and their degradation remains a cause for worry.

This degradation and deforestation have been linked to increased tropical diseases including deadly hemorrhagic fevers like Ebola and Lassa, and other mosquito-transmitted diseases like Malaria and Dengue.

Burning down of forests increases the local pollution and results in respiratory disorders. Prolonged exposure also results in increased instances of cancer in the region. It also leads to the resettlement of animals in the region and increased cases of Human-Wildlife Conflicts.

4.1.3 Industrialisation

Economic and social development has been contingent on the process of industrialisation. It is heavily dependent on basic natural resources including land, water, fossil fuels and forests. But with the rapid increase in population around the middle of the 20th Century, a multifold increase in the use of these natural resources has added a significant burden on the ecosystem and ecological balance.

This heightened human activity has led to increased temperatures, unprecedented territorial expansions, loss of habitat and displacement of humans and animals alike, extinction of flora and fauna, and has polluted and exploited resources like soil and water bodies in the surrounding areas. The contaminated water bodies, air pollution and proximity to industrial areas have led to several primary and secondary health issues for the citizens living near factories and industrial parks, including direct physical injuries, long term exposure to toxic material, consumption of contaminated food or water, vision issues, back problems, malnutrition, etc.

4.1.4 Rapid Urbanisation

According to the United Nations, by 2050, two-thirds of the world population will be living in cities, i.e., 2.5 billion more people will move to urban areas in search of better livelihood opportunities (*68% of the World Population Projected to Live in Urban Areas by 2050, Says UN*, 2018). As these commercial and economic hubs develop into megacities, consumption of fuel, electricity, water and food will increase drastically. Cities are a key contributor to climate change, and estimates suggest that cities are responsible for 75 per cent of global CO_2 emissions, with transport and buildings being among the largest contributors (*Cities and Climate Change*, n.d.).

Apart from the increased need for resources, growth in cities also impacts the surrounding forest and agricultural land area. Greenfield development - i.e developing fresh patches of available land around cities that allow cities to grow, can lead to desertification of the area around cities making them prone to freak weather phenomenon.

This urban boom is also making the residents prone to health issues. According to World Health Organization (WHO), health challenges that are particularly evident in cities relate to water, environment, violence and injury, non-communicable diseases (cardiovascular diseases, cancers, diabetes and chronic respiratory diseases), unhealthy diets and physical inactivity, harmful use of alcohol as well as the risks associated with disease outbreaks. Cities also often experience high levels of income inequality, which directly translates to differences in the level of nutrition and standard of lifestyle. This naturally makes the poor more vulnerable to both communicable, non-communicable and deficiency diseases, leading to a high level of health inequality between the urban rich and poor.

4.1.5 Livestock Production/livestock farming

Livestock production is the world's largest user of land, either directly through grazing or indirectly through the consumption of fodder and grains. Global livestock production currently accounts for about 40 per cent of the gross value of agricultural production. In industrial countries, this share is more than half. In developing countries, where it accounts for one-third, its share is rising quickly as a result of growth in population and incomes and changes in lifestyles and dietary habits.

Due to the high levels of methane and carbon dioxide emissions from livestock farming, it has become one of the major causes of climate change. Raising livestock generates 14.5 per cent of global greenhouse gas emissions. Water is another natural resource that is used extensively. About 92 per cent of the freshwater is used for farming purposes, and 1/3rd of it is used for rearing livestock and manufacturing animal products which create a huge carbon footprint (Brown, 2019).

It also has secondary impacts on health. Air pollution caused by increased emissions of both coarse and fine particle gases, secondary inorganic aerosols including ammonium sulphate and ammonium nitrate is harmful to humans. They can lead to an increase in cases of respiratory disorders and pulmonary diseases. Long term exposure can also compromise the quality of life. Increased production also increases the chances of a zoonotic virus jumping from an animal species to humans. This can have severe consequences as the human immune system cannot fight many such viruses (Smit & Heederik, 2017, p. 273).

4.2 Natural Phenomenon

As a result of the economic and developmental activities of human beings, global warming has become one of the greatest threats to our survival. According to the IPCC, there can be a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century (Jackson, n.d.). By 2100, sea levels could rise by a metre, displacing 10% of the world's population. Countries such as the Maldives will be submerged and the coastal regions of the Indian subcontinent will be left fighting for survival (Sky News, 2018). Desertification will ensue increased temperatures in other regions.

