

***[First draft only- Suggestions from the NOW yet to be incorporated]***

**NATIONAL CHILDREN'S SCIENCE CONGRESS  
ACTIVITY GUIDEBOOK FOR 2014 & 2015**

**Sub Theme-II**

**IMPACT OF HUMAN ACTIVITIES ON WEATHER AND CLIMATE**

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**Background**

It took about 60000 years for the human population to grow to one billion. It took a little more than two centuries only to grow from one billion to eight billion. Growing population requires environmental resources (life support systems like air, water and soil) for its survival and sustenance. Accordingly the pressure on environmental resources has grown many folds during last two centuries. This pressure has also impacted the climate as well as weather condition. When ever we undertake any activity we always utilise energy in some form or other. As a result the carbon stored in the energy source is released to the atmosphere in the form of carbon dioxide. That indicates our carbon footprint. The more severe is the footprint, the more impact will be there on weather and climate. Direct and indirect impacts of such activities listed below have resulted in change of weather and climate locally and globally.

1. Agriculture: The practices were at the expense of forest lands and other ecosystems. Chemical fertilizers, pesticides, irrigation, soil salinity, ground water contamination, methane generation NOx generation etc impacted weather and climate in one or the other way.
2. Animal husbandry: Demand for meat, dairy products, manure, draught animals and easy transport led to animal rearing in large scale resulting in soil compaction, over grazing energy wastage, methane generation, deforestation and water depletion.
3. Fisheries: Fertilizing the natural water bodies, eutrophication and ground water contamination results in generation of green house gases.
4. Human settlement and Urbanization: deforestation, conversion of agricultural lands to urban areas, more utilisation of energy, infra red radiation, depletion of natural resources etc created heat islands adding to the already aggravating global warming problems.
5. Industrialisation: the fast changing scenario in natural resource utilisation and industrialisation in the 19<sup>th</sup> century resulted in rampant deforestation, further conversion of agricultural lands, increased mining, quarrying, energy utilisation, heat islands, industrial effluents, solid waste generation, air and water pollution.
6. Transportation: The development of transportation facilities vehicle explosion cause increased fossil fuel utilisation, land use changes, heat generation and air pollution
7. Communication (paper and electronic):the communication revolution in the 20<sup>th</sup> century increased the demand for paper and other resources in a tremendous proportion. This led to changes in land use pattern, energy utilisation, depletion of water and deforestation.
8. Energy production: The progress of modernisation resulted in more energy input in all the realms of development. Energy from hydel, thermal and nuclear sources led to greater

ecological imbalance on land, water and atmosphere directly or indirectly impacting on weather and climate. Increase in GHG, deforestation, mining generating heat, increased water consumption, dumping of fly ash etc had direct impact. Even certain sectors of renewable sources of energy like wind and solar had its impact on ecosystems.

9. Waste generation: the life style changes and throw away culture led to generating huge quantity of municipal, biomedical, industrial and agricultural waste which is cumbersome for nature to take care in its course. The GHG, open burning, dumping yards and burning of rubber, plastic etc added more problems.
10. Tourism and entertainment: globalisation, increased transport and communication facilities enhanced a sudden disproportional growth in the tourism industry during the last few decades. This resulted in demand for huge quantity of energy and infrastructure facility which resulted in to large scale land and water encroachment, waste generation etc especially in the developing countries which contributed to the aggravating changes in the ecosystem.
11. Forestry: Due to increased demand for preferred type of timber and wood, for the last few centuries trees have been felled from natural forests. The land is utilised for non forestry purpose and at times the land is also utilised for reforestation. However the species diversity gets altered on account of preference of certain selected species like sal, eucalyptus, teak etc. As a result the ecological benefits of natural forests is lost. The relative humidity, temperature water percolation and soil profile etc are changed. Also the carbon sequestration pattern and the rate of biogeochemical cycles changed.

**What is to be understood:**

The children should be able to understand the direct as well as indirect impacts of human activities on weather and climate. The impacts may be in the form of temperature change, change in humidity, changes in water availability, changes in energy level received from sun etc.

**Why it is important:**

The children should know that human activities are impacting weather and climate in different ways. Some of the impacts may threaten the survival of human race itself. Even if it does not happen so, food shortage, water shortage, temperature variation, flooding, drought, sea level rise, cyclones etc may cause serious implications in terms of economy and well being.

**How to go for it:**

The children through their observations studies, projects, etc, will be able to understand the concept of weather and climate and their relationship with human activities. In future if they get opportunities they may be intellectually prepared to improve human activities in such away that weather and climate are impacted least.

We are suggesting some project ideas. Through these they can enrich their concept and knowledge which will help them in framing projects.

