Satellite remote sensing : Efficient tool for fisheries development

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Remote sensing techniques can be utilised directly, indirectly or as general aid in the detection and assessment of fishery resources. Knowledge of the oceanographic conditions that affect the harvesting strategies and fishing operations is also developed in the neighbouring countries which can be utilized through regional cooperation (BIMSTEC).

REMOTE Sensing is the process of sensing and measuring objects from a distance without physical contact with them. Satellite remote sensing observation systems brought with it the capability to synoptically survey vast areas in unprecedented detail. It appears feasible to use satellite sensors to measure selected parameters and then to use these measurements to predict the distribution and abundance of fisheries resources. Remote sensing technique can provide considerable information at a minimal cost and time for this type of study. This technique can be used reliably and effectively to map location, size, quality of wetlands and some aspects of habitat. Bangladesh Space Research and Remote Sensing (SPARRSO) has developed remote sensing techniques effectively and efficiently to locate, identify and quantify our inland, coastal and marine fisheries resources habitat. Some of the works accomplished by SPARRSO are as the following:

Water bodies survey : For proper planning, management and development of fisheries, it is necessary to know the extent, condition and location of the different types of water bodies of the country. In view of this SPARRSO undertook a survey work of water bodies using remote sensing technique in 1980. Maps at the scale of 1:50,000 of small water bodies (less than 25ha) in 40 selected thanas were produced. Large maps were produced showing the location of water bodies, communication network, and physical infrastructures using aerial photographs and Landsat satellite. Fisheries Directorate has used these maps for their planning, development and management of inland and coastal fisheries resources.

Updating inventory of waters using remotely sensed data and GIS: This is the partly updating of the previous study on water bodies survey of Bangladesh using remote sensing technique. This study has been made on water bodies of three administrative districts of Bangladesh namely Jessore, Sylhet and Natore using infrared aerial photography, SPOT satellite images in 1991.Eleven maps of 1:50,000 scale were prepared for the three districts showing different types of water bodies and infrastructures which are relevant to fisheries and water resource management in these areas. Chlorophyll content and different types of water bodies were classified with this image using GIS/ARC-INFO. Optimal fish ponds, potential areas of fish culture and fish processing industry were also identified.

Mangrove ecosystem study of Chakaria Sunderbans: Mangrove ecosystem of Chakaria Sunderbans was studied to identify shrimp ponds and monitor temporal changes and their impact on the ecosystem using aerial photography and Landsat satellite data in 1983. These maps were used to identify shrimp ponds and to assess the spatial coverage and temporal change in mangrove ecosystems. A suggestion was put forward for planting mangroves on the periphery of embankments of shrimp farms to balance the ecosystem. Such suggestion has been implemented at Ecuador of South America and in South East Asia and they got good result. After 1999, it was realized that, this suggestion should have been followed earlier in Bangladesh. If it was followed before 1991 then severe cyclone of 1991 would not have destroyed so much of our coastal area and shrimp farms.

Estimation of chlorophyll content of Bay of Bengal: Presence of phytoplankton can be considered as an index of biological productivity and it can be related to fish production. An attempt was therefore made to find the chlorophyll concentration in Bay of Bengal using Nimbus-7(CZCS) satellite data in 1991. The analysis showed that, chlorophyll content of the Bay varied between 0.1 and 10.0 mg/m3. Chlorophyll is found to be higher near the coast, because of availability of maximum nutrients which are drained through the rivers. Analysis of chlorophyll concentration is helpful in surveying the potentiality of fisheries resources of the sea. These data are also useful for estimation of global carbon cycle.

