

Climatic Change, Sustainability and Public Health – A Case Study  
Of Goa

Submitted by

[Name of Student]

[Date of Submission]

[Name of University]

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## Climatic Change, Sustainability and Public Health – A Case Study

***Introduction***

The habitability of the planet earth is mainly due to the atmospheric gases that are trapped in the environment that trap a portion of the energy that emits from the sunlight. Such gases are called the greenhouse gases and their ability to absorb the heat from the sun makes them distinct and empirical for the earth to remain habitable. Without these gases the planet earth would be too cold to be habitable by any living organism. Scientists have now recognized that due to the human activities and progression of the human race, there has been an increase in the greenhouse gases which is destabilizing the natural climate (Kelkar & Bhadwal, 2007). This has been mainly triggered after the onset of the industrial revolution from the late 1700s and has been increasing ever since (CDIAC, 2016). Human activities such as deforestation, burning of fossil fuels, agricultural developments and emissions from landfills has increased the concentration of the greenhouse gasses in the earth's atmosphere and if left unchecked, the rising global temperatures and the changes in the climatic pattern would affect the ecological health of the planet adversely and also undermine the economic and social development and prosperity of the human beings (CDIAC, 2016).

The significant changes in the climate and the atmosphere are considered to be threat to the public health and there have been thousands of deaths all over the world due to these climatic changes (World Health Organization, 2016). The adverse health impacts are a result of the heat waves, floods, droughts and other severe weather events. It can also affect the public health through the impacts on the quality of the agriculture, decreasing access and depletion of clean water and wide spread of global infections and diseases (Louis & Hess, 2008, p.527).

This report is a case study of the state of Goa in India and it studies the different factors of climatic changes and its effects on the environment and atmosphere of Goa. It explains the how the various effect of global warming and climatic changes influences the living standards of the population over there and how the public health is affected by it. This case also studies the impact of climatic changes on the sanitation activities of Goa.

### ***Landscape Overview of Goa***

Goa is a small state in the south western region of India. It is by far the smallest state of India bordered by the state of Maharashtra to the north and the state of Karnataka to the south east. The western coast of the state is outlined by the Arabian Sea. The capital city of the state is Panaji while Vasco De Gama is its largest city. With respect to the geographical aspects, most of Goa's part is covered with beaches and costal territories. There are five main rivers in the state; Mandovi, Terekhol, Zuari, Chapora and Sai. The total navigational length of the states is 253 km which is mostly covered with laterite soils rich in ferric aluminium oxides. The rich content of minerals in the soil makes it adaptable and conducive to **agriculture (Diaz & Gürses, 2012).**

The state of Goa experiences a pleasant climate throughout the year which boosts up the tourism industry of the state. Four to five months of the year consist of a typical coastal monsoon and in contrast the summers are hot and humid. The winter season only lasts only for 2 months ranging from mid of December to mid of February. Monsoon is the main season of Goa and during this season the state experiences only around three to five hours of sunshine per day.

Being partially covered with hilly areas and partially by coastal regions, the state of Goa experiences a high range of biodiversity in its Flora and Fauna aspects. Out of the nearly 1500 sq km of forestry, the 33% is covered by governmental forests while 62% is covered with National

Parks deemed as protected areas for wildlife sanctuaries and preservations (Wagle, 1993). These forested areas are located in the inland region of the state where as the tropical diversity can be identified through the various flora and fauna such as chillar barks, bamboo canes, bhirand and maharatha barks. The wildlife comprises of foxes, boars and migratory birds mainly ruling over the inland forests and aquatic wildlife comprises of crabs, jellyfishes, shrimps, lobsters, catfish and oysters. As the main income of the state depends on the tourism industry, the government understands the importance of preserving the nature and the wildlife of the state and developed various wildlife sanctuaries (Vaz, 2007).

#### ***A brief overview of health, sanitation and environment in India***

Environmental sanitation envisions promoting the communal health through the provision of harmless environment and violating the disease cycle. Various factors are involved in it such as people's hygienic rank, number of available resources along with their types, appropriate technological diffusion as per the needs of the people living in a community including the level of socioeconomic development in the country. Factors related to culture are also included such as determinants of environmental sanitation, political stability, concerned sectors and their capacity (Akhtar, 2007, p.51). Moreover, some social factors are also associated such as patterns of behaviour in the community, judicial actions being implemented, and many more. Taken a country from the Asian region, particularly India, it can be said that in the environmental sanitation sector, the country is still far behind from many developing countries (Kumar, Kar, & Jain, 2011). Therefore, it has become eminent for India to attend the wakeup call and take necessary measures to overcome unsanitary conditions in the country. The implementation of

newly developed strategies is required and conducting a strict evaluation is very crucial for the country.