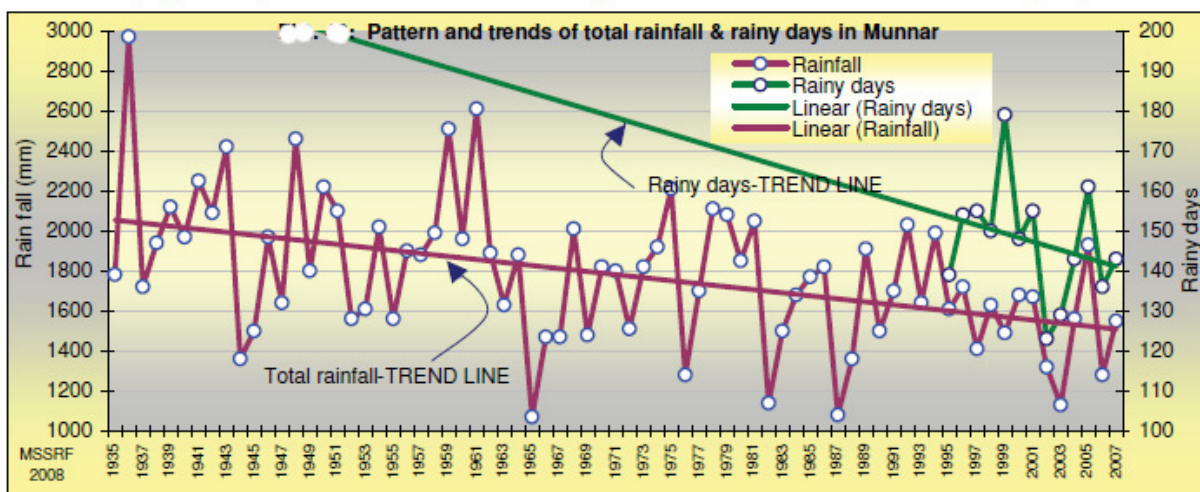
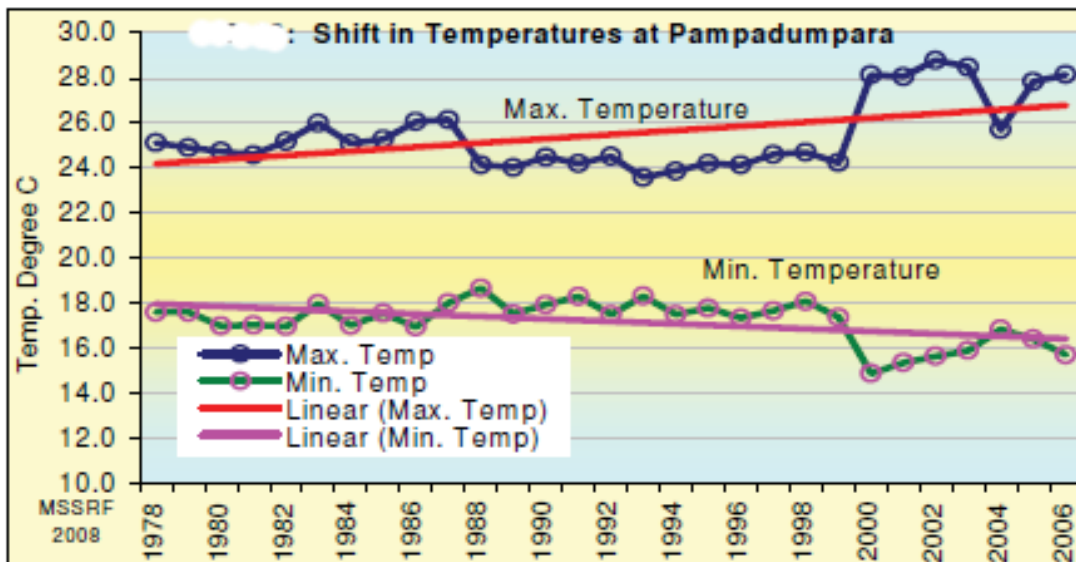
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**Box 1**

Anamalais is the Hill Range in the southern Western Ghats, immediately south to Palakkad Gap. The highest peak in the Western Ghats, Anamudi which stands at 2695 m above the sea level is in the Munnar region in the Anamalais. Further south to the Anamalais is the High Ranges which is a plateau with heavy rainfall and with undulating terrain. The area forms the catchment of Periyar, a

major river originating from the Southern Western Ghats. The area was once covered with dense evergreen forests, stunted shola forests and high altitude grasslands. The British during the colonial time discovered that this region would be ideal for some kind of plantations. Large stretches of forests in the Munnar region were cleared for raising tea plantations in the 1880s. The forests of High Ranges were opened up to cultivate cardamom in 1890s. The human population grew up in this region gradually and the human activities and the so called developmental activities resulted in dwindling of the forest cover in the region. Many small and large urban centers were emerged with the increase of population and increased transportation facilities causing further loss of forests.

