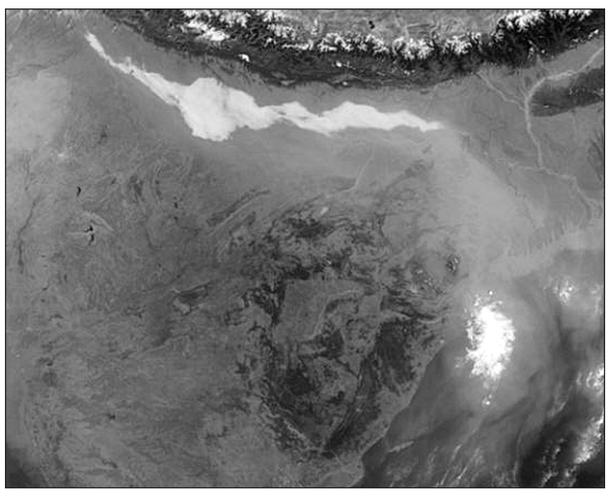
Now it is global dimming

MOHAMMED MUNIRUZZAM

As things stand, scientists believe that global dimming may have caused large-scale changes in weather systems. Climate modelers suggest that dimming, by shielding the oceans from the full power of the sun, may be disrupting the pattern of rainfall the world over. They go so far as to suggest that this reduction in sunshine may have led to the failure of monsoon in sub-Saharan Africa, together with the associated famines which claimed hundreds of thousands of lives during the 1970s and 80s.



MOST of us are aware, or at least heard of, terms like greenhouse gasses, greenhouse effect, and global warming. What about global dimming? Scientists like to define global dimming as the gradual reduction in the amount of global hemispherical irradiance (or total solar irradiance) on the earth's surface.

In other words, the sun's energy reaching the earth's surface has been gradually diminishing. The effect varies from place to place, but globally it has been observed that this reduction amounted to as much as 2 per cent to 5 per cent between 1950 and 1990. Dimming has a cooling effect, and thus all calculations and models based on warming by greenhouse gases may have been distorted by this effect.

Controversy abounds as to who should be credited with discovering global dimming. In a landmark paper published in the Tellus in 1966, M Budyko clearly points out this reduction in solar radiation. His paper attracted very little attention, as the word "dimming" had not yet been coined then. A flurry of papers on atmospheric transparency, cloudiness, and on trends and assessments on solar radiation were published by Atsumo Ohmura, Vivii Russak, and Beate Liepert during the 80s and the early 90s. All these papers pointed to the gradual reduction in solar radiation.

Gerry Stanhill, an English scientist studied these declines worldwide and introduced the term "global dimming." He found that sunlight was falling by 10 per cent over the US, as much as 30 per cent in parts of the former Soviet Union, and by almost 16 per cent in parts of Great Britain. His findings, published in 2001, however, met with skepticism, and critics simply refused to believe these numbers.

It is interesting to note that the observed effect is from measurements within the earth's atmosphere, and the value of solar radiation at the top of the atmosphere has not changed by more than a fraction of the global average. It was only recently that climatologists at the Australian National University discovered corroborating evidence in the global evaporation record. They declared that declining evaporation rates could be explained by declining levels of solar radiation. Further evidence of the declining solar radiation emerged from the Geophysical Union Meeting in 2004, held at Montreal, Canada.

The phenomenon that had puzzled the scientific community for more than half a century was finally established. Dimming appears to be related to particle pollution. Early in the 2005 it was discovered that the dimming trends had reversed since around 1990. Analysis of recent data also reveals that the surface of the planet has brightened by about 4 per cent in the past decades. The brightening trends have also been corroborated by analysis of satellite data. It is likely that at least parts of this change are due to decreases in particle pollution.

It is currently thought that increased presence of aerosols particles is responsible for global dimming. Burning coal, oil and wood produces not only carbon dioxide, the principle greenhouse gas responsible for green house warming, but also tiny airborne particles of soot, ash, sulfur compounds and other particles. Aerosols and other pollutants absorb energy and reflect sunlight back into space.