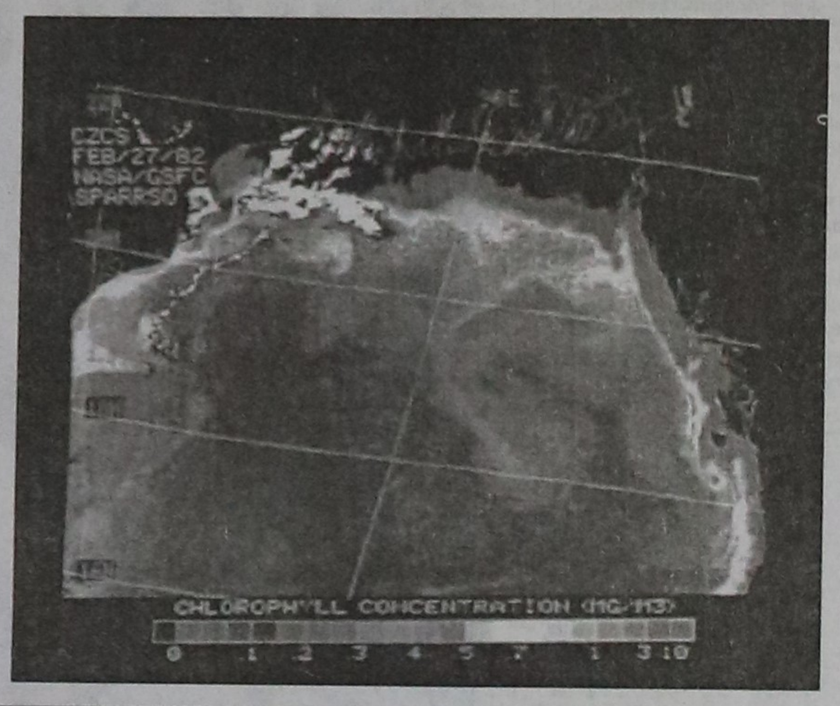
Coastal zone development and fishery environment analysis: The SPARRSO and Indian Space Research Organization (ISRO) have completed the study and coastal maps have been generated for the two study sites --Khulna-Satkhira and Cox's Bazar. The whole zone development and fishery environment analysis was done using remote sensing techniques in Bangladesh under a UN/ESCAP, TCDC programme in 1997. In this study different satellite data, thematic maps, fieldmeasured data and other relevant published data and information etc were used. Detailed and updated landuse work was performed in six major parts and the model for suitable site selection of shrimp farm (4S Model) was developed. In some of the ESCAP countries, respective governments are using this type of model for allocating shrimp farms in their respective country. Our Fisheries Department should use this model.

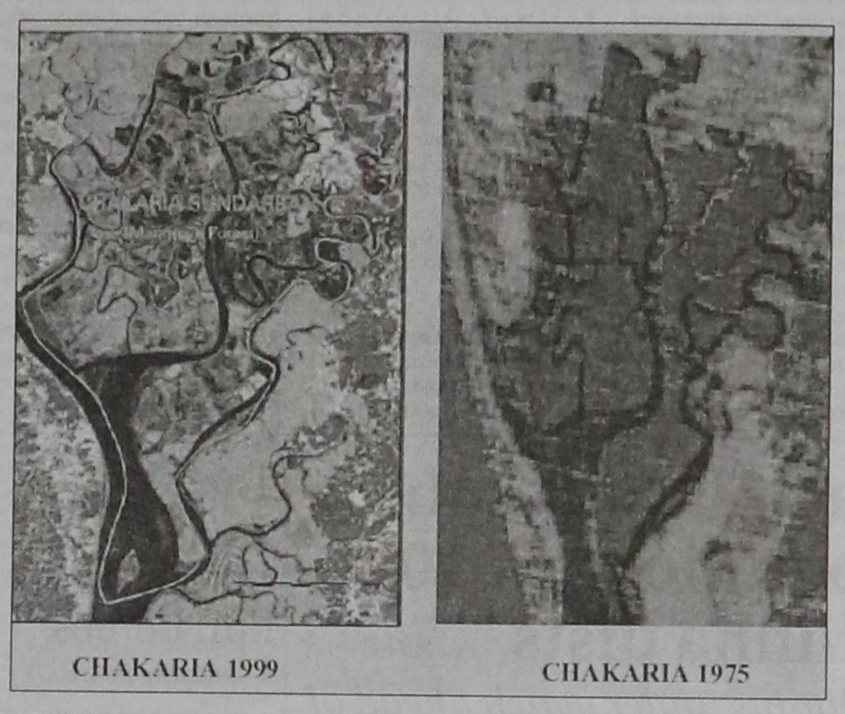
Impacts of shrimp farm on rice and other agricultural land in the south-western coastal region : The aim of this study was to identify and monitor the agricultural land encroached upon by shrimp farming activities, preparation of map showing the encroached agricultural areas of rice and other agricultural crop production. The study area was Satkhira district. Landsat TM satellite data of different date and topographic maps were used for this study. Upazila wise maps were prepared and area statistics were generated on shrimp farm, crop land, and settlement areas in 2003.

