Changing Climate: Red alert in Sunderban
Global temperature is rising and consequently the sea-level too

Sunderbans with Kolkata and many other places of South Bengal may get submerged

Scientists' opinion:
The number and intensity of storms and cyclones will increase in these region

ONLY MANGROVES CAN PROTECT FROM THESE CALAMITIES

Villagers have to protect the mangrove forests

Mangrove seedlings have to be planted in new places

Destiny is in your own hands. Villagers must protect themselves from forthcoming natural disasters.

An overview

The farmers and fishermen of the Sunderbans who primarily depend upon the nature for their livelihood are already facing problem with catchments and severe depressions in this region; whether all this is due to impact of climate change needs to be assessed, but it is apparent that the issue of climate change can no longer be ignored. Summers are extreme warm, monsoons are arriving late, that too characterised by irregular heavy rainfall; the severe attack of storms-cyclones and other calamities are also increasing. From time immemorial fishing and farming used to be carried here in accordance with the rhythm and laws of seasonal changes in nature, depending on the weather pattern. People are now confused - the unpredictable behaviour of the nature is making them more vulnerable. This change in the weather pattern is happening not only in the Sunderbans but all over the world. The following examples ascertain these facts.

Experiences in India

- Last few years' hilly provinces have experienced heavy rainfall, increased landslides. Cyclones and heat waves have killed many people in our country.
• In the year 2007, heavy rainfall has caused death of 1900 people in India and 642 people in Bangladesh. The category IV hurricane ‘Sidr’ that was about to hit the Indian Sunderbans changed course in the last minute and Bangladesh went through the devastation.

• In 2004, more than a thousand people died due to flood which resulted from heavy rainfall; again 50 people died due to heat waves in Rajasthan, the very same year.

• In 2003 rainfall & flood, cyclone, landslide killed 1795 people, 35 lakhs people were homeless; On the other side in UP, Haryana, Punjab, Rajasthan, Gujrat and in some other states heat waves killed 1392 people.

• In 1999 Orissa coast experienced a cyclone, where 30,000 people died. Large glaciers of Himalayas from where the rivers originate are declining at an average rate of 25 meters. The glaciers of Gomukh from which Ganga originates has receded by over 1250 feet.

Experiences in other countries of the world

Other countries are also facing similar catastrophies due to change in climate pattern.

• The year 1998 was the world’s hottest year, according to the records of meteorological department. People never came across such a hot year before. After this, two consecutive years 2002, 2003 were also hot years. Scientists had forecast many more of such hot years in the coming future.

• In 2003, heat waves in primarily cold countries of Europe killed 35,000 people.

• Africa- Tanzania used to face famine at an interval of 10 years. But now it’s happening at an interval of 3 years, following a flood.

• In 2007, Australia faced a terrible famine which was the worst of its kind in last thousand years.

• The ice patch on the Kilimanjaro Mountain in Africa that was strong enough for over eleven thousand years, has melted almost wholly in last ten years.

• The Arctic polar ice-caps have started melting.

• On the other hand, in the year 2007, terrible storms in South Asia have rendered nearly 2 crore people homeless.

• On August of 2005, the hurricane named ‘Katrina’ that rampaged on some of the coastal provinces of America, with a velocity of 280 km/hr took 1836 lives. Several lakhs of people became homeless and property worth several crores of US dollar was damaged.

• On 15th November 2007 cyclone ‘Sidr’ with a velocity of 240 km/hr struck the shores of Bangladesh and took 10,000 lives. We can as well think of the consequences if it had struck Sunderbans.
What is the cause of the sudden change of environment?

- Is this change a natural process, abiding nature's own course? And will it normalize and return back to its original form after few years? No, it is not so. The scientists have made responsible the unsustainable developmental activities of the human civilization which has only extracted the natural resources without maintaining the natural ecological balance of mother earth. They have even forecast a worse scenario in the future. And that is the cause of concern.