This will have a catastrophic impact on the global ecosystem, killing large chunks of rainforests, reducing the availability of food and potable water. It would also lead to increased and more intense episodes of natural calamities like floods, droughts, cyclones and hurricanes, unnatural thunder and lightning, and most importantly, change in rainfall patterns as seas become water and wind direction changes.

4.2.1 Droughts

According to the Centre for Disease Control and Prevention (CDC), droughts can cause far-reaching health implications. In the short term, it leads to a shortage of drinking water, poor quality drinking water, incomplete nutrition, impact on air quality, sanitation and hygiene, and proneness to diseases.

Reduced water supply leads to stagnant, toxic water which impacts fishing activities and increases chances of vector-borne diseases. Drought can limit the growing season and create conditions that encourage insect and disease infestation in certain crops. Low crop yields can result in rising food prices and shortages, potentially leading to malnutrition.

The dusty, dry conditions and wildfires that often accompany drought, can harm the health of humans by increasing the presence of suspended particles such as pollen, smoke, and fluorocarbons. These substances irritate the bronchial passages and lungs, making chronic respiratory illnesses like asthma worse. This can also increase the risk of acute respiratory infections like bronchitis and bacterial pneumonia. Also, changes in water quality, such as increased concentrations of contaminants, can threaten persons whose immune systems are compromised (*Health Implications of Drought | CDC*, n.d.)

4.2.2 Floods

According to WHO, floods are the most frequent type of natural disaster and occur when an overflow of water submerges the usually dry land. Floods are often caused by heavy rainfall, rapid snowmelt or a storm surge from a tropical cyclone or tsunami in coastal areas. Secondary factors like rapid urbanisation or unplanned industrialisation can also cause floods. They result in widespread devastation, loss of life and severe economic loss (*Floods*, n.d.).

With increasing climate change, the frequency and intensity of floods have been rapidly increasing. Floods in India are also turning more severe, unpredictable and rather intractable. In 2018 alone, India suffered damages worth over Rs. 950 billion due to floods (*Floods*, n.d.). As per the report presented in the Rajya Sabha, India lost 1,808 lives and suffered losses worth an estimated Rs. 957 billion (Rs. 95,736 crores) due to floods across the country. As per the national health portal, the immediate health impacts of floods include drowning, injuries, hypothermia, and animal bites. Health risks are also associated with the evacuation of patients, loss of health workers, and loss of health infrastructure including essential drugs and supplies.

Floods can also potentially increase the transmission of water-borne diseases, such as typhoid fever, cholera, leptospirosis and hepatitis A and E and vector-borne diseases, such as malaria, dengue and dengue haemorrhagic fever, and West Nile Fever (*Health Impacts of Flooding and Risk Management*, n.d.).

4.2.3 Cyclones/ Hurricanes

The National Disaster Management Authority (NDMA) defines cyclones as an atmospheric disturbance caused by a low-pressure area, distinguished by swift and often destructive air circulation (*Cyclone*, n.d.). The Indian subcontinent is one of the worst affected regions in the world; the subcontinent with a long coastline of 8041 kilometres is exposed to nearly 10 per cent of the world's tropical cyclones. On average, five to six tropical cyclones form every year, of which two or three could be severe.

With rising sea temperatures as a result of climate change, cyclones have become more frequent and deadly. This has in turn increased the damage to coastal areas, loss of lives and livelihood in the region and permanent ecological impact. For residents of low-lying areas, this also implies a certain level of uncertainty concerning settlement in the area.

Cyclones also have severe health consequences including storm-related mortality, serious injuries, psychological impact resulting in prolonged mental health issues, the spread of vector-borne and other infectious diseases like malaria, dengue, typhoid etc., and health issues from contaminated water and scarce food resources.

4.2.4 Shift in Rainfall patterns

Precipitation patterns are defined by the general direction of wind and water currents in an area that leads to the formation of clouds. They regulate the temperature, revive and rejuvenate water bodies and forests, and are extremely important for agriculture. As global warming increases, the effects of climate change are becoming more significant. Untimely rains due to increased heat are a major cause of crop destruction and crop failure in monsoon-dependent India. The lack of rainfall in some areas is leading to further desertification of land, degradation of dense forests and soil erosion.