Despite the fact that there is a constant force on the local government in order to supply drinking water under national plans, around 25% population of the country, being the residents of the rural areas, do not have the access to a sufficient and adequate amount of drinking water supply (Singh et al, 2011). Additionally, the situation regarding the sanitation is even worse that as about 75% of the rural population are still starving for basic hygiene and sanitary toilets (Saleth&Sastry, 2004, p. 163).

Keeping the grim environmental sanitation situation in India, there is a rising need to identify the prevailing system in relation to the structure and function of the system and to implement the prime strategies as per the country needs. Thus the prioritization of strategies is of vital importance due to water contaminations, health issues related to environment, significant growth rate of the country population, unequal water resources distribution, managerial issues, urbanization and industrial development.

### ***Impact of Climate Changes on Human Health in Goa***

Despite of the fact that low-income developing countries such as India contribute only a small percentage in the global greenhouse gas emissions, the impacts of adverse health effects associated with the climate changes falls disproportionately more on their populations. This inequality would result in more health disparities in nations (Wiley &Gostin, 2009, p.1218; Patz et al, 2007, p.397). The main risk of such climatic changes is upon those areas which are already faced by the dilemma of scarce resources, high rate of infectious diseases, over population, weak infrastructure and environmental degradation (Wiley &Gostin, 2009). Especially in tropic

regions such as Goa, the climatic changes lead to significant changes in the pathogen-human relationships (Sattenspiel, 2000, p.3). Changes in the temperature and the precipitation patterns in accordance with the climatic changes affects the ecology of various infectious diseases such as dengue, malaria, kala-azar, chikungunyaetc (Dhiman et al. 2010, p.763; Ebi and Paulson 2010 p.2).

India is considered to be very diverse according to the cultural geographical and climatic aspects (Bush et al, 2011, P.765). With its constantly increasing population, it comprises of the one-sixth of the world's population with 1/50 of the world's land and only 1/25 of the world's water resource (Singh,Upadhyay& Mittal, 2010, p.81). In the states of Goa, like other states of the country, the increasing rate of urbanization has caused severe climatic changes which pose a threat to increase the impacts of already existing health threats. There have not been many researches aiming to study the relationship between the variability in the climate and human health in Goa so as to aid in the development of early warning and prevention strategies.

The most effective impact of the climate changes in Goa has resulted to an overall increase in the widespread of waterborne infectious diseases. However, the estimates cannot be relied upon due to the lack of reporting, minimal data gathering infrastructure and poor surveillance. Approximately, around 73% of the rural population of India does not have proper water disinfection while 75% of the total population does not have access to proper sanitation or toilets (International Institute for Population Sciences and Macro International 2007).

Another impact of climate changes can be monitored through the temperature rises. In 2012, India experienced its hottest summer and the effects were far reached out over the general population of the country including hospitalization due to heat strokes, death and health deterioration of livestock and drought in the country affecting the agriculture and public health in

the region (Burke 2010). The need for adaptation to the climate changes has been recognized as empirical by the local government in order to achieve more effective responsive strategies for the climate changes and especially for regions such as Goa.

With respect to the agricultural conditions in Goa, the climate changes and the global warming has dramatically affected the agriculture of the area and its productivity. The rising temperature has shifted the growing season significantly and led to changes in the agricultural zones. Too much precipitation and untimely or delayed monsoon seasons also affects the crops which causes deterioration in the food quality and economy of the country. It also impacts the sale and purchase of input products for agriculture such as chemicals, pesticides, fertilizers etc.

### ***Present scenario in India***

Before getting into the detailed discussion about the positive and negative aspects of the different parts of the region, it is important to first analyse the current situation of the country. According to the estimation in 2006, it costed India to around \$54 billion due to inadequacy and insufficient measure taken to overcome sanitary issues, which constitutes 6.4% of the country's GDP (Lüthi, McConville, and Kvarnström, 2010, p. 50). The magnitude of this economic impact was so severe that over 70% or about \$38.5 billion was related to health concern, including diarrhoea which was followed by severe infections in the respiratory systems and the impact was about to 12% (2010). Researches and past studies have suggested that the improvements in sanitation are cost-beneficial for all the under developing global regions (Hutton, Haller, & Bartram, 2007, p. 500)

Moreover, it has been found out that the rising demand for water in different sectors is highly witnessed in India, and the reason being put forwarded is that it is happening due to



urbanization and according to the estimation, more than 50% of the population of India will be moved to urban cities and towns. Population increase, rising incomes, and industrial growth are also responsible for this dramatic shift. The recent development found with respect to sanitation issues is the National Urban Sanitation Policy 2008 for the urban areas of the country. In 2008, according to the Ministry of Urban Development custom-built survey on the part of National Urban Sanitation Policy, in rural areas, the concerned institutions who are the supervisors for the maintenance and operations of infrastructure are seemed to be weak and it is also reported that there is a shortage of finances as well which is a major constraint in carrying out the proper functions (Pattanayak, Poulos, Yang & Patil, 2010). Moreover, there is not a single big city in India having a constant water supply and approximately 72% of residents are still lacking free access to developed sanitation facilities.