- The scientists have made the ‘green house’ gases responsible for the rise in earth’s temperature. The green house gases mainly comprise of carbon dioxide and methane, nitrous oxide and some others. What is carbon dioxide? In simple words, during respiration we take oxygen and release carbon dioxide in the atmosphere. Again when wood, petroleum, coal and other such fuels are burnt, then also huge quantity of carbon dioxide is released. Now, the green house gases are not created by the human beings alone. In the earth these gases existed as a layer even before the inception of the human race. The earth absorbs heat from the sun and also radiates heat to keep her cool; the work of the green house gases is to trap a portion of the radiated heat and not allow the entire heat to escape into the space. Had the green house gases not existed the entire earth would have become extremely cold and covered with ice thereby not allowing any life form to survive, not even the human beings. This imbalance in composition of green house gases in nature did not exist even some 250-300 years ago; it began to change after the Industrial Revolution of eighteenth century, that led to the setting up of big factories and industries in Europe and America.

- These large-scale factories & industries required fuels. Lakhs of hectares of forests were cleared for making way for industries to be built and for collecting wood for fuel. Tonnes of coal began to be burnt in order to generate electricity in thermal power plants and to run locomotives. In due course of time coal was replaced by diesel and petrol. The petroleum products were also being used to run cars, planes and in various other works.

- The combustion of all these ‘fossil-fuels’ led to the release of excess carbon dioxide in the atmosphere in more and more increased level. Slowly with the advent of industrialization in other countries also, the ‘fossil-fuels’ came forward as the only means of energy and its use became manifold.

- The concentration of the greenhouse gases increased in the atmosphere, they began to retain more heat than ever before and hindered the radiated heat from earth's surface from escaping into the space (much like our blanket cover) which ultimately led to rise in temperature.

Now let us look at the increase in the level of carbon dioxide in the atmosphere.

<table>
<thead>
<tr>
<th>Year</th>
<th>ppm (parts per million)</th>
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<tbody>
<tr>
<td>1850</td>
<td>280</td>
</tr>
<tr>
<td>1973</td>
<td>330 (in last 123 years)</td>
</tr>
<tr>
<td>2006</td>
<td>380 (in last 33 years increased the same unit)</td>
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- In the year 1850 carbon dioxide was found in the air in 280 ppm, that is 280 parts in 10 lakh parts by volume. In the next 123 years the level increased to 330ppm. And then only in the next 33 years it became 380 ppm. At present the level of carbon dioxide in the atmosphere is increasing by two parts per year and it will continue
Thus, if the rate of using fossil-fuel that is coal, diesel, and petroleum, as the only means of energy is not drastically decreased.

- In the last 100 years earth's temperature has increased by 0.6 degree Celsius, the human civilization has never witnessed such rise before. We have gone through devastating natural calamities as a result of this. The weaker section of our society suffers most - they die either facing shortage of food due to drought or are rendered homeless due to flood etc. If the rate of emission of carbon dioxide continues to grow like this, by the year 2035 the earth's temperature would increase by 2 degree Celsius and by the year 2100 the temperature would increase upto 5.8 degree Celsius.

- Eight international organisations engaged in the work of preserving the environment are of opinion that all the glaciers of Himalayas would completely melt. Firstly it would bring flood in the rivers, and after all the glaciers have become completely melted the rivers would dry up. Agriculture would come to a stand still and severe water crisis will occur. The conditions can be visualised and these days are not very far.