On the other hand, unanticipated levels of rainfall increase the risk of flash floods and overflow of local water bodies, impacting human life and settlements in the surrounding area. Flooding and droughts are both very serious consequences of changing patterns of precipitation, due to their ugly impact on human civilization in terms of lack of food security, lack of availability of potable water, increase in diseases and chronic health issues, and loss of lives.

5.0 Factors affecting women in rural areas

Climate changes disproportionately affect groups that are less adaptive to frequent storms, floods, and drought. It threatens to derail global efforts to combat hunger and poverty. Women have been a part of this vulnerable section and gendered impacts of climate change have been identified as an issue requiring greater attention by the Commission on the Status of Women (CSW).

But women's and men's vulnerability to the impact of extreme climate events is determined, not only by biology but also by differences in their social roles and responsibilities (Easterling, 2000; Wisner et al., 2004). It is expected that women should fulfil their roles and responsibilities as caretakers of the family, placing an extra load on them during times of crisis.

5.1 Water shortage/scarcity

By 2030, water demand in India will grow to almost 1.5 trillion m^3. A shift in rainfall patterns, increased rates of evaporation and population growth are expected to result in an additional 1–4 billion individuals exposed to drought by the end of the century (Sorensen et al., 2018). Water Scarcity forces communities to relocate or travel long distances. Globally, up to 200 million hours are spent collecting water every day, and in 8 out of 10 households, it is women and girls who undertake this responsibility (Mehta & Basu, 2019). They can take up to six trips a day i.e an average of ten miles a day, carrying up to 15 litres of water every day (Barton, n.d.). With several household chores - cleaning, cooking, and washing, it significantly adds to their physical strain.

Indian women are also at a higher risk for infections due to their frequent contact with contaminated water. Trachoma, a water-washed disease that can lead to blindness, is transmitted through contaminated water where women gather. Women and girls collecting water are also susceptible to diarrhoea, hepatitis A, and leptospirosis, a bacterial infection from water that is tainted by animal urine (Barton, n.d.). Hence, the repercussion of the water crisis is manifold, and it affects women on several grounds.

5.2 Impact on livelihood opportunity

The dependence of women on natural resources intensifies their vulnerability to climate change. The migration of Indian men for better work opportunities leaves the burden of household, children and employment on women. Most of these women become contractual farm labourers. Forty-five million women joined farming as cultivators or labourers between 1981-2011. An Oxfam study assessed that women log 3,300 hours of work on farm labour during a crop season, compared to the 1,860 hours logged by men, which is evidence of the extreme inequality prevalent in the society. (Jain & Anand, 2020).

For Example - According to a report published in The Hindu BusinessLine, in the drought-prone Beed district of Maharashtra, several women voluntarily undergo hysterectomies (surgical removal of the uterus) to increase their employment opportunities. These women migrate to the sugarcane farms of western Maharashtra every year. Fear of losing this job opportunity due to menstruation makes them take the extreme step of removing their uterus. (Jadhav, 2019). Such instances are extreme consequences of climate change that demand our immediate attention.

5.3 Decreased Food Security

As carbon emissions and the temperature continues to rise, India will be among the countries which are likely to be the worst affected due to its tropical location and relatively lower levels of income. Agriculture and food production are likely to be significantly affected by climate change. According to one estimate, yields of major crops could decline by up to 25%. The projected country-wide loss to agriculture by 2030 is over $7 billion, which will severely affect the income of 10% of the Indian population (Barros et al., 2014).

As women are the primary agricultural producers in developing countries, responsible for the provision of 60–80% of all food (German Development Institute, 2017), not just their livelihoods, but also the nutritional requirement is threatened by crop failures. Prevalent socio-cultural norms exacerbate these hazards and hence suffer on both ends i.e - impact on their physical and mental health due to the decreased food security and losses in agricultural yields due to lack of knowledge to equip themselves against environmental degradation.

5.3.1 Impact on Women's Health due to decreased Food Security

As household managers, women depend heavily on natural resources like wood fires, forests, and grazing grounds and are therefore extremely sensitive to the effects of food scarcity and resulting nutritional deficiencies. Existing gender differences further intensify the nutritional scarcity by prioritizing food provision for males. Poor nutritional status with resulting anaemia is highly prevalent among women and children in India (World Bank Group, 2018a). Micronutrient deficiencies are associated with cognitive impairments, including poor attention span, diminished working memory, emotional and behavioural issues, and impaired sensory perception, which lead to poor educational outcomes (Jáuregui-Lobera, 2014).