Coastal and marine biodiversity: Status of coastal and marine biodiversity of Bangladesh was studied as fauna a total 453 species of birds, 42 species of mammals, 35 reptiles and 8 amphibian species for the whole coastal zone. A total of 301 species of mollusks and over 50 species of commercially important crustaceans have been recorded so far. Among the endangered species are 5 mammals,25 birds, 14 reptiles, 1 crocodile, 8 turtles,1 snake, 2 frogs, and 4 lizards, The marine waters of Bangladesh are also remarkable for being a habitat of 475 species of fishes and at least 36 species of marine shrimps. About 336 species of marine mollusks including coastal mollusks covering 151 genera, 3 lobsters and 7 species of turtles and tortoises, 168 species of seaweeds, 3 sponges,16 crabs,10 frogs, 3 crocodiles, 24 snakes, 3 otters,1 porcupine, 9 dolphins and 3 species of whale were found in Bangladesh territory of Bay of Bengal. Among the marine migratory species of animals 4 fishes, 5 reptiles, 6 birds and 3 mammals are threatened.

Monitoring fluctuations of water area in Sylhet-Mymensingh basin: The study describes monitoring seasonal fluctuation of water area in the Sylhet-Mymensingh basin using microwave remote sensing and GIS techniques. RADARSAT, Landsat satellite images, topographic and thematic maps were used as reference map for the study. Seasonal fluctuations of water areas for each district were calculated separately.

Conclusion: Remote sensing techniques can be utilised directly, indirectly or as general aid in the detection and assessment of fishery resources. Knowledge of the oceanographic conditions that affect the harvesting strategies and fishing operations is also developed in the neighbouring countries which can be utilized through regional cooperation (BIMSTEC). SPARRSO with its limited facilities has done some works on remote sensing applications in inland, coastal and marine fisheries resources. Some of them are discussed in this article. If we can utilize this study through fisheries department it will be easier for management and development our fisheries resources. This subject is rapidly developing throughout the world. If we do not proceed we will just lag behind. Especially our marine fisheries sector will lag far behind. So, some realistic projects using satellite remote sensing should be undertaken by Fisheries Department/fish farmers with SPARRSO and allied organisations without wasting time.





CHAKARIA 1999 CHAKARIA 1975

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The giving trees

SHARON LEVY

The boldest effort yet to create a viable carbon offset market for forests has been in California, where the California Air Resources Board (CARB) recently adopted a new forest protocol that aims to provide financial incentives for increasing carbon storage. The protocol is one of a series of new policies sparked by the California Global Warming Solutions Act of 2006, which mandates reduction of greenhouse gas emissions in the state to 1990 levels by the year 2020.

FOR some people forests are measured in board-feet of lumber. For others they're a source of spiritual renewal. But scientists are finding that protecting ancient trees could also be an important new strategy in the fight against global warming.

In an era of climate crisis a clearer understanding of the role forests play in absorbing carbon is becoming crucial. Mass deforestation, particularly in tropical countries such as Brazil and Indonesia, accounts for more than 20 percent of annual greenhouse gas emissions. Meanwhile, recent studies show that Northern Hemisphere forests, now beginning to bulk up as they recover from centuries of logging, capture large amounts of CO2 from the atmosphere. Finding ways to preserve forests -- wherever they may be -- can buy us precious time to wean ourselves from fossil fuels.

