Sentinel Asia

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The APRSAF was established in 1993, in response to the declaration adopted by the Asia-Pacific International Space Year Conference (APIC) in 1992, to enhance the development of each country's space program and to exchange views toward future cooperation in space activities in the Asia-Pacific region. APRSAF was originally designed to provide opportunities for regional space agencies and associated governmental bodies to exchange technical views, opinions and information on national space programs and space resources.

According to UN statistics, the Asia and Oceania region has the largest proportion of natural disasters in the world. Even before the recent Indian Ocean Tsunami and earthquakes in India and Pakistan, compounded by its high levels of population (close to 3 Billion), the region has more than 50% of the global fatalities associated with such disasters.

In view of these circumstances, the APRSAF proposed a new project called "Sentinel Asia" in 2004, to showcase the value and impact of earth observation technologies, combined with near real-time internet dissemination methods and Web-GIS mapping tools for the disaster management support in the Asia-Pacific region. Its aims are:

- To improve safety in society using ICT and space technology
- To improve the speed and accuracy of disaster preparedness and early warning
- To minimize victims and social/economic losses

Concept of Sentinel Asia

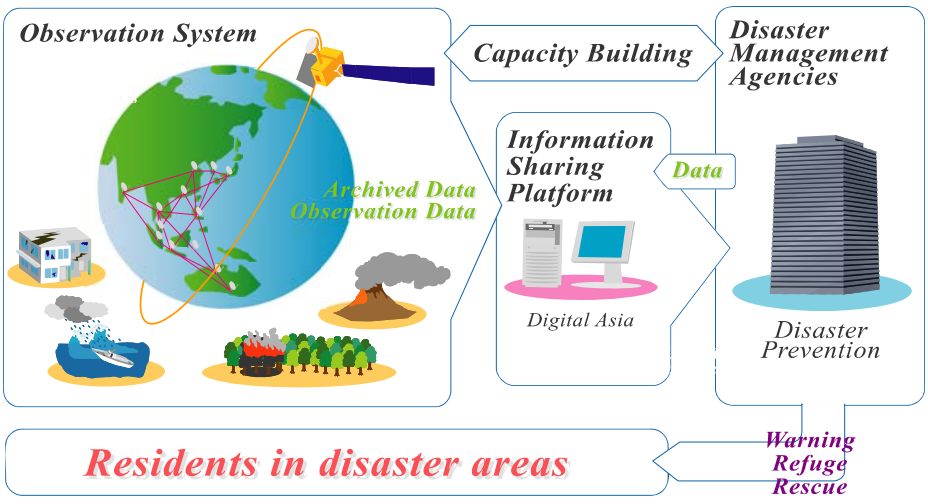

Fig 1 Concept of Sentinel Asia

Main activities of Sentinel Asia are as follows:

- Emergency observation by earth observation satellites in case of major disasters
- Acceptance of observation requests
- Wildfire monitoring and Flood monitoring
- Capacity building for utilization of satellite images for disaster managemen

Operations of Sentinel Asia have been commenced since October 2006 by opening its Web site. (http://dmss.tksc.jaxa.jp/sentinel)

Approach of Sentinel Asia is as follows:

(1) Contribution to Disaster Management:
Sentinel-Asia is "voluntary initiative" led by the APRSAF to share the disaster information in the Asia-Pacific region to make the best use of earth observation satellites data for disaster management in the Asia-Pacific region by applying remote sensing technology, GIS technology, and ICT. The concept of Sentinel Asia is shown in Fig 1.