5.4 Health factors

Over the last 50 years, human activities – in particular the burning of fossil fuels – have released sufficient quantities of greenhouse gases and affect our health. . Many of these health risks reflect gender differences in how they affect different communities and economic groups. The gender-gap effects on life expectancy tend to be greater in more severe disasters, and in places where the socio-economic status of women is particularly low. (*Gender, Climate Change and Health*, 2010).

5.4.1 Vector-borne diseases (VBDs)

As a developing country with a high population density, India might experience a myriad of human health effects because of climate change. These effects could include infectious diseases such as malaria, chikungunya, and water-borne illnesses. (Dhara et al., 2013, p. 850). For example, the recent increase of Dengue in certain regions of India is likely due to permissive ecologic conditions, which favour mosquito development coupled with population expansion, unplanned urbanization, deteriorating basic sanitary conditions, and inadequate water supply and waste management systems on a local level (Gupta & Reddy, 2013). Men and women react differently to VBDs because of different biological factors. Pregnant women are notably more vulnerable.

5.4.2 Air Quality and Temperature Variation

Increasing atmospheric CO_2, CO and other air particles contribute to poor outdoor air quality, which in turn negatively impact human cardiopulmonary health (Fann et al., 2016). Women are at higher risk of cardiovascular complications, as demonstrated in a recent study where the intima-media thickness of arteries in women was significantly correlated with ambient levels of PM2.5, whereas in men it was not (Künzli et al., 2005). With a large part of rural India still struggling to afford Liquified Petroleum Gas (LPG), the use of an inefficient energy source such as biomass for household cooking is an affordable alternative. For women in low- and middle-income countries, this is the single leading environmental health risk and the main cause of diseases like strokes, chronic obstructive pulmonary disease, lung cancer, and heart disease. This is more than evident from the fact that more than 60% of all premature deaths from household air pollution in 2012 were among women and children (*Household Air Pollution Is a Gender Issue*, n.d.). Climate change's accelerating impact on global temperatures will make the heat a more serious threat to maternal health (Martel, 2017). Apart from this, the cultural norms and the socio-economic status don't allow for access to healthcare facilities or education about this.

5.4.3 Disaster-Related Impacts

According to a recent Lancet report, the frequency of weather-related disasters—including hurricanes, flooding, and wildfires—increased by 46% from 2007 to 2016 (Watts et al., 2017).

While disasters seldom differentiate between people, the repercussions of such climate changes vary between men and women. It is a global trend that women are affected more than men by climate change disasters. In fact, according to a 2004 WHO report, it is women who are more likely to die during floods and cyclones. Resource shortage due to disasters also impacts women more intensely as they are biologically weaker than men. Pregnant women are a particularly vulnerable population and more than half of the women die during childbirth (Dey, 2019). Rural women constitute the less mobile, economically dependent part of the population, that do not have access to basic amenities like education and healthcare and live in more poverty than men. In the aftermath of climate-driven disasters, women and girls—especially the elderly or those living in lower socio-economic circumstances—are at higher risk of physical, sexual, and domestic violence (International Federation of the Red Cross and Red Crescent, 2007; UNDAW, 2001).

5.4.4 Socio-Economic Factors

Vulnerability is a complex and dynamic concept. It depends on many contextual factors and system components, such as environmental, social, cultural, economic, and institutional factors and livelihood strategies. Demographic and socio-economic factors affect vulnerability to climate change. It is widely asserted that the poor, with a high reliance on natural resources and fewer alternatives, will be hardest hit by climate change. (*Understanding Climate Change as a Social Development Issue*, 2016). The unequal gender-based division of labour is further aggravated by climate change, as women travel distances to procure basic resources (such as water, fuelwood, fodder, food, pastures, medicinal plants, fuel, and crops.). Certain cultures in India also restrict women from education and learning basic survival skills like swimming or tree climbing, which could save their lives in a natural disaster.

After repetitive natural disasters, economically poor women with minimal finances, land, and other assets are likely to lose any buffer they have and instead face increased indebtedness, inequality, and economic poverty.