People who cut down trees for a living tend to measure their value in dollars and cents. Traditionally, the timber industry has seen mature forests, with massive trees left standing and big logs rotting on the ground, as examples of waste; replanted clear-cuts, by contrast, represent an ideal of economic productivity. Now global warming has forced foresters to address the impact of logging on the flow of carbon between forests and the atmosphere, and many in the industry have insisted that stands of young, fast-growing trees capture carbon more efficiently than do older forests. Using a recently developed technology called the eddy covariance method -- more commonly known as eddy flux measurement -- Bev Law and her colleagues are showing that those assumptions are wrong. Law, a professor of global forest science at Oregon State University is the director of the AmeriFlux Network, an international collaborative project founded in 1996 that tracks the exchange of CO2, water vapour, and energy in all sorts of biomass throughout the Americas.

It turns out that forests hundreds of years old can continue to actively absorb carbon, holding great quantities in storage. Resprouting clear-cuts, on the other hand, often emit carbon for years, despite the rapid growth rate of young trees. This is because decomposer microbes in the forest soil, which release CO2 as they break down dead branches and roots, work more quickly after a stand is logged. On the dry eastern face of the Cascades, for example, where trees grow slowly, a replanted clear-cut gives off more CO2 than it absorbs for as much as 20 years.

Can we develop a new model of forest economics that draws on this knowledge -- a model that makes sense to foresters as well as the policy makers and conservationists who are now taking the first steps toward developing a viable market in forest carbon? Because financial pressures drive deforestation, the hope is that putting a cash value on the carbon captured and stored by living trees will one day provide an alternative economic incentive to those who do the cutting.

Since the mid-1990s Law has monitored the movement of carbon in the ponderosa pine forests along the Metolius River in the central Oregon Cascades, starting with a rare stand of ancient trees that contains pines as old as 250 years. She studies the forest ecosystem on every level, from the workings of a single leaf to sweeping landscape images produced by remote sensing satellites.

Eddy flux measurement is one of Law's most crucial tools, enabling her to track the exchange of CO2 and water vapour between forest and air over large swaths of landscape, and at a level of detail that's never before been possible. Other tools provide Law with additional insights into the flow of carbon through the intricate pathways of the forest.

Law's data show that this 90-year-old forest is, in fact, at the peak of its ability to absorb carbon. The uptake of carbon by ponderosa pines increases gradually, then reaches a plateau at some point between 50 years and 90 years. Once this plateau is reached, the trees and the soil will together continue to form a rich bank of stored carbon that cannot be equaled by any newly sprouted stand. During her work in California and the Pacific Northwest, she's found forests as old as 800 years that continue to absorb more carbon than they release.

Eddy flux technology has made it possible to set up a standardized way of tracking carbon in any ecosystem, anywhere in the world. More than 90 separate sites are now part of the AmeriFlux Network, studying jack pine and old-growth maple and birch in Michigan, loblolly and slash pine in North Carolina and Florida, and a Massachusetts hemlock forest, among others.

On the other side of the country, in Petersham, Massachusetts, atmospheric chemist Steven Wofsy of Harvard University, another member of the AmeriFlux Network, studies a site that even more dramatically defies the theory that trees lose their ability to soak up carbon with age. Wofsy began the world's first long-term, large-scale eddy flux study at Harvard Forest in 1989.

"All the ecological models said that temperate forests stop their net carbon uptake at about 50 years," Wofsy says. "Eddy flux data has clearly shown that this is not true." At the start of the study, when the trees were a half century old, the researchers found that Harvard Forest was absorbing about 0.8 tons of carbon per acre every year. After 15 years the rate of carbon uptake -- expected to decline with age -- had instead doubled.