The pollutants can also become nuclei of water droplets. These water droplets in clouds coalesce around the particles. Increased pollution, resulting in more particulates, creates clouds consisting of a greater number of smaller droplets, which in turn makes them more reflective, thus bouncing more sun's rays back into space.

Some climatologists suggested that aircraft contrails (known as vapour trails) also contribute to global dimming. The constant flow of aircrafts meant that the hypothesis could never be tested. The near total shut-down of air-traffic following 9/11 attacks on the twin towers, provided a rare opportunity to observe the dimming effects at least in the US. Measurements during that period produced variations of one degree celsius in some parts of the US. Aircraft contrails may have been raising nighttime temperatures and lowering daytime temperatures much more than previously thought.

As things stand, scientists believe that global dimming may have caused large-scale changes in weather systems. Climate modelers suggest that dimming, by shielding the oceans from the full power of the sun, may be disrupting the pattern of rainfall the world over. They go so far as to suggest that this reduction in sunshine may have led to the failure of monsoon in sub-Saharan Africa, together with the associated famines which claimed hundreds of thousands of lives during the 1970s and 80s.

Similar sentiments are also expressed by Professor V Ramanathan, of the University of California, San Diego, when he says: "My main concern is global dimming is also having a detrimental impact on Asian monsoon. We are talking about billions of people." Ohmura believes that during the 70s and 80s global dimming caused by air pollution, buffered the climate against global warming, caused by greenhouse gasses. As the increasing amounts of gases warmed the earth, the increasing amounts of air pollution reduced the sunlight that reached the earth's surface, thereby cooling the planet. In other words, one form of pollution counteracted the other.

The implications of the above are that the impact of both the particle pollution and the greenhouse gases on the world's climate have been underestimated by the scientific community. Does it also imply that the Kyoto Protocol underestimated the dangers of global warming? It now appears that the greenhouse gases are expected to rise in the coming decades and that particle pollutants are being brought under control.

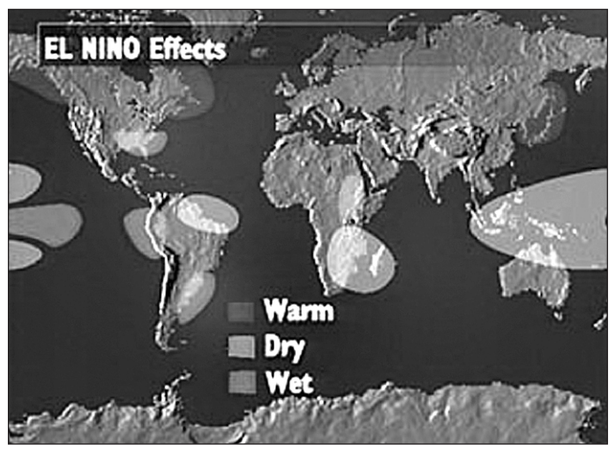
The situation has been aptly summed up by Dr Peter Cox, a leading climate modeler: "We are going to be in a situation, unless we act, where the cooling pollutant is dropping off while the warming pollutant is going up." That means we'll get falling temperatures and increased heating at the same time and that's a problem. That means all forecasts of global warming will now have to be revised.

Dr. Mohammed Muniruzzaman is Professor, Department of Physics, Jahangirnar University.

El Nino update: 2006-07

El Niño brings about abnormal weather conditions around the globe, including flooding in Ecuador and Peru, and drought in Bangladesh. For example, the 1997 drought in Bangladesh was particularly severe as the region was hit by both a mega El Niño and cooling in the eastern tropical Indian Ocean.

MD. RASHED CHOWDHURY



AN El Niño has been developing in the equatorial Pacific since early summer and, based on conditions in the Indian Ocean, will likely grow in strength over the next two months. This forecasts is made on the basis of latest calculations of researchers at the University of Hawaii's climate centre, the International Pacific Research Centre (IPRC).