**How to get rid of the increasing temperature?**

- The only way to protect the environment from this is to search for alternate sources of energy to carry on the works of the industrialization and other developmental works so that the emission of greenhouse gases especially carbon dioxide is reduced drastically. It is observed that 25 countries emit 80% of the total greenhouse gases of the world. America tops the list followed by China. The two are followed by the European countries, after which comes India, Brazil, etc. Till now 172 countries of the world have signed an agreement named "Kyoto protocol". It aims to reduce the emission of carbon dioxide by 5% of the level prevalent in 1990, within the year 2012. Although England, Germany, France along with some other countries have taken active steps in this regard, but America who is responsible by large, is yet to take any steps due to its dispute with China. On the other hand China is also delaying taking active steps putting blame on the developed country. Even our government is yet to take any active measure in this regard. But the importance and relevance of this problem is evident from the fact that the Nobel Peace prize for this year has been awarded jointly to Mr. Al Gore (former US vice president) and I.P.C.C (Intergovernmental Panel for Climate Change) - who are working on climate change impact on our planet due to increase of global temperature.

What is the risk for the Sunderbans?

Sunderbans is a delta-region situated in the estuaries of the Bay of Bengal. The mangrove forests, the people and animals of Sunderban, are very much adapted to the sudden change of tides, which is a typical phenomena of this tide country. And that is why they are threatened by the rise of sea level along with the adverse effect of the storms and cyclones that originate from above the sea. The sea surface or the level of sea water was more or less stationary till the year 1900 and it increased by one-tenth part of one mm per year. But after the year 1900 with the increase in earth's temperature this rate became 1-2 mm on average and after 1992 it started to rise 3mm per year on an average. Keeping in mind the rate at which the earth's temperature is increasing it can be concluded beyond doubt that more and more glaciers would melt to increase the volume of sea water and there would be consequent rise in sea level not only in Sunderbans, but areas 100kms from the sea shore and the areas 10ms above the sea surface are pointed as most vulnerable, which are likely to be submerged, i.e. in coming 30-100 years along with Sunderbans, Kolkata, parts of North and South 24-pgs and Midnapore areas are likely to be submerged. With the increase of temperature of our environment the temperature under the sea also increases, and with the increase of the temperature under the sea the possibilities of storms, cyclone, and hurricanes become frequent. In the nineties alone, earth has witnessed powerful cyclones and hurricanes none of whose speed is below 200km/hr and their frequency is 35% more than before. If the amount of emission of greenhouse gases is not decreased then these hazards will increase, and people of Sunderban will face the consequences.
It is true that the people of Sunderbans are least involved in the emission of the greenhouse gases, but the dire consequences related to unlimited emission of such gases are taking away the lives of the people of Sunderbans. Now it is to be seen what steps the developed & developing countries take to control the increase in temperature; but can we, the local people of Sunderbans also take some initial steps to prevent the possible disaster?

Mangrove forest - the only means of survival

In the sea shore or in the estuaries where fresh water and the saline water mixes, there in the clayey soil, a special type of trees are found, they are known as mangrove. Byne, goran, gorjon, keora, hetal, golpata are some of the well known mangroves. Again dhani ghash and other such grasses that grow and survive in these conditions are called associated mangrove. All these comprise the well known mangrove forest of Sunderbans. Sunderban, including Bangladesh has a total area of 26,000 sq.kms, and there is no other place in the world that house such a large mangrove forest. Compared to other forest, the mangrove forest have the special ability to survive in adverse condition. The Saline water, the clayey soil, the roots being constantly washed by water; high tides occurring twice a day, submerging the trees and again during low tide the water level dropping upto 15-20 ft.; increase in concentration of salt in water due to heat and cold, again decrease in concentration of salt due to fresh rain water; trees being constantly beaten by tides; regular storms and cyclones; are a typical of mangrove forests.

In spite of all these they hold on to their soft clayey soil-this ability of the mangroves to survive in the ever changing adverse conditions, is giving the scientists a ray of hope.