6.0 Analysis

Factors	Issues	Study	Finding/ Inferences
Air Quality	1. Respiratory Disorders - Asthma, Bronchitis	"A recent study examined the effect of cooking smoke on the reported prevalence of asthma in the elderly (>60 years age). It revealed that the risk of asthma is 1.59 times (women 1.83 and men 1.32 times) among rural households who use biomass fuel for cooking."	In a study conducted by (AV Ramanakumar et al,2004) that focuses on mortality due to respiratory issues in India, there is a clear unfavourable bias for women as they are more prone to developing respiratory disorders from exposure to biofuel, debris, and dust (from construction sites).
	2. Household air pollution	"The results indicate that adult women living in households using biomass and solid fuels have a significantly higher risk of asthma than those living in households using cleaner fuels (OR: 1.26; 95%CI: 1.06–1.49; p = .010)."	According to a nationwide cross-sectional study conducted by (Sutapa Gupta, 2012) women are more affected by the usage of biomass fuels, as compared to men.
Water Quality	1. Water-borne diseases	"In a survey done for water-borne diseases, the results were as follows: "At Subdivision 1, the survey male adults and male children show a higher percentage, 2.9% and 2.5%, of water-borne diseases female children are at (0.95%). In Adults, the percentage of affected men and women is 2.9% and 2.2% respectively."	According to a study conducted by (Yashi Gupta et al, 2020), in the Indian City of Haldwani, adult women are less prone to contracting water-borne diseases like malaria, typhoid, hepatitis and other such diseases. This is due to work exposure. Workforce data shows that out of the total workforce population 86.2% are men and only 13.8% women.

		"At Subdivision 2, adult men affected by waterborne low-income disease is at 3.17% which is followed by 0.73% for girls and adult women each, 0.24%"	Women are engaged in day labour jobs such as rag-picking and scavenging other than taking care of the household/fetching potable water. The vulnerability to illness exists in the case of women too because of the non-conducive work environment.
	2. Toxicity	"We found marked differences in urine concentrations of metals and trace elements. In general, women had higher urinary concentrations of toxic metals, especially Cd (median 0.81 μg/L) compared to men (0.66 μg/L) and U (median 10 ng/L in women, compared to 6.4 ng/L in men).	Based on research undertaken by (Marika Berglund et al, 2011) on the role of gender in metal toxicity, there is clear evidence proving the impact of toxin-contaminated water in women as compared to men. Women and children seemed to be more at risk for toxic metal exposure than men.
Food Security	1. Micronutrient Deficiency	"The prevalence of subclinical vitamin A deficiency was reported as 4%among tribal rural women of reproductive age in Central India. Insufficient iodine intake among pregnant women has been reported in10 districts of the country.Studies carried out to assess copper levels have reported deficiency of around 29-34% among pregnant women and adult tribal populations."	A study to assess the micronutrient status of the Indian population, conducted by Gonmei and Toeja 2018 has determined extensive micronutrient deficiency (Vit A, Zinc, copper) in Indian women. This is more prevalent in pregnant women and women in tribal areas but affects women in rural areas just as much.

	2. Malnutrition and Anemia	"A total of 51.6% of women were suffering from anaemia during 2015–16. The zone with the lowest percentage of anaemic women (38.8%) was the North East and the highest percentage was found in the East zone (60.5%). (DeMayer et al., 1998). "	In a study conducted by Bharati, Pal & Bharati (2018) to show the relation between anaemia and related malnutrition among different socio-economic groups in India, it has been proven that rural women are severely affected by anaemia due to reduced income status.
Impact of Temperature	1. Loss Of Jobs	India is projected to about 34 million jobs due to global warming by 2030. Particularly, in the agro and construction sectors, a report by the UN labour agency said. With some 940 million people active in agriculture around the world, farmers are set to be worst hit by rising temperatures.	Heatwaves are supposed to affect the agriculture and construction sectors the most. The impact will be higher for farmers in most cases men who are the earning members of the family than any other individual.
	2. Impact on Health	Kuehn & McCormick, 2017 and Van Zutphen et al., 2012; both the studies collectively suggest that increase in temperature is likely to affect the health of pregnant women the most.	Adverse reproductive outcomes including preterm delivery, congenital defects, gestational hypertension, and preeclampsia .

