
POTENTIALITY OF REMOTE SENSING IN ENVIRONMENTAL RISK ASSESSMENT BASED ON GUIDELINES BY BANGLADESH BANK

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Abstract

Purpose- This paper proposes a thorough investigation of the impact of the potentiality of remote sensing in environmental risk assessment based on the guidelines of Bangladesh Banks. This study aims to explore the issues arising from any uncertain natural calamities which might be prevented through remote sensing by detailed examination in the banking venues in Bangladesh which might prevent immeasurable loss and also to conclude the necessity of remote sensing in the banking sector which might be a better alternative solution for prevention driving to added advantages.

Methodology- The study is qualitative in nature. For the study several literatures, Article and Websites were reviewed. The worth amount was reserved form the organizations conducting required tests and generating reports. The objective was to introduce Remote sensing in the sector of Banking and Financial organizations and the advantages of the method.

Findings- From the study the results were that for preliminary environmental assessment for financial institutions to evaluate lands or properties remote sensing can be an effective tool and method than ground survey. It is a cost-effective solution as well as less time consuming compared to the other tools and methods. As the central bank of Bangladesh issues a guideline where the financial institutions need to conduct environmental assessment before providing loans or finance. This tool and method can be effective for the financial institutions of Bangladesh.

Practical Implications- The identification of the role of remote sensing in financial institutions of Bangladesh for efficient preliminary environmental assessment which may guide the institutions to undertake their actions of providing loans or financing with reduced risk.

Originality- This study is the initial attempt to show the potentiality of remote sensing in the financial institutions of Bangladesh and the efficacy of the tool and method which can reduce the financing risks.

Keywords: Remote Sensing, Space-borne, Sensor, Environmental Assessment, Financial Institutions, Bangladesh bank, Ground survey.

Introduction

Remote sensing is that by estimating it's reflected and transmitted radiation a way off (normally from satellite or airplane) the technique for spotting and noticing the actual qualities of a

fragment. Exceptional gadgets gather distantly detected pictures, which assist analysts with getting data of things about the planet. Remote sensing is that process of data collection where an object or phenomenon does not come with physical contact with the device used and thus in contrast to on-site observation, especially the world. Remote sensing is employed in numerous fields amongst which commercial, economic, planning, and humanitarian applications are the sectors where the application is higher.[8] [9]. Conditions for accomplishing the natural control of different exercises are a significant component in securing and settling on precise choices. Remote sensing plays a significant part in giving the required geospatial data to information bases and in checking the whole surface of the Earth, which can be utilized unequivocally to identify or carry out an environmental risk assessment based on the target area in which the financial entity will be formed. Satellite remote sensing utilizes space-borne sensors, and it is a cutting-edge procedure that permits accomplishment of information in a deliberate manner and wide-going coverage. High temporal resolution between several minutes and several days, the three-dimensional resolution and the increasingly high precision of information are the main standards in choosing this type of data to perform environmental impact studies [25]. The results of remote sensing are near to accurate almost about 80% above. [16] The facts state that proper use of remote sensing can be a noteworthy example of modernization in the field of Banks and Financial Institutions.

As the environment of Bangladesh is significantly demeaning the main areas which are unbecoming are: Land, Water, Air, and Biodiversity. As Bangladesh is a disaster-prone country the disasters are creating impact on the environment every now and then. Bangladesh as a country is already a victim of vulnerable climate change. Bank of Bangladesh (Bangladesh Bank) has developed environmental risk assessment guidelines for banks / Financial Institutions where the problems regarding environment & unrests related with potential business activities projected for funding are checked. The evaluation is led for distinguishing proof, examination and to address the ecological dangers including the monetary outcomes emerging from these issues and worries with improvement of the credit hazard evaluation measure. Form the guideline and the parameters the banks / Financial Institutions would process the credits and financing. For environmental risk assessment the standards of Department of Environment. The banks / Financial Institutions should take into consideration of the reports of several environmental aspects like water quality, Hazardous materials, Climate impacts, Location of the land etc.

