

Article

Comparative Study of Various Fire Detecting Sensors for Sustainable Forest

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A B S T R A C T

Forests are one of the main resources on condition that by the nature. Forests are cut down to make space for building and other structures. Increase in global warming, Ice melting in the North Pole, forest fires. These are all caused due to ignorance of natural order. And to prevent further disasters, measures for sustainable environment should be taken.

This research paper intends to explore and study detection of forest fires using MODIS, SEVIRI and microwave radiometer sensors which will drive to manage and prevent forest fire which will lead to sustainability in forest management.

Keywords: Forest Sustainability, Fire Detection, Satellite Imagery, Modis, Sevir, Microwave Radiometer

Introduction

Importance of Forest

Forest play an advantageous role in local, national and global level. Some of these benefits be contingent upon the forest being unharmed or minimum interference is done with forest. Other benefits are by utilizing wood and other resources of the forest.

Wood is one of the most versatile products used by humans. Wood is found in everyday products such as timber, newspaper, furniture, cardboard etc. As a construction substantial, wood is strong, light and a durable substantial and also has insulating properties. And unlike the alternatives such as bricks, concrete, plastics and metals, wood takes less energy for transport and is biodegradable and the final products are renewable.

Forests are chiefly remained seen as a wood- producing unit and other products are considered as minor forest products and their provisions were considered as low priority. It is now flattering acknowledged that other forest products recognized as economically and communally

significant may be the key to active involvement of people in forest management. Example of non-wood forest products are plants for food and medicine, fibers, animal fodder, and other necessities. Some of these products are also commercially imperative at a local level. A number of goods are also an export commodity for instance gums and resins, bamboo, oils, honey, spices, etc.

Many people dwell in the forests and woodlands. Individuals comprise persons who are mentioned to as tribal people, persons who have lately enthused there who are mentioned to as settlers and folks that alive share time in the forest who effort as small-scale loggers or harvest forest products.

Forests also have a significant role in protecting the setting. The tree roots bind the soil and protect it against erosion and landslide. Throughout spring, the forests assistance normalize the rate at which the snow dissolves and decrease the danger of avalanche. At local levels, the trees make available defense in contradiction of wind erosion. Forest helps to increase the rate at which rainwater penetrates and renews the groundwater. In coastal areas, mangroves

keep the land from corrosion by the sea and make available breeding grounds for fish and shrimps.

Forests too consume a progressively imperative role for wildlife and for the protection of in danger of extinction plants and animals' species. Forest helps in biodiversity and genetic resources. The term "genetic resources" refers to monetary, technical and social value of the genetic variation in species.

Forests assistance in adaptable the temperature of the environment. The amount of greenhouse gases is meaningfully cumulative mainly due to sweltering of fossil fuels. Reforestation is recommended as events of countering the increase of greenhouse gases in the troposphere since trees engage carbon dioxide through photosynthesis.¹

Importance of Sustainable Forest Management

Improved pressure on forest resources of the country over the last few decades has vulnerable the livelihoods of masses of forest-dwellers and other poor persons quick in the vicinity of the forests. Forest resources consume imperative for the affluence of any nation and its communities. They are an indispensable natural resource as long as multiple welfares to people as well other authoritative functions.

Such as biodiversity preservation, global carbon packing and a warehouse for upcoming option standards. The rich and the poor alike are in need of on forest resources, straight or circuitously, and forestry in countless unindustrialized countries, as well as India is likewise understood as an incomes for eliminating rural poverty and attaining sustainable expansion. The compression on current forest resources is huge in India. Consuming only 2.5% of the world's geographic area and 1.85% of the world's forest area, we have 17% of the world's population and 18% of cattle population.

In this background, it is authoritative to reservation the forests and manage them sustainably, so as to safeguard secure livelihood of the forest- reliant on communities as well as preserving our biological diversity.

Lately, as a moment of cumulative public consciousness and numerous treaties and agreements all over the world, there is a movement towards accepting only those forest products which have originated from sustainably managed forests. It has emerged as a market-based mechanism in support of sustainable forest management.

Authorization and eco-labelling are such new machineries attractive forest-product positioning for a best price on the one hand, and ensuring healthier management performs for forests on the other.²

One of the main glitches faced by forest these days is forest fire. Methods are increasing and additional and healthier

substantial and work force are being practical to ace forest fires, however the condition itself has not so much altered particularly all complete the ages. Woods fires have existed here since boundless junctures.

The undergrowth tolerates, yet is rarely totally demolished; it recovers over in everywhere two years. The local verdure has become conversant with the flames and replies appropriately. Pine trees and sweet-smelling plants, for example, rosemary and basil, and heather and floor brushes flourish here usually. Each one of these plants have solid roots and not many leaves and two extra even potentials: They recover quickly and are, unpardonably, moreover truly flammable.