(2) Cooperation among existing Communities:
Sentinel Asia is promoted under cooperation among the following four communities as shown in Fig 2: Space Community (APRSAF); International Community (UNESCAP, ASEAN and AIT etc.); Disaster Reduction Community (Asian Disaster Reduction Center and its member countries); and Digital Asia Community (Keio University etc.) . To support the implementation of the Sentinel Asia project, a "Joint Project Team (JPT)" was

(3) Step-by-step Approach:
A step-by-step approach for implementation of this system has been adopted as follows:
Step 1: Implementation of the backbone Sentinel Asia system as a pilot project, to showcase the value and impact of the technology using standard Internet dissemination systems (2006-2007)
Step 2: Expansion of the system with new satellite communication systems (2008-2012)
Step 3: Establishment of a comprehensive disaster management support system (2013 and onwards)

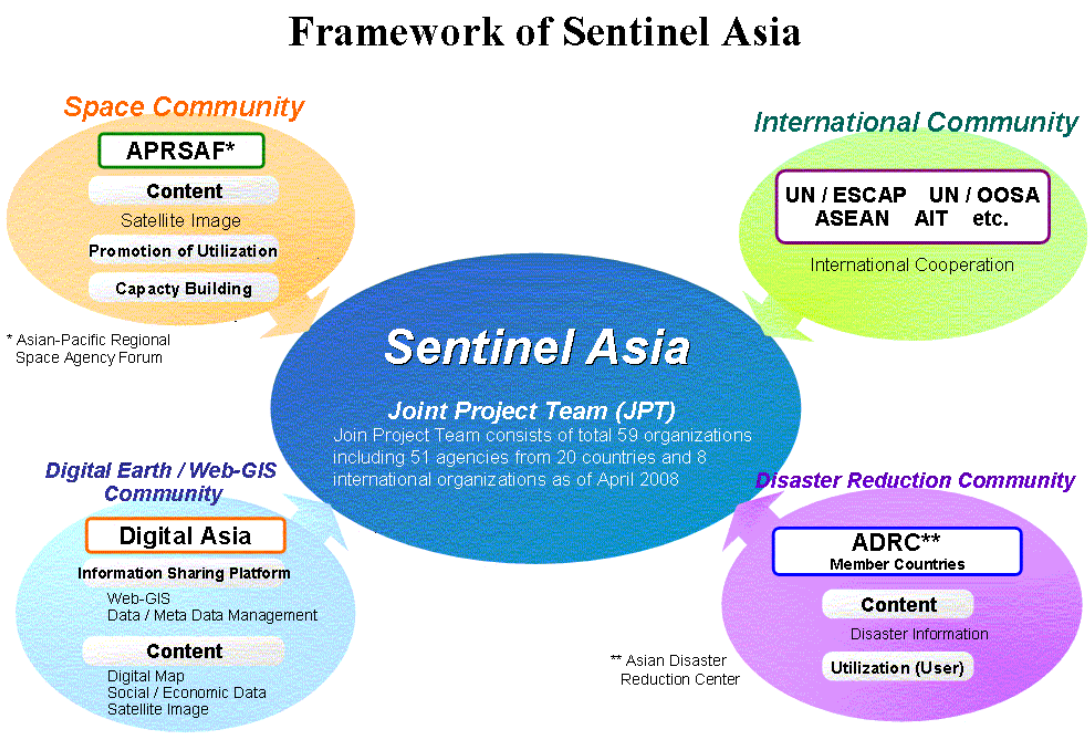

Fig 2 Framework of Sentinel Asia

Overview of Sentinel Asia Wild Fire Initiative

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Introduction In 2005, Sentinel Asia activity was authorized at the APRSAF Meeting in Japan as to mitigate natural disasters in Asian Countries. Before the establishment of Sentinel Asia, JAXA conducted the survey among Asian counties about the required disasters to be mitigated by means of satellite technology. Large scale earthquake, volcanic eruption and Tsunami are excluded out from target disasters because of unpredictability of these natural hazards. Countermeasures to these disasters are difficult its unpredictable nature. Two disasters, those are wild fire and flood, were selected to be major objectives for mitigation programs. Then two working groups were set up in Sentinel Asia Program. One of these working groups, wild fire working group is functioned as Sentinel Asia Wild Fire Initiative. During initial period of activity called Step1 for two years, wild fire Initiative members conducted substantially important activity as to initiate the full operation in next Step2. In this paper, author reports the main activity of this working group and perspective to next Step2.