Literature Review

Remote sensing is the process of acquiring of information from a distance it could be 1cm to 1 million meters. NASA observes the Earth and other planetary bodies through satellites and aircraft which have various sensors which can collect data of the earth and planetary bodies by detection and recording energy reflected or emitted. Remote sensors, which provide a global perspective and a wealth of data about Earth systems, enable data-informed decision making based on the current and future state of our planet [26]. Remote sensing is the science of attaining the physical properties of an area without being there. It measures discharged and redirected radiation captured typically from sensors on airplanes, satellites, and drones. There are two types of remote sensing: Active remote sensing and Passive remote sensing [8][9].

Remote sensing is the science [and to some extent, art] of obtaining information about the Earth's surface without being in contact with it. This is done by monitoring and recording the energy reflected or emitted and processing, analysis and application of that data. In much of remote sensing, the procedure includes an interface between incident radiation and the targets of interest. This is illustrated using imaging systems [4].

Passive sensors respond to external stimuli, gathering radiation that is reflected or emitted by an object or the surrounding space, whereas Active sensors use internal stimuli to collect data, emitting energy to inspect objects and areas according to which a sensor measures the energy reflected from the targeted object. The remote sensing data gathered is then processed and analyzed with remote sensing hardware and computer software, which is available in a variety of proprietary and open-source applications. Remote sensing technology is used in a wide variety of disciplines including earth sciences, as well as military, intelligence, commercial, economic, planning etc. Remote sensing makes it likely to gather data from hazardous or unreachable areas, with growing relevance in recent society. It replaces slower, costly data collection on the ground, providing fast and repetitive coverage of extremely large areas for everyday applications, ranging from weather forecasts to reports on natural disasters or climate change. Remote sensing is also an unobstructed method, allowing users to collect data and perform data processing and analysis offsite without disturbing the target area or object [8][9].

Remote sensing is one of a broad range of geospatial technologies that have a growing influence in a wide range of fields, from trade to research to national administration. The field of remote sensing progressed from the analysis of aerial photographs to the analysis of satellite images, and from local area studies to global analyses, with advances in sensor system technologies and digital computing. Today remote sensor systems can provide data from all parts of the electromagnetic spectrum from the energy emitted, reflected, and/or transmitted. Examples of the applications of such data include population and demographic studies, archeological site studies, urban planning, enforcement of the environmental treaty and agricultural yields [22].

While remote sensing techniques have been viewed mostly as a means of collecting data which are then deduced by the user, they increasingly serve other roles in science and applied research. Distantly detected information on regular and anthropogenic highlights, for example, vegetation cover, land use, geology, and hydrography presently fill in as contribution to a scope of recreation models, including hydrologic, climatic, natural, and financial model. Remote sensing can be defined shortly as a process of collecting data without physical connection [1].

Methodology:

The paper is based on qualitative data. For the paper we reviewed several literatures, Article and Websites. The information was taken from the literature review and from those we created a comparison between lab and Remote Sensing. Then we also took the price menu form the organizations who conducts required tests and creates reports. The objective was to introduce Remote sensing in the sector of Banking and Financial organizations and the advantages of the method.

Bangladesh Bank Guidelines:

As the environment of Bangladesh is degrading significantly the main areas which is degrading are: Land, Water, Air, Biodiversity. As Bangladesh is a disaster-prone country the disasters are creating some impact on the environment. Bangladesh already is one of the most vulnerable countries to climate change. It will become even more vulnerable because of climate change and is expected to be one of the worst affected countries because of the impacts of climate change. Floods, tropical cyclones, storm surges and droughts are predicted to rise in frequency and intensity in the coming years. These will cause both human and property damage and impede economic development.