The analysis of weather data being recorded for the last more than 100 years has clearly shown a change in climate in Munnar and High Ranges during this period. The temperature data from Pampadumpara in the High Ranges showed a shift in the maximum and minimum temperature during the last 30 years. As per the data available from Munnar, there is a decreasing trend in the total rainfall and number of rainy days during the last more than 70 years. These changes are supposed to be because of the impacts of human activities in the region during last more than 100 years.



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## Box 2 Climate Change and Increasing Disasters

These short term climate fluctuations and extreme weather events have been the most frequently occurring hazards and in combination with social vulnerability have been responsible for the vast majority of disaster losses worldwide. Centre for Research on Epidemiology of Diseases (CRED) categorizes these disasters resulting from climatic variability and other climatic and meteorological causes as hydro-meteorological disasters (floods, landslides, mudflows, avalanches, tidal waves, windstorms, including typhoons, cyclones, hurricanes, storms, winter storms, tropical storms and tornadoes, droughts, extreme temperatures, and complex disasters associated with drought) as distinct from geological disasters (earthquakes, volcanic eruptions and tsunamis). The hydro-meteorological disasters resulting from climate variability and other climatic and meteorological causes are also commonly referred as 'climate disasters' in disaster studies. Climate disasters have always been a recurring theme in human history, and are on rising trend. A number of experts link the current trends in extreme weather events with the increase in the global mean temperature. The CRED report states that there 'there is increasingly conclusive evidence which confirms that global climate change will have an impact on the occurrence and magnitude of extreme events. These impacts are envisaged to increase human vulnerability to natural disasters, thus emphasizing the need for improved measures of preparedness in every part of the world'. The report also surmises that the current trends are consistent with the predictions in the case of Asia, and West Africa that are already suffering from more severe and frequent floods. Many future projections by Intergovernmental Panel for Climate and Climate change (IPCC) indicate that there is 'increased confidence that some weather events and extremes will become more frequent, more widespread and/or more intense during the 21st century and impacts due to altered frequencies and intensities of extreme weather, climate and sea level events are very likely to change'.

Also, there is evidence now that climate change, with present developmental trends, will not express itself in through slow shifts in average conditions, but will manifest at an unprecedented rate with increased variability, frequency of extreme events, long term implications and possibility of abrupt change, fuelled largely through anthropogenic causes. Under such trajectory these two processes do have the potential to coalesce generating destructive forces which could cause mega disasters unless urgent, radical and resolute mitigation actions are not implemented. The projected climate change will affect India particularly severely. Its consequences include a rise in sea level, threatening areas such as the densely populated Ganges delta, changes in the monsoon rains, the melting of the glaciers in the Hindukush-Karakorum-Himalaya region (crucial for the water supply in the dry seasons), and the foreseeable increase in heavy rain events and intensity of tropical cyclones. The unprecedented heavy rain on 26<sup>th</sup> July 2005 in Mumbai is an example. In a span of 24 hours Mumbai recorded more than 90 cm rainfall, a rare event in the western coast. Nobody will forget the aftermath of the cloudburst on 16 the June 2013 in the Utharakhand Himalayas and the massive landslides in Kedar and Kumaon regions which killed thousands of people.

The thousands of glaciers located across the 2,400 km of the Himalayan range are at the epicenter of an emerging crisis. The effect of possible changes in the intensity of the monsoons will be particularly sensitive, because large parts of India receive the majority of their annual precipitation during the summer monsoon rains, which already vary noticeably in different regions. The summer monsoon is crucial to the annual precipitation total of the Indian subcontinent. Over 40 million hectares (12 % of land), is prone to floods, close to 5700 kms of its 7516 km coast line (about 8%), is cyclone prone and exposed to tsunamis and storm surges, 2% of land is landslide

prone, and 68% of India's arable land is affected by droughts. Of the 35 States and Union Territories, as many as 27 are disaster prone. Most disasters in India are water related the east coast of India, which lies in the path of tropical hurricanes from the Gulf of Bengal, is particularly at risk of being damaged by storms and floods. The projections by the National Institute of Oceanography (NIO), under the Council of Scientific and Industrial Research (CSIR), Government of India on the impacts of climate change on sea level, to assess the degree to which mean sea level and the occurrence of extreme events may change, showed an increased occurrence of cyclones in the Bay of Bengal, particularly in the post-monsoon period, along with increased maximum wind speeds associated with cyclones and a greater number of high surges under climate change. In addition, the strength of tropical cyclones, which represent a threat to the eastern coast of India and to Bangladesh, could increase. The risk to these areas will be aggravated by the rising sea level.