*Environmental sanitation and the health profile of people in Karnataka*

Saleth & Sastry, (2004, p. 163) explained that as the sewerage system is utterly poor in the country's urban and rural areas, aquatic infection becomes a major health concern, particularly amongst the weak regions. However, cities like Karnataka have shown a notable growth in the recent years. They further stated that although facilities available for better wastewater treatment and indicates the potential for improving sanitation, yet at the household level, there is a better predictor of sanitation that is people's access to toilets facilities. It is evident from the studies that the toilet facilities in urban areas are far better than rural ones. More specifically, comparing to other the people living in the coastal and mountainous regions of Karnataka have an access to toilet facilities compared to the remaining parts of the state because the residents enjoy a reasonable economic status, education level and infrastructure condition. In either case, only the

quarter of the nation's population has an access to facilitated toilets, which certainly depicts that sanitation problem is a major for Karnataka.

*Environmental sanitation and the health profile of people in Tamil Nadu*

Tamil Nadu is considered among the most urbanized states of India, where almost half of the state's population are living in the urban areas. It is also estimated that about 69.1% of the population will the rural and moved to urban areas of Tamil Nadu. However, with the rising percentage of the urban residents, the need to have basic hygiene facilities is also in demand. According to the sanitation policy document (2012, p.6), the population residing in urban areas in Tamil Nadu is around 59 lacs, and about 35.7% of that population do not have toilet facilities and basic hygiene services, 7.7% have access to community toilets, 30% residents do not have drainage facilities while 35% people are able to access draining networks. Additionally, the vulnerability in the climate adds to the existing crisis, due to which the urban environment is further disturbed. World Bank (2001) has reported that Chennai and Delhi are the worst performers in terms of water availability on the basis of per day and per hour (Nair, 2009, p. 6).

*Environmental sanitation and the health profile of people in Goa:*

During the period when there was a Portuguese Regime, the most popular state of India which is known as Goa was not a healthy place to stay in. Lack of sanitation problems due to lack of availability of water resource and drainage facilities has resulted in critical diseases such as typhoid, diarrhoea, and certain lower respiration infections (Gracias, 1994, p. 64). Since Goa is considered to be a place for tourism and there are a substantial number of tourists visiting this place every year, the environmental aspect of the state is of crucial importance. Due to

environmental hazards faced by the state due to the global warming, depletion of natural resources and hole in the ozone layer, there is a severe impact being tolerated by Goa on the part of coastal zone. The impacts are listed as loss of mangroves, decline in the fish catching because of unscientific fishing methods, erosion of soil, and siltation in the rivers (Sawkar, Noronha, Mascarenhas & Chauhan, 1998, p.10).

It could be seen from the literature that countries like India, that have the second largest population in the world, is suffering from enormous environmental crisis due to global warming and climate change, but these are the external factors. However, there are certain internal factors that constitute to this problem. Those factors have also been highlighted earlier such as lack of facilities available for sanitation, sewerage issues, unhygienic drainage systems leading to critical diseases such as typhoid, diarrhoea, lung problems and respiratory infections which is a serious state concern and should not be neglected. Besides, the legislative government have been making efforts and implementing different sanitation strategies to control the situation but sadly they are destined to failure.

By analysing past researchers, a strategy was identified that could be implemented in different states of India to overcome the rising water crisis (Sawkar, Noronha, Mascarenhas & Chauhan, 1998, p.9). The approach includes a wide variety of technological options, realizing the cost and benefits perceived by the consumer, identifying the perfect equilibrium between the price paid and level of service being provided while maintaining the economic efficiency, taking capacity-building initiatives in order to make all the stakeholders responsive. However, it is possible to obtain sustainability only when there is efficiency in both investment and operations.

Additionally, in order to improve and enhance the prospects of future sustainability, demand adoption, utilizing the available yet unused resources and encouraging partnering

amongst the stakeholders could be of help while implementing the strategy (Prahl, 2013).

Associating individual's needs to the project can also help in obtaining positive results. The core advantage of involving consumers in decision-making is that if required, they would provide all the resources they own and would make payments for consistent facilities. Involving users can also help in fostering changes in the consumer's behavioural pattern for instance, better awareness about hygiene and improved sanitation practices leading to greater benefits on health. Other benefits that can be sought are related to the domestic environmental, social and economic returns are likely to be generated if the users who are the ultimate beneficiaries will consume the services correctly and assure the proper functioning and maintenance of the facilities (Wright, 1997, p. 8). The interesting part of this strategy is that it is sound to implement in urban and as well as in the rural areas of the country. However, the use of technological diffusion is not mandatory in the rural areas; therefore, the implementation would be comparatively easy.