Diseases	1. Malaria	Rijken et al., 2012, Steketee et al., 1996), Kourtis et al., 2014; the combination of each of these studies suggests that a Vector Borne Disease such as Malaria is likely to affect pregnant women 3 times more when compared to other men and women.	Malaria infection during pregnancy results in intrauterine growth restriction and increased vulnerability of the mother to hemorrhagic complications of delivery. 3 districts in India experiencing 23% of maternal deaths due to Malaria.
	2. Dengue	Mutheneni et al., 2017 and Pouliot et al., 2010 the studies confirm the impact and severity of Dengue on pregnant women compared to men.	Dengue virus is associated with an increased risk of cesarean delivery, preeclampsia and intrauterine growth restriction.
	3. Mental health issues	According to Behere & Behere, 2008; Nagaraj, 2008 suicides among farmers after a period of droughts indicates the impact on their mental health as a result of climate change.	This shows that males more impacted by stress levels are compared to women.
	4. Cardio-Vascular Diseases	"In a study conducted by Dutta, Ray & Banerjee (2012), systemic inflammatory changes and oxidative stress have been associated with cardiovascular disorders for women cooking with biomass in rural areas."	Cooking with biomass exacerbates systemic inflammation, oxidative stress, hypertension and tachycardia in poor women and hence, predisposes them to increased risk of CVD development compared to the controls.

Socio-Economic Factors	1. Added physical labor	"Mehretu & Mutambirwa, 1992; Dasgupta, 1993; Page, 1996; Seaforth, 2001; Research Foundation for Science, Technology and Ecology, 2005; Ray, 2007, the collective research indicates how added physical labour as a response to water scarcity affects women more as compared to men."	During the dry season in rural India, about 30% of a woman's daily energy intake is spent fetching water. Indian women can take up to six trips a day carrying heavy loads causing cumulative damage to the spine, the neck muscle and the lower back, thus leading to early ageing of the vertebral column.
	2. Loss of livelihood	According to Skinner, 2011; it is comparatively difficult for women to shift their livelihoods since most of them are dependent on natural resources.	Unequal distribution of assets, limited financial resources and illiteracy often reduce livelihood opportunities.
	3. Gender Norms	Brody et al, 2008 suggested that the gender norms make women stay at home and act as caretakers taking away the opportunity to earn and involvement in the decision-making process on climate change and disaster risk reduction. In the South Asian context, social norms regulate dress codes and societal notions of modesty may hinder women and girls from learning to swim, which can	Women and girls are inherently expected to take care of household chores, including in times of disaster and environmental stress. This limits their learning and livelihood opportunities, making them dependent for life. Oxfam, 2005; This study indicates that gender norms and the expectations around behaviours that deem "appropriate" impact women to acquire basic life skills like swimming when compared to men.

		severely reduce their chances of survival in flooding disasters.	

Disaster Related Impacts	1. Mortality rate	" As per Peterson, 2007 a detailed study on how natural disaster impacts the life expectancy of men and women. It was found that women have a higher mortality rate in climate induced natural disasters"	Studies show that women, boys, and girls are 14 times more likely than men to die during a disaster
	2. Psychological Impact	"Women are prone to greater worry and feelings of vulnerability and are at greater risk for PTSD, anxiety disorder, and other adverse psychological outcomes "	Studies by Trumbo,et al., 2011 and Corrarino, 2008; Norris et al. 2002, confirm that the psychological impact on women is greater than men as a result of Natural Disasters.
	3. Gender-based violence	"Following a disaster, it is more likely that women will be victims of domestic and sexual violence; they even avoid using shelters for fear of being sexually assaulted."	According to Davis et al, 2005, a detailed study on how climate change results in gender-based violence, the result indicates that such violence increases as an aftereffect of disasters.
	4. Rescue Operation	"Skutsch, 2004 examines how the rescue operations and assistance given to women is often less when compared to men."	In flooded areas of Bangladesh, women are often the last people to receive assistance, as they get pushed around by men for supplies.
	5. Mobility	"Pregnant and lactating women	This biological factor creates a highly vulnerable population within

		with limited mobility, have an increased need for food and water. ”	a group that is already at risk.

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The analysis puts forth a clear picture about the status of women's health and welfare in a society increasingly impacted by climate change. As per the findings, women are more likely to be impacted by air pollution, temperature, increasing viral diseases and secondary factors like malnutrition, micronutrient deficiency and anemia, and cardio-vascular disorders. They are also more vulnerable to economic problems, gender based violence, and natural disasters. It is only in case of water borne diseases and mental health issues that men are likely to be affected more.