Vast stretches of land in India suffers acute water shortage. Of the net area sown in the country, 68 percent is prone to drought, and of this 33 percent is chronically drought-prone, receiving rainfall of less than 750 mm per annum, while 35 percent receives rainfall between 750-1,125 mm per annum. The steady shrinking of the Himalayan Glacier ranges will drastically cut down water availability in downstream plains of Uttar Pradesh and Bihar. India's initial National Communication to the United Nations Framework Convention (UNFCCC) on Climate Change projects that Luni, the west flowing rivers of Kutchh and Saurashtra occupying about one fourth of the area of Gujarat and 60 % of Rajasthan are likely to experience acute physical water scarcity. The river basins of Mahi, Pennar, Sabarmati and Tapi are also likely to experience constant water scarcities and shortages .

Landslides The areas that suffer from landslide hazards are located in the hilly tracts of the Himalayas, Northeast India, Nilgiris, Eastern Ghats and Western Ghats. With the melting of the glaciers in the Hindukush-Karakorum- Himalaya region, and the foreseeable increase in heavy rain events and intensity of tropical cyclones, the incidences of landslides are likely to increase.

Coastal zone India has an 8000 km-long coastline with two cyclone seasons, during the southwest and northeast monsoons. Cyclones have been observed to be more frequent in the Bay of Bengal than the Arabian Sea. Future climate change in the coastal zones is likely to be manifested through worsening of some of the existing coastal zonal problems. Some of the main climate related concerns in the context of the Indian coastal zones are erosions, flooding, submergence and deterioration of coastal ecosystems, such as mangroves and salinization. In many case these are caused by, or, exacerbated by, sea level rise and tropical cyclones.

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### **Ideas for projects**

1. long term changes in weather condition of the locality : rainfall(total and pattern), temperature , relative humidity, number of rainy days, wind speed and direction data are to be obtained on long term basis (for more than 30 years) from sources already available and plot the data to indicate any obvious changes in the parameters. If possible discuss and correlate the changes with certain observable parameters in the environment of the area. The changes may be correlated with the impact on agricultural production, drought, flood etc.
2. Urbanisation: Changes in land use in the area due to human habitation and urbanisation: Children will interact with senior persons in their locality to obtain information about

changes in land use in the form of conversion of agricultural land, orchards, grass land, wilderness areas into human habitation. The topographic sheets of different periods and Google Earth images may be used (students should get a chance to know topographic sheets and other sources of knowledge on earth surface, past and present). They will quantify diversions for various purposes. Compare temperature regime and humidity level in the surrounding area and in the habitation.

3. Analysis of waste generation and collection and disposal in a locality and its impact on weather and climate: children will sample waste generated in few premises and classify them under biodegradable and non biodegradable. They will observe the approximate percentage of waste collected by the local authority and their disposal methods. They will make rough estimations of carbon dioxide and methane emissions from the waste. These two gases directly impact the climate and weather, as these are GHGs.
4. Evaporation from man made reservoirs and its impact on local weather: Children can plan experiments with containers of different diameters. They can put same quantity of water in all the containers and leave them. Every second day they can measure the loss of water by measuring the quantity left in each container. They should correlate evaporation rate with diameter of the container which is indicative of exposed surface area. They can correlate the findings with field observations. Ponds, ditches, lakes etc which are shallow dry up fast as compared to the deeper ones. Water vapour is a green house component and also loss of water will reflect on availability of water in the locality

### **Suggested projects**

1. Loss of forest/wilderness areas in the locality
2. Loss of water bodies with time
3. Changes in cropping pattern in the locality
4. loss of mangrove forest in coastal area and possible impact in terms of coastal erosion
5. The effect of mangrove loss on the impact of cyclone in the coastal area.
6. Food wastage and carbon footprint
7. Life style and carbon footprint
8. Afforestation and carbon footprint
9. Use of fuel in industry and impact on weather and climate.
10. Artificial fish culture, fertilizing water and GHG emission
11. Use of biowaste as compost and reduction in carbon footprint
12. Replacement of non biodegradable plates, cups etc with biodegradable to reduce carbon footprint
13. Use of bicycle in the place of motorised vehicle and reduction in carbon footprint
14. Energy saving devices to reduce GHG emission
15. Use of natural light in place of artificial light.