According to them with increased global warming and with the increase in the sea level, the rate of storms and cyclone will also increase, and in these conditions only the mangrove forest will be able to adjust and survive. There is always an uncertainty as to what will happen if conditions change drastically, but it is evident that the mangrove forest to a large extent can adjust with the adverse condition, their adaptive features are unique- how they support themselves in this loose and soft clayey soil by growing support roots, the way they collect oxygen by pushing out breathing roots from beneath the ground, the manner in which roots sprout from the seeds while they are still in the tree, falls in water and drifts with the water to get hold on to the land and forms roots proves that the scientists' hopes are not mere figments of imagination, even we can have our faith upon the mangroves. The scientists have opined Sunderbans can be saved only by these mangroves. According to
them, from historical times the development of Sunderbans as a delta is not complete, since more and more estuarine lands are developing almost everyday, since the fresh water from the Himalayas are depositing new silt everyday, there is still a chance to compensate the damage already done. But we should keep in mind that we must not interfere in the process of reconstruction of the forests by our activities (such as setting up large and small industries, dams, settlements, roads, etc) so that they are harmful to the environment of Sunderbans. We must keep in mind all these in order to save ourselves from larger natural calamities that are impending on us.

**How the mangrove forest can save us from impending natural calamities**

**Mangrove acts as a bio shield:**

The mangrove forest standing with a thick cluster of support roots and breathing roots, acts like an impenetrable citadel against the storms and cyclones. The destructiveness of the waves, created due to the storms is reduced by 70%-80% when they hit the mangrove forest. Statistical analysis says, that the cost of building an artificial dam equivalent to that of 1km of mangrove forest would cross several lakhs of rupees. Even then with the passage of each day the dam would become weaker and weaker whereas the mangrove forest can increase its strength each day by producing new seedlings.

It is also a fact that humans are paying the price for destroying such a wonderful gift of nature for some materialistic gains (like-for fuel, for making towns, hotels, making way for civilisation or for the cultivation of prawns, that requires several miles of area). When Sri Lanka was hit by the devastating Tsunami, it was observed that in the villages protected by the mangrove forests only two people had died. Whereas, where there were no shield of mangrove forest or where the mangroves were destroyed, nearly 6,000 people lost their lives. A similar experience was observed during the cyclone in the Orissa coast in 1999, the less the mangrove cover in a place, the more loss to life and property was experienced.

Hence the one and only way that can save the people of Sunderan from extinction due to cyclones is the mangrove forest. Besides, the inhabited islands of Sunderban possess a special feature. Each and every island is surrounded by a high embankment made of clayey mud-soil. Had these embankments not existed the saline water would have entered these islands twice a day since the height of these islands is less than the level of water during high tide.
The total stretch of this natural embankment in the whole of Sunderban is 3,500 kms. But this embankment gets broken being beaten by tidal waves. The age-old practice is to give support with sand bags, bamboo & brick structures etc. but they also wear out. The best way to protect the embankments is to plant mangrove trees along its outer edge; within 2-3 yrs, mangrove are strong enough to protect the embankments. The difference of having mangroves and not having mangroves on the embankments can be best seen in Village Dulk just opposite to Sudhanyakhal - on one side of the jetty are the mangroves which are protecting the embankment, while the other portion of embankment supported by bricks cannot withstand even two days' rain. But where the land is being eaten up by the river vertically and no mud flat is available to plant what can be the effective way? This has to be worked out by the senior and experienced person of the village along with the experts of irrigation and development department as to the details of shore engineering. But there are no other alternative of mangroves who can protect the villages and embankments from natural calamities. With the increase of global temperature and consequent rise of the sea level some islands may get submerged.

**Mangrove elevates land level:**

The strength of the mangrove trees lies in the way it survives and grows up. For its growth the mangrove depend upon decayed leaves, decomposed material brought by the tide water and above all the silt brought by the rivers. The mangrove trees with its stilt roots and breathing roots in the clayey soil entrap the decayed leaves and minute particles of silt in order to survive and to reproduce. On the other hand we can see that the leaves and the silt day after day, forms soil, leads to the increase in height of the land and also expands in area.