El Niño, the recurring climate phenomenon with unusual warm ocean temperatures in the equatorial Pacific Ocean, causes abnormal weather conditions around the globe. While it has been the "poster boy" of climate variability over the past 20-30 years, scientists mostly ignored the Indian Ocean thinking it showed too little variation to excite any interest.

This all changed in fall 1997 when scientists were stunned by rapid cooling of the normally warm Indian Ocean off Sumatra Island. This cooling of the eastern tropical Indian Ocean caught the curiosity of the climate community and drew many to study the Indian Ocean. They traced the unusual Indian Ocean cooling, dubbed Indian Ocean Dipole, to the big El Niño that was happening at the same time in the Pacific in 1997.

In a recent study published last year in Journal of Climate, it has been investigated how such cooling in the eastern tropical Indian Ocean might impact El Niño and found that this unusual cooling weakens atmospheric convection over the region. This, in turn, sends atmospheric waves, called Kelvin waves, along the equator to the Pacific, and these waves cause anomalous westerly winds. It has been known for some time that such westerly wind anomalies are associated with a growing El Niño.

In September, there was a report of an imminent cooling in the eastern Indian Ocean and, based on past 35 years of data, it has been found that when an El Niño was accompanied by an Indian Ocean cooling, there was a good chance that it would grow greatly in strength in the fall. For instance, the two super El Niños in 1982-83 and 1997-98 were both accompanied by unusual cooling in the eastern Indian Ocean. It has therefore been suggested by the researchers that it was these Indian Ocean conditions that powered the disturbances into the 'El Niños of the century.' Since 1997, there have been El Niño events in 2002 and 2004. Both were mediocre in strength, the researchers believe, because they didn't have the "push for growth from the Indian Ocean."

El Niño prediction is being routinely carried out at weather agencies around the globe, but intensity forecasts are generally poor, which could be because many prediction models did not include the Indian Ocean. In fact, both the 1982 and 1997 super El Niños caught scientists by surprise as they were unfolding.

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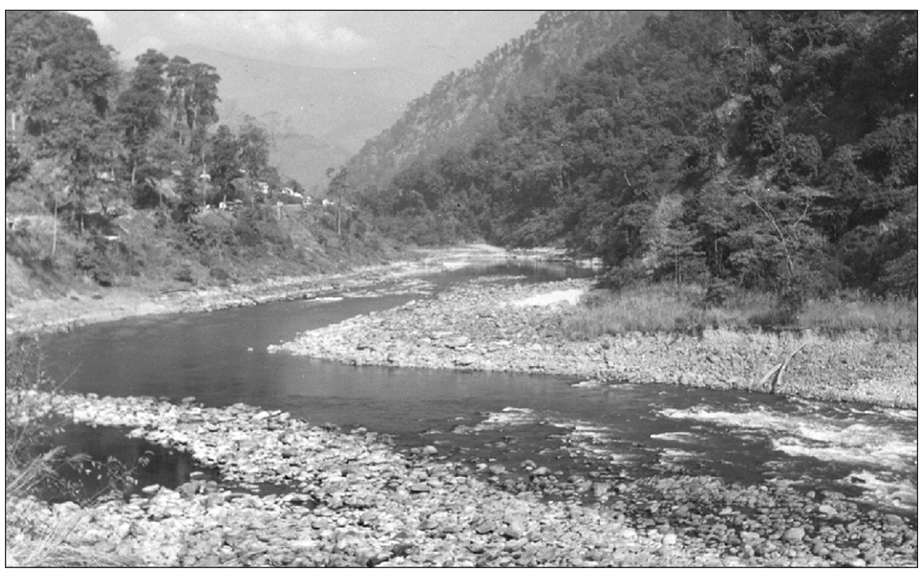
Dr. Md. Rashed Chowdhury is Research Scientist and a Graduate Faculty at the Pacific ENSO Applications Center in the University of Hawaii, USA (rashed@hawaii.edu)

Dammed river, dead river: A case study on Teesta

NAZRUL ISLAM

The mighty river, flowing and replenishing its surroundings for thousands of years, is going to be almost vanished within a decade due to human interference with its natural course to accomplish their greed. And it can surely be said that the consequences of altering the nature would not ultimately bring any good for the people.