For the effective implementation of the strategy, a research is conducted for about a decade in order to determine the role of gender in the implementation of sanitation strategy. It was emphasized that the strategy implementation would be successful only when the managing committees, financial management, service maintenance would be highly influenced by women (Mutanana, 2015). However, increasing women's influence over management does not mean that they are brutally burdened. Additionally, there should be a fair distribution of time required to complete the project, labour, and finances on the part of both the genders. The potential influence of women has always been neglected in the past. There should be ways designed to facilitate women's participation in the decision making, planning and operations management. The important role played by men should also be taken into consideration at the same time.

The effectiveness of this strategy is evident from the example of the country, Pakistan, where there is more or less same environmental aspects and nearly the same climate. As this strategy is focusing the people empowerment in the project execution, the similar was the condition in Pakistan when Orangi Pilot Project (OPP) was being implemented (Hassan, 2011). By using the consultation style, the OPP managed to build up smaller communities who mended their drainage systems and sewerage lines. Those smaller communities combined together to pressurize the municipal corporations to provide them funds.

### ***Conclusion***

The climatic change in Goa is an issue that has not been given much importance even after the widespread destruction of environments due to the various eco-degrading activities like mining, tourism, high rising buildings and extensive housing projects. The increase in the sale and purchase of lands has caused a huge massacre of hills, agricultural fields and forests. According to the geological facts, Goa is identified to be an accidental products of geological movements and is considered to be most vulnerable to the climate changes an global warming out of all the states of India. Hence a nationwide project to protect the environment and to maintain the balance of the ecosystem needs to be enforced throughout the locations in the state where rural-urban disparities and ignorance in the waste management are the major reasons behind the increase in the environmental degradation.

The impacts have already begun taking its toll on the environment of Goa as the state experiences abnormal weather conditions since 1991, including days with high maximum temperatures and low minimum temperatures varying according to the seasons. Such strange weather conditions have led to disturbing patterns with respect to the topographical changes in

the region and haphazard industrialization. The climate conditions of Goa are soon to be changed for the worst, partly due to the natural effects of global warming but largely due to the human interference in the areas moisture and thermal conditions.

Water bodies in Goa, which act as heat sinks, have also been neglected and ill maintained and as they evaporate, they affect the climate adversely by creating micro-environmental changes. In and around the urban areas, most of the green cover areas have been destroyed and the replacement in the form of lawns and gardens is not sufficient to support the balance of the ecosystem and the environmental changes. Without providing proper replacements for the heat sinks, the concrete structures with high reflective capabilities and heat storages have also played a great role in the climatic adversity. The amount of heat emitted from the plain surfaces of concrete structures, changes the thermal state of Goa. In addition to that, the exhaust from the vehicles and ships also contributes largely to the heat and carbon accumulation. Thinning of the trees and forestation is also interfering the with local moisture conditions as trees large canopies provide a balance to the moisture in the air affecting the overall temperature of the area. Unfortunately, very few cities of Goa have gardens or parks which have trees with large canopies.

The environmental sanitation is the rising concern in India's major states such as Karnataka, Tamil Nadu, and tourist state Goa. Although Karnataka has been making efforts to improve the quality of living since 50% of the country's population has moved to urban areas and still the percentage is growing. However, majority of the residents do not have access to sanitation facilities and drainage systems. In Tamil Nadu, Chennai city is considered to be a worst performer by the World Bank in terms of sanitary, water related facilities. While Goa has been improving since the state is a famous tourist place and tourism contributes in the economic

development of the country. Concern regarding the sanitation is being highlighted because of the increasing percentages of diseases like Typhoid, Diarrhoea, and other critical infections among the people of India leading to the increasing death rates.

Cities of Goa, mainly Panjin, Margao and Vasco de Gama have been facing frequent smoggy days during the two months of winter season. This is caused by the temperature inversion and trapping of gases from exhaust pipes and atmospheric dust. Respiratory disorders increase during such days and the overall quality of the breathable air is reduced immensely due to these foggy days. Another aspect is the melting of the ice caps. When the glaciers and the snow on the northern areas of the country melt, the tropical regions such as Goa would not be affected immediately but the sea level is bound to rise sooner or later. Already the post monsoon erosions on the beaches of Goa has begun and taken alarming positions resulting in the erosion of huge chunks of beaches such as Colva, Utorda, Morjim and many others. Large amounts of coastal vegetation such as coconut plantations and casuarina trees have been uprooted and washed away with the sea waves. Lately the intrusion of the sea waves has been experienced on around 50 coastal villages of Goa at one time or another and this number is soon expected to increase if no reforms for the preservation of the environment are taken by the governmental bodies.

Like other problems have a solution, this crisis can also be resolved using the strategy discussed in detail. This concern can only be solved through empowering nation particularly women in India.

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