It would be vastly better-quality to plant different trees, for instance stopper oaks, olives or almond trees, as were basic when there was more horticulture in our general vicinity. The leaves of these trees are juicier and don't consume as effectively. More fireproof trees would not forestall every single woodland fire however would decrease their number and the region expended.

These trees likewise cost supplementary than pine trees and develop gradually. In this manner the government must choose on the off chance that they wish to contribute subsidizes now for the future, or spend less, presently, and pause and burn through cash on putting out fires and rebuilding.

The risk proceeds after the fire: the ground, without plants to settle it is defenseless to being washed away by water, particularly on steeply inclined regions. Luckily, the stayed underground roots help to keep the dirt steady, much after a major fire; even dead roots are as yet ready to hold a portion of the earth. However, the best assurance against soil disintegration is thick sound vegetation. In a specific sense, be that as it may, only just in this sense, backwoods fires are valuable for the nature of the earth. After a fire the presentation of consumed wood adds various mineral materials to the dirt.

A fire additionally significantly impacts the lives of creatures. Creepy crawlies are the first to lose their lives to warmth and smoke. Likewise, eggs, which were laid in trees, and so on are obliterated. Winged creatures can spare themselves and most different creatures have a risk cautioning framework and are normally ready to relocate away from the threat to a protected zone.

They look for another living space and may choose to come back to the risk territory when there are suitable conditions for their prosperity. That may take numerous years. Pines need around 5 years to arrive at a size that can give security to the animals. A fire can, in any case, be so fast and spread over such a huge region that creatures are surrounded and they die.³

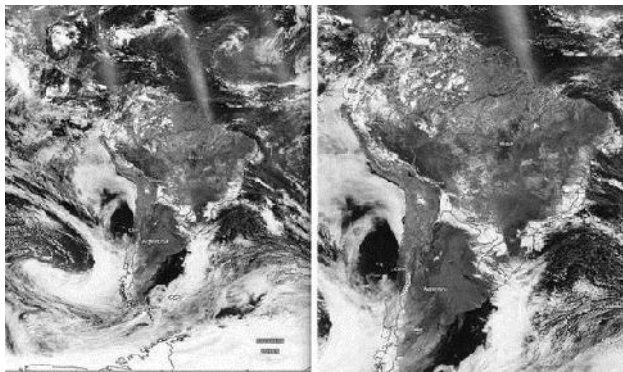


Figure 1. Satellite images of the Amazon fires in Brazil

Literature Review

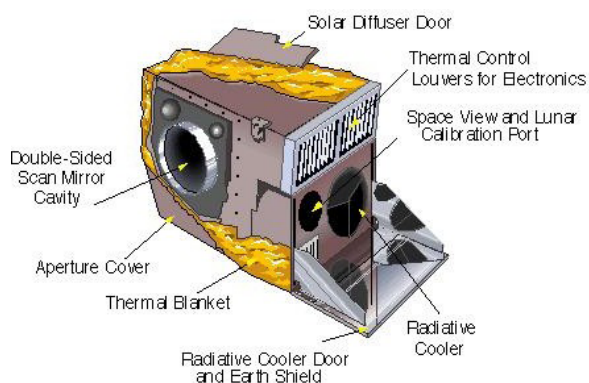


Figure 2. MODIS sensor

In the paper,⁴ satellite-based fire explanations and ground based lightning detections were cooperative to classify lightning strikes which reason forest fires. The lightning data from the government was collected to estimate the location and timing of lightning strikes. MODIS sensor is used particularly for ecosystem monitoring including fire detection were used. The technique was found to be accomplishment decently well in distinguishing expansive scale spatiotemporal examples of lightning fire movement in the conterminous United States regardless of the intrinsic restrictions that rise up out of the idea of MODIS dynamic fire info.

Given the worldwide inclusion of MODIS information, combined with the accessibility of lightning location organizes in different areas of the world it might be conceivable to direct this examination in other countries attempts too. In regions with lacking information about lightning fire movement, and in remote regions where flames consume without human intercession (or even identification), this methodology could give a premise to building a fire record in lieu of ground-based fire reports. Results from such examinations could encourage extra investigations to improve our comprehension of the climatic main thrusts behind wide scale lightning fire action.

In the paper,⁵ initially proposed for the SAT- TV showcase,

are appropriate for the acknowledgment of 12-GHz microwave radiometers. These radiometers have enough affectability to recognize fires with filling factor beneath 1%, and, misusing a constant clamor including adjustment, great increase security can be effectively acquired. Subsequently, the instrument can dependably work at encompassing temperature, therefore sparing the electrical force required by a warm control unit to balance out the recipient temperature.