The Teesta near its source

EVIDENCES show that the natural flow of all rivers is inherently variable, and that this variability is critical to ecosystem functioning and native biodiversity. The flow of the rivers sometimes changes due to geophysical changes. But when people change the courses or discharges, the rivers gradually lose their existence. Rivers with highly altered and regulated flows lose their ability to support natural processes. In other words, dammed rivers are dead rivers.

In this write-up I would try to prove the above proposition through presenting example of gradual death of the mighty river Teesta.

Once the Teesta that used to hold water throughout the year now dries up just after the monsoon. Numerous chars and shoals have been emerged on the riverbed. The discharge capacity of Teesta has drastically been reduced due to withdrawal of water and the discharge of heavy silts from the upper catchments. A series of dams and barrages erected over the vibrant river are virtually causing its death. The shrinkage of the river has been causing heavy erosion almost throughout the year displacing and making destitute hundreds of people every year.

It seems certain that the dynamic equilibrium of the river will be impaired with the construction of a series of dams and the sediment load will be trapped within the reservoirs, reducing their capacity. This, in turn, could compel dam managers to release water during heavy rainfall, causing sudden flash floods downstream.

Origin of Teesta

The river Teesta originates in the mysterious Cho Lhamu Lake at an elevation of 5,330m (17,500 feet) above sea level in the mighty Himalayas. This lake lies to the north of the Donkia Pass near Shetschen, where the summit of the pass is about eight kilometres north-east of Darjeeling.

The Teesta is then fed by rivulets, which arise in Thangu, Yumthang and Donkia-La ranges and flows past the town of Rangpo where it forms the border between Sikkim and West Bengal up till Teesta Bazaar. At Teesta Suspension Bridge, which joins Kalimpong with Darjeeling, the river is met by its main tributary, the Rangeet river. At this point, it changes course southwards flowing entirely into West Bengal. The river hits the plains at Sevoke, where it is spanned by the Coronation Bridge which links the Northeastern states to the rest of India. The river then courses its way to Jalpaiguri and then to Lalmonirhat district of Bangladesh, before finally merging with the mighty Brahmaputra at Fulchhori in Gaibandha.

The Teesta is a rain and snow-fed river. The permanently snow-covered area of the basin is about 158.40 sq. km. The upper catchment receives a total annual rainfall of 1,328 mm. while the middle of the basin receives 2,619 mm. It has been recorded that about 77-84 per cent of the annual rainfall is received between June and September.

Dams on the Teesta

A number of dams and barrages have been built on the river Teesta on its 414 km journey to the sea from its source in Sikkim to the coast of Bangladesh. These include: Teesta Barrage in Bangladesh, Teesta Barrage Project at Gojoldoba in West Bengal, two hydro-electricity dams in Sikkim -- one at Kulekhani and other at the upstream. The Indian government is also planning to construct two more hydro-electricity dams over the Teesta.

Teesta Barrage: The Teesta Barrage has been built at Doani in Lalmonirhat with an ambitious objective to bring 750,000ha of land under irrigation command area with net irrigation area of 540,000 hectares to augment agri production.

It is spread over 12 upazilas -- Nilphamari, Dimla, Jaldhaka, Kishoreganj, Saidpur, Rangpur, Taraganj, Badarganj, Gangachara, Parbatipur, Chirirbandar and Khanshama. The project included construction of a barrage, flood embankment, flood bypass, silt trap, main canal and part of canal system with improvement of existing drainage canal.