Hence if the rate of accretion of land is more than the rate of rise in the sea level, due to global warming, then the threat of submerging the land becomes visibly less. A similar case is observed in the western Jamaica, where the sea level rises at the rate of 3.8mm every year; still the islands have not submerged because there the rise in land level due to the mangrove forest takes place at a higher rate. But it is also true that if the sea level rises at a rate 7/8 mm per year then it would become impossible for any mangrove forest to save it, in fact this would lead to the destruction of the mangrove forest itself and ultimately the islands would be submerged.
Accretion of the land level is also dependent upon the supply of silt. If the supply of silt becomes less then naturally the rate of accretion would come down. The good thing about Sunderban is that they still have sufficient supply of silt. We must keep in mind the fact that these natural supply of silt should never be disturbed by us by erecting large dams or by setting up hydroelectric projects in the last course of the river. Lastly, we should be specific about the species while planting the trees. Our goal will not be met by only planting Bynet trees at some places and kakra at other. In order to trap the silt and leaves by the mesh of their support roots and breathing roots, we must select the species according to the natural law in which they appear in the mudflats and then plant it, specially those that can hold on the silt more firmly.

**Mangroves sequestrate carbon-di-oxide**

Carbon dioxide is one of the main greenhouse gases responsible for global warming. All green plants in the presence of sunlight, with the help of chlorophyll while preparing its food (the process is called photosynthesis) takes up carbon dioxide from the atmosphere. In the coastal areas, like the Sunderbans this absorption of carbon dioxide is generally done by the mangrove forest. Hence the rise in global warming is directly linked with the destruction of mangrove forest. In that way, we must not only try and save the existing mangrove forests but also plant more and more mangrove trees. The amount of carbon dioxide absorbed by a type of forest differs from another type. Many scientists have referred to the absorption of CO₂ by the mangrove forest equivalent to that of the rain forests. It has been calculated that one hectare of the rain forest absorbs 1.5 metric tone of carbon dioxide over a year. Inspite of this every year 1,50,000 hectares of mangrove forest is being cleared and thus we are destroying the chance of absorbing 2.25,000 metric tones of carbon oxide per year.

To keep on with their fight against the impending natural calamities it is evident that the people of Sunderbans would not follow this disastrous path.

**What are the responsibilities of the villagers**

- The main work of the villagers is to protect the mangrove forests at any cost, and to be vigilant that they are not destroyed by any means. If required the villagers must cooperate with Forest Department and other NGO’s that work for protecting Sunderbans. In simple words, we must take active initiative to save the mangroves.

- The mangroves of Sunderbans have been cleared to create settlement. Prawn cultivation areas have been created where the mangroves once existed. It is impossible to reconstruct all the mangroves that have been lost but it is the responsibility of the villagers to decide where afforestation of the mangrove can be done. People should come forward to protect and replant the mangroves. If they do not take immediate measures, and keep waiting for the assistance of Forest Department, then they would be digging their own graves.
The embankment saves the villages from tidal surges. There is no alternative other than planting mangrove trees along the natural embankments. If possible we must select different species of mangrove in order to extract the best possible result. The villagers also must look into the matter that the plants are neither devoured by grazing animals nor they are uprooted by the fishing nets. And this type of vigilance is possible and has been successfully implemented in some villages.

In the forthcoming years with the increase in number and intensity of storms, cyclones and high waves the villages of the Sunderbans are exposed to several catastrophies; and obviously the poor people will be affected most. We have very little scope in framing the policies of the countries of the developed world. But we ought to be grateful towards nature for gifting us the greatest mangrove forest and it is our responsibility to save them. And that work does not only belong to any single Department or organization, that work is of the villagers themselves, for their own survival. Though this task is very hard but together we can achieve many things. Honestly speaking there is no time to think and waste. If Sunderbans get drowned the whole of Kolkata, South and North 24-pgs and part of Midnapur will be submerged along with it. And all the people of these region are looking up to the people of Sunderbans. In this war the villagers are the real soldiers.