The segments cost of the acknowledged model (counting additionally the costly accuracy clamor source) is about \$1800 and can be diminished with an appropriate building of the framework. Real fire tests have been completed both in the lab and open-space conditions.

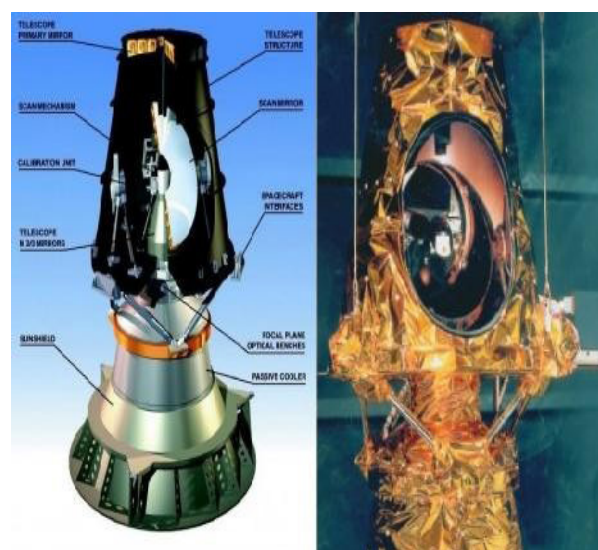


Figure 3. SEVIRI Sensor

From the deliberate information, the reality rises that the significant commitment to the microwave emanation of a wooden fire is because of the coals. Last, the understanding between trial outcomes and filling-factor recreations suggests that such a model can viably be utilized to anticipate the exhibition of microwave radiometer frameworks as forest fire sensors.

The paper⁶ completed an examination of the utilization of SEVIRI pictures to the early discovery of flames in the Mediterranean districts. As per fire-fighting organizations, a satellite-based fire-identification framework can be measured operationally helpful for Mediterranean nations when fires with a base degree of 1500 m² can be recognized with a fleeting goal of 30 min. Indeed, such a framework ought to have the option to identify fires at their first stage when it is conceivable to smother them all the more effectively.

The Centro di Ricerca Progetto San Marco has been breaking down for quite a long while the probability of utilizing pictures procured by the Spinning Enhanced Visible and

Infrared Imager sensor locally available the geostationary satellite Meteosat Second Generation for this reason. Another preparing approach abusing the expansion in both spatial and fleeting goals (15 min) as for past meteosat frameworks is depicted in this paper. The thought depends on the utilization of a change- location method to augment the papers abilities of the framework regardless of its restricted spatial goals.⁷⁻¹¹

This procedure comprises of looking at least two pictures obtained at 15-min interims, for which any temperature change can be ascribed to quick powerful marvels, for example, fires, when characteristic changes are displayed and expelled. An appraisal of the exhibitions of this calculation is done contrasting its outcomes and the report made accessible by Italian fire-fighting organizations and with fire items dependent on higher goals sensors, for example, the Moderate Resolution Imaging Spectroradiometer.¹²

Comparative Study

In this paper, we have studied and compared the sensors used to detect forest fires. In paper,⁴ MODIS was used and an algorithm was developed to detect forest fires caused by lightning whereas in paper⁵ a low-cost noise adding radio wave meter was used to detect forest fires and in paper,⁶ a SEVIRI sensor was used for early detection. In,⁴ fires more than 0.4km² was considered.

In paper,⁵ the microwave radiometer was able to detect fire of 0.2 m² placed at a distance of about 30 m from the antenna. In paper⁶ fires with a minimum extent of 1500 m² could be noticed with a temporal resolution of 30 min which is early stage of forest fire. In⁴ and ⁶, the sensors were used on a satellite and in,⁵ two operational cases were studied where first one being building towers and second being sensor used with UAV.

The disadvantage of using MODIS is that it cannot detect fires from cloud covers and it fails to detect small fires. In paper [6], example of real-time forest fire detection is shown where MODIS failed to detect the forest fires but SEVIRI images showed fires in early stage. In paper [5], the given operational cases are to use multiple towers which form a network or to use unmanned aircraft vehicle or UAVs but the problem with towers is that it will create more pixels of the same image and more time is needed to create the image and problem with UAV is that it cannot continuously scan the area. Hence, using SEVIRI would be the better option for early detection of forest fire.¹³⁻¹⁵

Conclusion

In this paper, we studied and compared various sensors for detection of forest fire. The best sensor to detect forest fire is to use SEVIRI sensor images as it showed fires in early stage which in turn will lead to forest sustainability.

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