Although the implementation of the project started in 1960, the actual construction of the barrage was taken up in 1979 and that of canal system in 1984-85. The first phase of the barrage has been completed in June, 1998 and the cost incurred is Tk. 9695.29 million.

Teesta Barrage Project (TBP) at Gajoldoba in West Bengal: The TBP is an overtly ambitious multi-purpose project. It plans to irrigate 9.22 lakh ha of land in six districts of Indian north Bengal without any storage system. Three pick-up barrages are to divert river water towards agricultural land. The system may be successful for kharif cultivation when the soil is naturally wet and rivers are full. Since the rivers of north Bengal are much reduced in the lean months, it would be impossible to ensure water to dry variety paddy over 90,000 ha. The cumulative irrigation potential achieved by the project till June 2001 from its inception in 1976 was 12,6110 ha., which is less than 14 per cent of the ultimate target.

The TBP is excessively optimistic in its projections, especially considering that it has no reservoir and depends exclusively on diversion barrages with no storage capacity.

The Teesta was untamed in its upper catchment when the TBP was formulated. The series of proposed dams in the upper reaches will reduce the available discharge for irrigation as each hydro power project is expected to consume at least five per cent of the running water in the river. The lack of coordination between National Hydro Power Corporation (NHPC) and TBP has further complicated the situation.

The reservoir that was planned to be constructed during the second phase of the Teesta irrigation project cannot be now undertaken since the NHPC has already started working towards the implementation of the 'low dam' just 400m. upstream of the Coronation bridge. So the plan to generate an additional 600 MW power under the TBP will probably never take off.

Present situation:

The Teesta has been drying up at different points during the dry season threatening the boro cultivation in six northern districts. The once mighty Teesta is now bereft of water following construction of a barrage upstream at Gojoldoba point in Jalpaiguri of the Indian state of West Bengal.

The farmers in Nilphamari, Lalmonirhat, Gaibandha, Rangpur, Dinajpur and Bogra are worried over the bleak prospect of getting required quantum of water from the Teesta for the irrigation of boro fields. The construction of the barrage on this river across the border to divert its flow of water has badly affected the efficacy of the Teesta Barrage Project.

According to Water Development Board sources, Bangladesh got only about two per cent of the required quantum of water from across the border last year. The release of such low quantum water was affecting navigation, irrigation, fishery and ecology of our lower riparian country, the sources added.

On the other hand, they said, there should be 10,000 cusecs of water to bring an estimated 111,000 hectares under the Rabi crop programme but only 1,000 to 1,200 cusecs are now available in the upstream of the Teesta Barrage. The Indian authorities are reportedly withdrawing the total water from the rivers Teesta and Mohananda through their Gajoldoba and Mohanada Barrages in the upstream.

Pattern of discharge

It can be seen from the chart below that the average lowest discharge of Teesta was above 4,000 cubic metre/sec before construction of the two barrages -- one at Doani in Bangladesh and other at Gajoldoba in West Bengal. But after construction of two barrages the lowest discharge has drastically reduced to 529 cum/sec in 2000 and just after five years in 2005 it came down to just 8 cum/sec. I think, there requires no further explanation what is going to happen to the fate of the Teesta in the near future.

On the other hand, in the Indian part, the mean annual discharge of the Teesta at Anderson bridge was about 580 cum/sec a decade back and it declines to 90 cum/sec in the lean months. The peak discharge may be as much as 4,000-5,000 cum/sec. It was estimated that the peak discharge of the river at Jalpaiguri during the devastating flood of 1968 was 19,800 cum/sec. The sediment load in the river increases with high monsoon discharge. It was observed that 72 per cent of the suspended load is transported between July and August when the bulk of discharge flows through the river.