In the report of Bangladesh Bank it was mentioned that, "Banks/FIs in Bangladesh have to be compelled to defend their funding from the risks arising out of the deteriorating environmental situation and therefore the global climate change impacts. A baseline study on Banks'/Financial Institutions' exposure to environmental risks in disposal discovered that 98% of the Bank's prime management believed that environmental risks area unit being thought of however their Business Development Officers didn't think about environmental risk in their credit rating in follow. this is often a transparent indication that there's a large gap between perception and follow within the Banks/FIs. The study conjointly discovered the necessity for a efficient formal and uniform approach in order that all money establishments in Bangladesh move towards managing environmental risks in their operations. Failing to think about these environmental risks - as a vicinity of funding selections - can result in a rise in non-performing loans (NPLs) for Banks/FIs. Not solely ought to the receiver meet regulative needs, however, conjointly ought to the receiver assure that these risks area unit being effectively managed. By managing these risks, Banks/FIs will be playing an impactful and important role towards local and global sustainable development, by the management of these risks." [2]

Bank of Bangladesh has developed environmental risk assessment guidelines for banks / FIs where the environmental problems and concerns associated with possible business activities proposed for funding are checked. The assessment is conducted for identification, analysis and address the environmental risks and the financial consequences arising from these problems and concerns with enhancement of the credit risk appraisal process Form the guideline and the parameters the banks / FI's would process the credits and financing. For environmental risk assessment the standards of Department of Environment. The banks / FI's should take consideration of the reports of some environmental aspects like water quality, Hazardous materials, Climate impacts, Location of the land etc.

Remote sensing:

According to American Society for Photogrammetry and Remote Sensing (ASPRS) definition of remote sensing is, "the measurement or acquisition of information of some property of an object or phenomenon, by a recording device that is not in physical or intimate contact with the object or phenomenon under study" [13]. So, remote sensing means collecting information of an object from a distance without contacting that object. The object can be earth or any land or place of earth. In remote sensing what is mainly used is the analysis of the data collected remotely. It can be image or any sort of data which can be interpreted, and the information of the object can be

gained. The instruments which are used for remote sensing are multispectral and hyperspectral sensors, cameras, Radio Detection and Ranging (RADAR)sensors, and Light Detection and Ranging (LiDAR), any kind of aircraft either orbital or suborbital which has these on board can be used for remote sensing. Advantage of remote sensing is we can collect information without going to the place and data or information of remote places can be collected easily, and it will save time. About the distance how far it could be when remote sensing is being executed; well, it can be 1 cm to 1 million meters. [8][9] Remote sensing doesn't cause any kind of intervention to any place and data is collected systematically, due to this reason we can get information like longitude, latitude, altitude and physical characteristics of the object. [8][9] In this paper we are going to discuss about the suborbital and orbital collected data which is collecting data by aircrafts. Then the interpretation and analysis of data will give the results we want, or the outcome can be presented. For this we need the data and the software or platforms to process the data for analysis and making it presentable. There are many platforms and software for remote sensing the open-source software are: The Sentinel Toolbox, QGIS Semi-Automatic Classification Plugin (SCP), SAGA GIS: System for Automated Geoscientific Analyses, ORFEO Toolbox (OTB): Optical and Radar Federated Earth Observation etc. [19]. There is also licensed software like: ESRI GIS Software, ArcGIS Pro, ERDAS IMAGINE, Trimble Pathfinder Office, Terra Sync and GPS Correct etc. [21]. The data can be purchased from different agencies or data can be accessed free in some cases. Many agencies like United States Geological Survey (USGS), European Space Agency, National Aeronautical and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), Japan Aerospace Exploration Agency (JAXA) etc., agencies provide both free and paid data.[17] The problem with free data is it has some limitations where paid data has every property which can be used. The price of the images or data can differ depending on the properties.

Use of remote sensing in land cover monitoring:

Remote sensing can be used as a tool for landcover monitoring. By using the data either airborne or terrestrial we can conduct landcover assessment and monitor the landcover changes from the previous years if there is any change and if there is a database which can give recent data or Realtime data then the monitoring will be easy. There have been studies regarding landcover monitoring with remote sensing. Depending on the availability of Data we can monitor the landcover changes. In the study of Carlson, T. N., & Sanchez-Azofeifa, G. A. (1999) showed the land changes of San Jose´ and its surrounding areas by using remote sensing. For this study they used Landsat Thematic Mapper (TM) satellite images. Then they sorted them with 20% cloud coverage and georeferenced it.[5] NASA Mission to Planet Earth and the NASA Pathfinder Tropical Deforestation Project provided the data for this study. The data was taken of 7 years from 1991 to 1997. Advanced Very High-Resolution Radiometry (AVHRR) scenes were used for this study and those images were classified. The pixels were divided into 4 major parts: forest, crops, pasture and urban. Then a ground survey was done to validate the study. The study showed 91% accuracy on forest class. Later the AVHRR images the landcover change was related with changes of surface moisture and evapotranspiration. The result of the study says that it was able to detect the loss of forest and increase of crop lands and urban areas. They were able to point out the changes and if the area and the land is big enough then it can be done in the same process. In the study of Yuan, F. (2008) Mankato and North Mankato was taken as study area