7.0 Local Case Study

Following are some case studies that highlight lessons learned from local leadership of women adopting climate-resilient methods and becoming agents of change. They are evidence of the importance of increased women’s participation in our society.

7.1 Climate- Resilient Farming In Marathwada

The district of Marathwada is an agriculturally rich region that is highly susceptible to droughts. According to a study by the Indian Institute of Tropical Meteorology, between 1870 and 2015 the region faced 22 droughts, of which there were five instances of two consecutive droughts, the most recent of which were in 2014–2015 and 2015–2016 (Kulkarni et al., 2016; Seetharaman, 2017). Through focus groups of the local female farmers, led by Swayam Shikshan Prayog (SSP)—an organization that works for women's empowerment, it was discovered that although women are extensively involved in farming, decisions related to crop selection, cultivation, and consumption rest exclusively with the male counterparts who prioritised cash crops like soya, cotton and sugarcane.

So, SSP initiated a women-centered climate-resilient farming model (Katakam, 2018). This approach repositions women as decision makers by enabling them to make informed decisions. They are trained in resilience-building practices including use of bio fertilizers, increasing crop diversity, water-conserving irrigation techniques, and tree plantation. Adoption of the model has resulted in improved food and nutrition security of the households,

reduced the cost of cultivation, increased productivity, and rendered other social, economic, and environmental benefits (Katakam, 2018).

7.2 Solar Engineers from Rajasthan

Barefoot college from Rajasthan, spread over eight acres, runs entirely on solar energy, and has brought power to more than 13,000 homes across India. An additional 6,000 households, in more than 120 villages in 24 countries from Afghanistan to Uganda, have been powered on the same model. Women from the villages of Rajasthan are getting trained to become solar engineers under this project. A drop in the ocean, perhaps – since 44% of rural households in India have no electricity – but these women are making an important contribution to the nation's power needs.

Using solar energy as a substitute for conventional energy sources like biomass is definitely an important step towards achieving clean energy transition and Sustainable Development Goals.

8.0 Recommendations

1. **Dedicated reforestation in rural areas:** To slow down the localised impact of climate change we need to correct the ecological balance of the region. This can be achieved by planting trees in regions where the process of desertification is being accelerated by weather patterns and temperature. This will reverse the severity of the damage and allow for natural restoration. A second ingenious method involves doing nothing - i.e leaving a piece of land in a suitable climate as it grows back naturally, with a wide variety of trees.
2. **Conservation of MDF & VDF Forests:** Policies to restrict the use of MDF and VDF forests should be put in place with absolute urgency. All commercial activity should be done under surveillance and in a sustainable manner - i.e. not displacing any wildlife, affecting the bird population, and being cautious of the endangering tree species that grow only in specific regions.
3. **Restore Local water bodies:** Conscious and concentrated efforts should be made towards restoring lakes and other water bodies. This can be done through the planting of trees in the surrounding area, reducing runoffs from agricultural fields, checking illegal construction of borewells and cleaning the water bodies Engaging enthusiastic

volunteers and villagers, educating them and providing them with the necessary equipment is crucial to its success.

4. **Reliance on technology to preserve the ecosystem:** India can further tap into the digital and technological potential to prevent further degradation. Through the use of drone technology, illegal logging can be checked and the health of the forest can be assessed.
5. **Practising sustainable agriculture; Practice of polyculture:** Industrial agriculture may be good for economies of scale but can have detrimental effects on the environment. Polyculture helps different species of crops complement each other and make better use of soil nutrients (*MONOCULTURE FARMING IN AGRICULTURE INDUSTRY*, n.d.). For an agro-based economy like India, polyculture can reduce the use of water and fertilisers. It can also allow for round-the-year harvestation with a lower impact on the quality of soil.
6. **Waste Segregation:** In India, despite growing awareness and policy changes towards increased waste separation and recycling, a lot is still to be done. The government should engage with external contractors, consultants and NGOs to come up with innovative solutions. For example, in an attempt to reduce the pollution of rivers by drains, a small town in Australia has started installing wire nets at drain outlets that allow the water to flow through but block all solid waste from passing. In four months, these wire nets collected about 370Kgs of trash. A similar plan can be implemented in India too (Utaraitė, 2019).
7. **Vulnerability assessment across India - Identification and preparation of the weakest communities:** A vulnerability assessment can help determine the communities most likely to be affected by climate change. There should be extra emphasis on low-income and poverty-stricken families when scoping for possible economic repercussions of disasters.
8. **The Shift from disaster response to risk management:** The government should strengthen public health infrastructure with a focus on disaster preparedness. This includes checking settlement in flood-prone areas, allowing for reasonable flood banks, increasing tree planting to check the damage from high tides and prevent soil

erosion, checking indiscriminate logging and putting in place policies to use suitable construction materials for areas prone to natural disasters. These measures can prevent both economic and environmental loss in the event of a disaster.