Conclusion

The dams and barrages already constructed in the river Teesta have caused a negative impact on free flow of its water. Due to the obstruction on its water flow, the Teesta was heavily silted up and changed its courses at many places, especially in the lower catchment, and erodes its both banks engulfing thousands of hectares of land every year. Moreover, the ambitious objective of both the Bangladesh and Indian authorities of irrigating thousands of hectares of land to increase agricultural production is also gradually dwindling with scarcity of water during the lean period in the river. It was feared that the Teesta barrages both in Bangladesh and Indian may lose their efficacy within a decade. And by that time, the mighty river will not only become dysfunctional but also die in terms of water flow and replenishing its surroundings.

The Teesta is going to embrace the fate of the Aral Sea project in Russia and Irtsh-Karaganda Canal in Kazakhtan which have been proved to be ecological disasters of water management. The mighty river, flowing and replenishing its surroundings for thousands of years, is going to be almost vanished within a decade due to human interference with its natural course to accomplish their greed. And it can surely be said that the consequences of altering the nature would not ultimately bring any good for the people. As Fredrick Engels said "Let us not flatter ourselves overmuch on account of our human victories over nature. For each such victory, nature takes its revenge on us. Each victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which too often cancel the first."

Nazrul Islam is a freelance journalist and environmentalist.

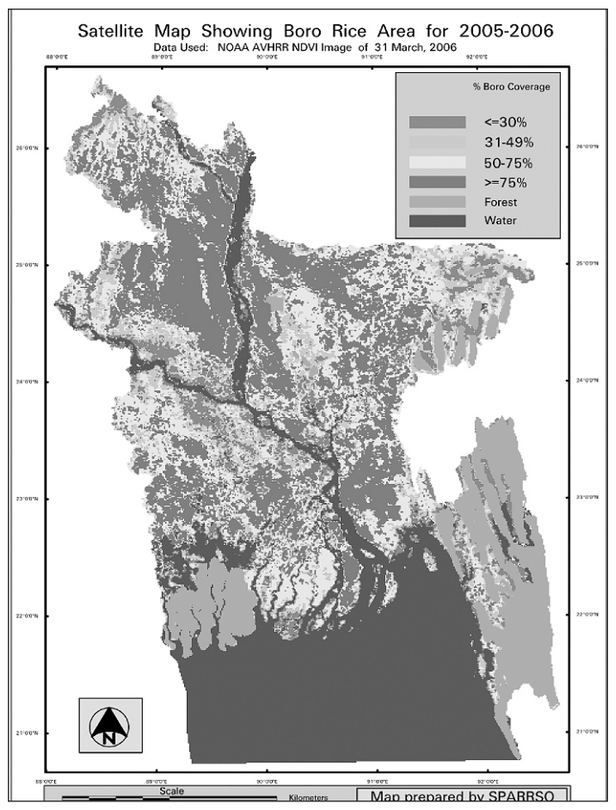
CHART: Discharge of Teesta

Year	Lowest discharge	Highest discharge	Remarks
1980	4494 cum/sec	84,900cum/sec	Lowest discharge generally occurs in Feb-March while highest in Aug-Sept.
1990	4732 cum/sec	158,096 cum/sec	
2000	529 cum/sec	174,702cum/sec	
2005	8 cum/sec	3,892 cum/sec	

Source: Hydrology department, Rangpur

SPARRSO works for food security

JINNAHTUL ISLAM



NOAA satellite Phoptomap of 31 March 2006 showing the BORO Rice Crop area of Bangladesh

FOOD security is the ensured access of all people at all times to enough food for an active, healthy life. Food security includes, at a minimum, ready availability of nutritionally adequate, and safe, food. It also assures the ability to acquire acceptable food in socially acceptable ways. It is a great and important work to ensure food security to the people of a country. Increasing food security in developing countries through increased and subsidised food production in an economically and environmentally sustainable way is also very important

Food security is linked to the consumption, production, and marketing of food, and survey and monitoring of food production, specially food grains. For the scientific management of food security in the country SPARRSO is providing support to the Government of Bangladesh through the estimation and forecasting of rice yield, using satellite technology in the Boro and Aman seasons.