and high-resolution aerial photographs, National Agricultural Imagery Programme (NAIP) colour digital orthophoto, and QuickBird satellite imagery were used to conduct the study which had data from 1971 -2003. Here four-pixel classification were done where it had forest, impervious surface, cropland/grass, and water. The accuracy overall was 91% where the data of 2003 were accurate as the remote sensing technologies got advanced with time.[28] It also showed the urban growth and decrease of other areas like forest, water and croplands or grasslands. Accurate and High-resolution data can be used for landcover monitoring. Not only that in “Remote sensing for environmental protection of the eastern Mediterranean rugged mountainous areas, Lebanon.” remote sensing was used for environmental protection where they mentioned remote sensing as quick, accurate and cheap [10]. It makes easy to access data of remote places where it takes a lot of time to collect data from the ground. Remote sensing helped to do the study on environmental protection of the eastern Mediterranean rugged mountainous areas in Lebanon. Then in the study of “Accuracy assessment of land use/land cover classification using remote sensing and GIS” the accuracy of the land use assessment was 81.7% where they studied a part of the province Limpopo in South Africa. [16] They classified the lands and made a map where the land was divided based on its land cover. The study showed accuracy of remote sensing on Landcover assessment. So, remote sensing has a potential of being used as a tool in terms of land cover assessment. For assessment of a land and environmental risk management we can see the past condition of the land and its surroundings also. There are many natural hazards which may affect the land or might cause damage to the land. The risk and exposure of the land towards natural hazards can be monitored by using remote sensing. The landcover change can show that there is any possibility of riverbank erosion or flooding, even the images can be used for flood risk mapping and it's very useful [3]

Water Quality Assessment:

Remote sensing can be a tool for assessment of water quality. In the study “A comprehensive review on water quality parameters estimation using remote sensing techniques. *Sensors*” [7] it was clearly shown that using remote sensing for water quality is efficient than in-situ water quality assessment. In the study how chlorophyll-a, Secchi Disk Depth, Temperature, Colored Dissolved Organic Matters, Total Organic Carbon, Dissolved Organic Carbon, Total Suspended Matters, Turbidity, Sea Surface Salinity, Total Phosphorus, Chemical Oxygen Demand (COD), Ortho-Phosphate, Biochemical Oxygen Demand, Electrical Conductivity, Ammonia Nitrogen can be measured using remote sensing was discussed. The process was effective and which sensor and which data are effective for measuring water quality was also showed. Other water quality parameters like PH, total nitrogen (TN), ammonia nitrogen (NH₃-N), nitrate nitrogen (NO₃-N), and dissolved phosphorus (DP), etc. were not measured due to weak optical characteristics and low signal noise. But it still covered a huge part of water quality assessment parameters. In the study of Essam Sharaf El Din turbidity, Total dissolved solids (TSS), Chemical Oxygen Demand (COD), Chemical Oxygen Demand (BOD), and Dissolved Oxygen (DO) was measured and they used latest data from Landsat 8 and used Artificial intelligence to assess the water quality and it was accurate highly. In the study of Dor, I., & Ben-Yosef, N. (1996). remote sensing was used for monitoring water quality of hypertrophic wastewater reservoirs. The study shows remote sensing can be used for water quality assessment. [6]

Use of Remote sensing in financial institutions around the world:

Remote sensing is being used in different financial institutions for assessments around the world. Even the Hedge funds is outperforming just because of the satellite images [30]. Swiss investment firm UBS Investment Research used satellite images to do the assessment of the occupancy of parking lots of Walmart and in recent years insights regarding any area are easily accessible and faster due to the increasing number of satellites being commissioned in the space, which is making the work of fund managers easy to gain information to stay ahead of others [30]. Satellite images can play role in showing the macroeconomic activity, as Example in China Space know a New York based company collected the satellite images of China and observed 6000 and observed 6000 economic sites and the result was that in the first 3 months of 2020 China saw a downfall in the economy due to COVID-19 outbreak and it was observed easily because of the satellite images where it was found that the pollution got less due to the least economic activity and it explains the downfall of the GDP which indicates that we can do assessment easily and faster [30]. For being cost effective for environment and natural resources assessment remote sensing is being used in different countries, it has a great potential for developing countries where they have incomplete or out of date maps and data regarding natural resources and environment, which leads to complications in development project planning and design where remote sensing is filling the gap now as many agencies like United nations are giving free access to the satellite data to the developing countries. [31]. China being the producer and launching highest numbers of satellites is using remote sensing to observe their economic activities and agricultural activities, remote sensing and related technologies have targeted the finance sector as major target where Remote sensing and artificial intelligence is being used to help finance companies to make decisions regarding credit, pricing, evaluation etc. [32] China is using remote sensing as a tool for boosting economic activities and trying to meet the economic gap between urban and rural areas, not only remote sensing is being used in the section of industry and agriculture also for startup development and funding assessment where remote sensing is getting cheaper and are more accurate. [32] If have a look on the present performance budget what we will see is it's trend based where there are less information in growth trends and ground truth verification which is creating a blind spot for the banks where they can invest for future potentiality, if we see the agricultural banking then what we can do is we can assess the land and it's production and from there we can decide where or whom to fund, then for industrial finance we can look at the business or industry location it's potentiality and others, for infrastructure finance we can make see the development progress and with 3D satellite images we can see the progress or assess the land if it's suitable for the structure or check the information of previous assessment. [33] For Financial Inclusion remote sensing is gaining importance as data being available, better machines are available, remote sensing being affordable and lastly reduction in marginal costs of financial inclusion [34]

Benefits of using remote sensing in environmental risk assessment:

A cost comparison of lab test and Remote sensing is given below:

Test No.	Name of the test	Cost	
		Lab (BUET Lab cost) (23)	Remote sensing (SPARRSO) (29)
1.	Climate change impact Monitor	Not Possible/ Previous physical survey data from Government office	Free – 2,00,000 BDT (Considering 24 hours multiple operators of SPARRSO)
2.	Land Location /Site	Not Possible /Previous physical survey data from Government office	
3.	Waste water assessment	1,50,000-2,00,000 BDT	
4.	Digital Land Survey	90,000-1,20,000 BDT	

Table 1: Cost comparison between lab test and remote sensing (BUET and SPARRSO costs) (23,29)

Remote sensing has some benefits those are:

- Land assessment can be done without going to a location.
- Wide area and repetitive coverage
- Faster, efficient and convenient
- Computer, software, data and knowledge is enough to do the assessment
- Can be used as proofing tool of the physically collected data
- Near Real-time monitor is possible (Depends on the availability of the data)
- Less chances of Data tempering.
- Cheaper than traditional methods

Conclusion:

Bangladesh is county with higher risk of climate change and natural hazards for this financing in several business needs environment assessment and thus the central bank of Bangladesh set a guideline for assessment for environmental risk assessment. Because the finance might come out nonperforming due to the environmental impacts. Using traditional ways to assess the environmental risks particularly land location, water quality, hazardous materials, land history etc. might take time and be costly if the Banks or financial institutions go for investigation but remote sensing is a process which can be effective as it uses satellite images and it cannot be manipulated and the accuracy is high, the cost is less than the lab tests and it can be done without going to the place or location. Additional time for traveling and collection of data will be saved, and previous data can be found by which previous climatic impacts can be assessed and history can also be available. Loss of water body and vegetation can be monitored which will help in analysis of environmental impacts also it can be helpful in the investment decisions. There are several models based on which might be helpful for assessment of the environment and impact.

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