9. **Disaster management training for women:** Gender and societal norms stop women from acquiring basic survival skills. It has become extremely important to design a Disaster Management Training Drill for women, involving women in the rescue and rehabilitation process. Educating them about administering First-Aid should be made compulsory.
10. **Access to quality healthcare - setting up of health camps for reproductive health, provision of basic micronutrient booster:** Access to regular healthcare for women and girls especially after a natural calamity is the need of the hour. Hygiene and sanitation are two specific areas concerning the reproductive health of women. These health camps additionally can provide the necessary micronutrients to both women and children.
11. **Awareness, Literacy, and preparedness for dangers/impending disasters-recognising signs:** Awareness campaigns through street plays, door-to-door visits around disaster-prone areas and mobilising the communities especially women and girls to recognise signs of an impending disaster. Apart from this public warnings systems should be installed in disaster-prone regions.
12. **Training in basic life skills - purification of water for impurities:** Empowering women with the right skill set can go a long way in ensuring healthy families. This includes teaching them basic life skills like at-home purification of water, ridding vegetables of pesticides, and efficient use of biomass in areas where LPG cylinders are still not available.
13. **Basic awareness about employment and just/ fair pay:** Since women workers constitute a large part of the workforce, it is essential to educate them about fair compensation and basic labour rights that allow them to negotiate reasonable terms of employment. This will have an extremely positive impact on their health as they will have a better work-life balance, mental health and income to feed themselves and their families.

14. **Women empowerment through Digitisation**: The government has already started initiatives in this direction with ventures like W2E2 - women for empowerment and entrepreneurship, but there needs to be a scaling up of such applications to include areas such as health, employment, skill development and education.

15. **Pan India access to PNG/LPG:** Around half the global population cooks daily with traditional biomass fuels (e.g. dung, crop residues, wood, charcoal), it is therefore imperative to provide an LPG/PNG connection to all the rural households to avoid indoor air pollution and its adverse effects on the health. (Haines et al., 2006).
16. **Land ownership Laws:** Changes need to be made in our laws to provide land ownership rights to women farmers. Currently, about 73.2% of rural women workers are farmers, but only about 12.8% have land holdings (Raman, 2019). This skewed ownership allows for the exploitation of women workers where they are overworked and tired, and develop chronic health issues over time.

9.0 Conclusion

As climate change increases at an alarming rate, concerns about its impact are increasing as well. One such aspect that has been studied in this paper is the impact on women's health and lifestyle in rural India. The study concludes that women belonging to low-income rural households are indeed severely affected by the changing ecosystem. This can be attributed partly to socio-economic factors pertaining to livelihood, social customs and rigid gender roles in the society, and partly to the direct impact of localised unplanned development, industrialisation and natural calamities.

With the above mentioned as the basic parameters, the study recommends a set of actions that can be used to mitigate the impact of climate change at the ground level. It also focuses on increasing the role of women in decision-making and empowering them with the right skill-sets, know-how and opportunities that allow them to make better and more sustainable choices for their health and well-being.

The case studies mentioned here indicate how women-led climate-resilient models combat both gender inequalities and climate changes. Each of these stories is about women from rural backgrounds, who were given access to education and allowed to participate in the decision-making process, and how they come out as leaders and trendsetters of change. They

show the need for comprehensive strategies to include gender empowerment in climate mitigation. Their understanding of nature and natural resources places them in a position of advantage and their participation can only enrich the cause. Understanding the gendered dimension of climate change is the key to achieving the UN's Sustainable Development Goals (SDGs).

Equipping women with skills and knowledge will result in environmental and economic gains, furthering the link between SDG 5 (gender equality and women empowerment) and SDG 13 (action to combat climate change). Hence, it is crucial to assess vulnerability to climate change through the gender lens and to bridge gender disparity in the fight against climate change.

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