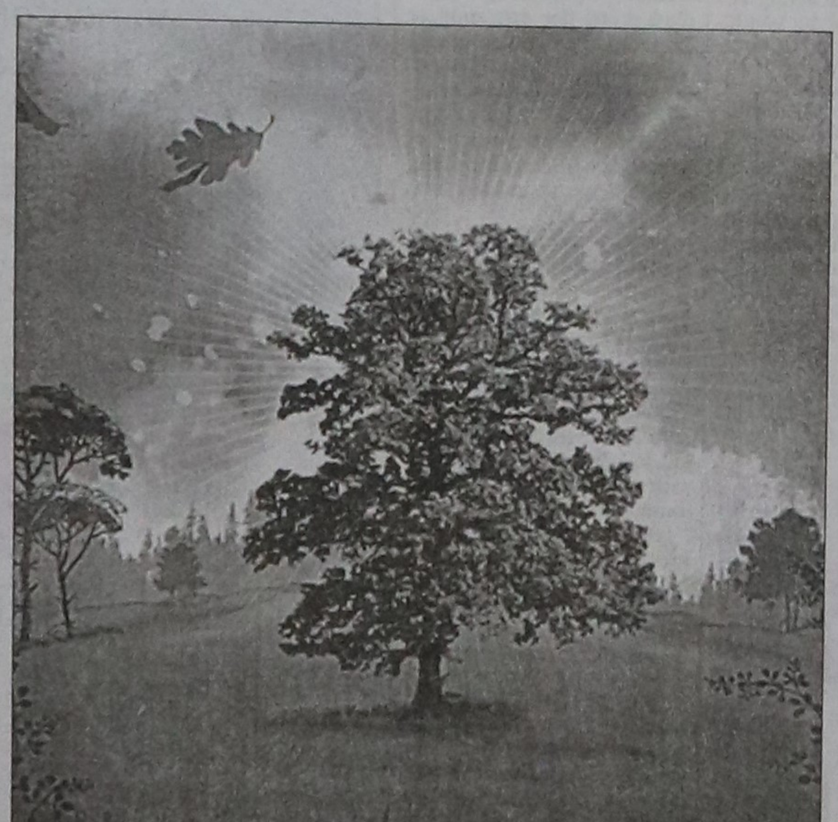
Working with CarboEurope and other networks collecting eddy flux data, AmeriFlux researchers have been able to piece together a global picture of the interactions between the greenhouse gas and natural landscapes. While biological differences between one kind of forest and another may mean that the rate of continued carbon uptake will vary, an important general principle holds true. "Across forest types globally," Law says, "we find that the amount of carbon stored is high in older forests, and that live carbon [the carbon in living wood] continues to accumulate for centuries."

But these findings are news to the foresters I know. All of them remember, from college textbooks, a graph of tree growth that shows young trees bulking up rapidly over the first few decades of their lives, reaching a peak at 60 years to 70 years. After that, growth rates drop off. This pattern, which indicates that the most profitable point at which to harvest timber comes before the trees reach a century of growth, is deeply ingrained forestry wisdom.

"Young trees 'eat' atmospheric carbon like teenagers devour pizza," wrote forester William Wade Keye in a recent opinion piece for the Sacramento Bee. "Mature trees store carbon, but does old growth capture more atmospheric CO2 than younger timber stands? No, it doesn't. Old forests have many ecological values, but they're essentially geriatric wards when it comes to their net growth."

Keye's argument ignores the importance of the large amounts of carbon held in the living wood and fertile soil of old forests. When such stands are cut, about a third of the carbon is captured in marketable timber; the rest is rapidly released into the atmosphere. Like most foresters, Keye appears unaware of recent studies by Law, Wofsy, and their colleagues. Eddy flux measurement, supplemented by careful accounting of the carbon absorbed and released from leaves, the live roots burgeoning beneath the soil, and the rotting detritus of the forest floor, reflects the life of forests in far greater detail than traditional forestry analyses, which are based on measuring only those trees that are large enough to produce marketable timber.

Today, market forces are intensifying the timber industry's impact on climate. "To compete with much cheaper supplies of fiber and wood from overseas, U.S. landowners have been harvesting more and more aggressively," says Laurie Wayburn, president of the Pacific Forest Trust, a nonprofit group based in San Francisco that focuses on conservation of privately held forests. "Pressure for timberland to deliver faster profits has transformed this industry from a long-term investment strategy for many owners to one that has to deliver an 18 percent to 20 percent return. The only way to accomplish that is through selling off land for development."