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) is a multidisciplinary research and development organization of the Government of the People's Republic of Bangladesh under the Ministry of Defence. It is devoted to applying space technology and Geographic Information System (GIS) for surveying, mapping and monitoring natural resources, as well as monitoring the environment and disasters in the country. It is the focal point of all space and remote sensing related activities in the country. As a multidisciplinary organization, SPARRSO activities are related to a large number of fields like agriculture, water resources, fisheries, forestry, oceanography, meteorology, environment, land use, cartography, geology and geology.

SPARRSO has carried out a number of studies on cropping pattern determination, rice area and yield estimation using satellite remote sensing. Enumeration area mapping, vegetation index mapping, coastal zone monitoring and change detection mapping, monitoring of river course changes, inventory of forest resources, mapping and monitoring of natural hazards like cyclones, storm surges, floods, tornadoes, nor'westers, droughts etc. are being done more or less on a regular basis. The information and knowledge gathered through analysis of satellite data are being supplied to concerned ministries and user agencies in the form of maps, reports, articles and papers, with recommendations. As a part of resource inventory SPARRSO has been making all-out efforts for exploitation of space science and remote sensing technology toward food security in the country.

Bangladesh is an agricultural country with high density of population. The lands are mainly used for rice cultivation to fulfill the demands of the main cereal food. Agriculture is one of the most important fields where satellite technology can be used effectively, specially in the field of rice crop inventory and forecasting. SPARRSO estimates crop area and rice yield on a regular basis, particularly for Aman and Boro rice, using NOAA AVHRR data.

The NOAA satellite receives AVHRR imagery of the earth and its atmosphere in five spectral channels of which channels 1 and 2 are situated in the visible and near infrared regions respectively. The data values in these channels are used to calculate the area and state of crops. In fact, the data from these two channels are used to calculate the Normalized Difference Vegetation Index (NDVI) using the equation: NDVI = (Channel 2 Channel 1)/Channel 2 + Channel 1). The NDVI image efficiently represents the green vegetation and other properties of the earth's surface. A correction algorithm developed by SPARRSO has been employed to take into account the fractional coverage and spatial heterogeneity of rice area.

In order to estimate the Boro rice area in April-May the NOAA images of March 31 have been corrected geometrically, geo-referenced and analyzed. An Arc/Info based administrative boundary layer of the country has been used to obtain the crop statistics from the NOAA AVHRR data and NDVI product. The following photomap prepared from the NOAA picture shows the Boro rice area in the country. The Boro rice area has been extracted from the crop statistics of this map.

Some sample field surveys, fairly distributed over the country, have been carried out for verifying the different identified classes in the field, and to collect corresponding yield data. The rice area has been multiplied by the average rice yield/ha to obtain the total yield of the country. Later the estimated result was ratified by Bangladesh Bureau of Statistics, Department of Agriculture Extension and Ministry of Food for national use.

It is known to the scientists that that NOAA satellite provides very low resolution (1. 1 km) picture. It has a number of constraints in estimating rice crop area. Moreover we cannot estimate precisely other crops like potato, jute, sugarcane and many other vegetables because of its extremely low resolution picture. In fact NOAA is a weather satellite. For this kind of survey and monitoring we need high resolution picture of Earth Resources Satellite like Landsat, IRS etc. But, ironically, we do not have any Earth Resource Satellite in Bangladesh. Bangladesh should have her own high resolution satellite. It will provide us high resolution pictures for this kind of study for food and disaster forecasting, and for scientific management of natural resources on the sustaining yield basis. We need, and it is high time to develop, satellite technology in the country. It will help us to build a happy and prosperous nation. The nation will be scientifically and technologically sound and will be consistent with the rest of the world. This is our national expectation.

Dr. Jinnahtul Islam is a remote sensing, forest and environment specialist.