Inducing foresters and landowners to manage forests for their carbon value, as well as for their timber, will take a revolutionary shift in both mind set and economics. Eddy flux studies like Law's provide solid evidence that letting forests grow longer can lead to real climate benefits, but creating financial incentives to make that shift a reality is a complex proposition.

Ten years ago the Kyoto Protocol established a system for capping emissions of greenhouse gases, setting up a "cap and trade" carbon market. The basic idea is that governments limit the total amount of greenhouse gases that can be released, divvying up pollution rights among regulated industries. Those industries can then buy and sell carbon allowances. Over time the cap becomes more stringent, eventually leading to a significant overall drop in emissions. By 2006 the global market in carbon allowances, governed by Kyoto and the European Union Emissions Trading Scheme, had reached $30 billion, and it is growing rapidly.

Polluters who can't manage to reduce their own emissions can also compensate by buying a carbon emission reduction credit, or offset -- that is, paying for someone else to either lower emissions or increase CO2 capture. Sellers of offsets are supposed to meet strict standards that show their actions really are reducing the amount of atmospheric CO2 in a way that would not happen without the incentives offered by the carbon market.

Rewarding the conservation of forests is especially tricky, and the Kyoto -E.U. market did not create any way to do so, despite the alarm at the original Kyoto conference over the headlong destruction of tropical forests. The problem is that while power plant emissions are easy to measure, the market in forest carbon could easily become a shell game, with all-too-real CO2 emissions being traded for possibly illusory increases in forest carbon storage.

The idea of marketing the carbon held in tropical forests was much discussed at the United Nations Forum on Climate Change in Bali last December, and delegates floated several models. Some proposed allowing nongovernmental organizations, governments, or private entrepreneurs to develop conservation projects and to sell carbon offsets based on the deforestation they prevent. Others suggested creating a fund to provide incentives for forest protection without involving any trade of offsets for pollution allowances.

The boldest effort yet to create a viable carbon offset market for forests has been in California, where the California Air Resources Board (CARB) recently adopted a new forest protocol that aims to provide financial incentives for increasing carbon storage. The protocol is one of a series of new policies sparked by the California Global Warming Solutions Act of 2006, which mandates reduction of greenhouse gas emissions in the state to 1990 levels by the year 2020.

Wayburn, who helped shape the CARB forest protocol, says that it sets up "a standardized system that recognizes the climate value of standing forests for the first time globally." And Pacific Gas & Electric, California's major power supplier, offers its ratepayers the chance to pay a "Climate Smart" surcharge on their energy bills, which will go in part toward buying the carbon in living trees at van Eck.

Yet van Eck illustrates some of the pitfalls and limitations of the CARB scheme. The forest, which had been cut over in the 1950s, was bought in 1969 by New York investment banker Fred van Eck, who loved the woods and didn't need to milk them for money. The forest is now owned by a foundation set up in van Eck's will and managed under a conservation easement held by Wayburn's Pacific Forest Trust. Customers who pay for offsets at van Eck "are buying a product that has already been developed, delivered, registered, and certified," Wayburn says. "The carbon is already there on the ground."

Still, the architects of the CARB protocol hope to use examples like van Eck to grow a market in forest carbon that's strong enough to combat the pressures pushing development and overharvesting throughout the state and to set an example for the world. To ensure that offset projects provide a permanent increase in carbon uptake, the protocol demands that landowners set up conservation easements that prevent land from being sold for development. In terms of climate mitigation, that policy is essential, but many in the timber industry see it as a nonstarter.

Wofsy, however, sees hope in the idea of marketing forest carbon. He explains that older, larger timber is ultimately more valuable; the key is to compensate owners for the loss of short-term profits while they wait for their trees to grow.

Countering commerce in lumber with commerce in carbon may be part of the solution, but if so, it will be a winding way through the woods. Still, armed with their high-tech wizardry, Law and her colleagues have opened a new window into the intimate workings of forests. Their findings lay to rest the hoary notion that old-growth forests are worthless in the fight against global warming. On the contrary, they are an essential part of the struggle.

Source: Internet
Courtesy: Onearth
The above are excerpts from the original in the publication.