The concept of wild fire control is shown in Fig.1.

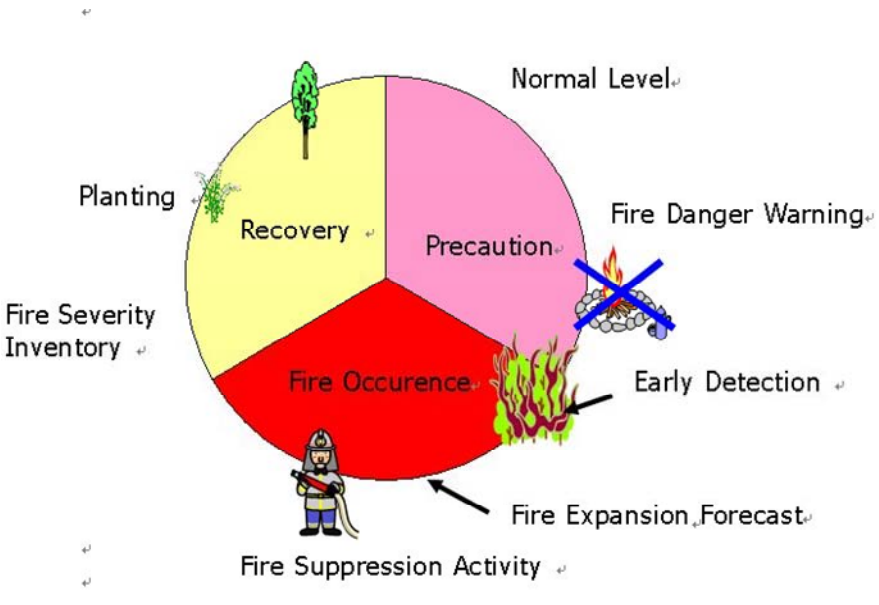

Fig 1 Concept of wild fire control initiative

In the most of Asian forested regions there is a distinctive cycle of rainy and dry seasons. The high numbers of large fire tends to occur in dry season. It is important for public to provide early fire

danger warning. Our activity may develop the fire danger index based upon current weather condition and fuel condition in the forest. However once fire occurs in some location, the earliest detection of fire occurrence by Satellite is also important. The initiative will develop the hot spot detection algorithm. Once fire site is detected , the fire expansion forecast will be done in real time. The most effective fire site information will be directly sent to the local fire fighting agency. The post fire remediation is also planned based on appropriate burnt information obtained by Satellite data. From the normal stage to fire occurrence and post fire treatment, tactical information for fire suppression is generated in real time manner using Satellite data.

Validation Campaign in 2206 and 2007 One of the key technology is the earliest fire detection by MODIS data. The conventional detection algorithm was developed by NASA termed as MOD14. In some case of fire occurrence in Asian forest, false alarms are frequently picked up. These false alarms mainly arouse due to in appropriate threshold temperature in the algorithm. Our team conducted validation field campaign in Kalimantan Indonesia, northern Thailand and Mongolia. Local fire fighting team made the field record reports of fire occurrence with GIS data. At the same time, several MODIS receiving stations such as AIT, Lapan and CRISP generated hot spot mapping. The ground truth data were compared with hot spot distribution map. Based on these analyses, our Initiative has developed improved hot spot detection algorithm.

Fire Expansion Forecast Information Geographical information of detected hot spot is input to the numerical analysis for fire expansion fore cast. In addition to hot spot location, current weather data, topographical information and vegetation information are used for numerical analysis. Forecasted fire information will be transmitted through Data Communication Satellite (WINDS) or other conventional telephone system to directly the local fire fighting agencies. In coming phase, we attempt to establish the overall system for better wild fire control operation. The ideal system of operation is shown in Fig 2.

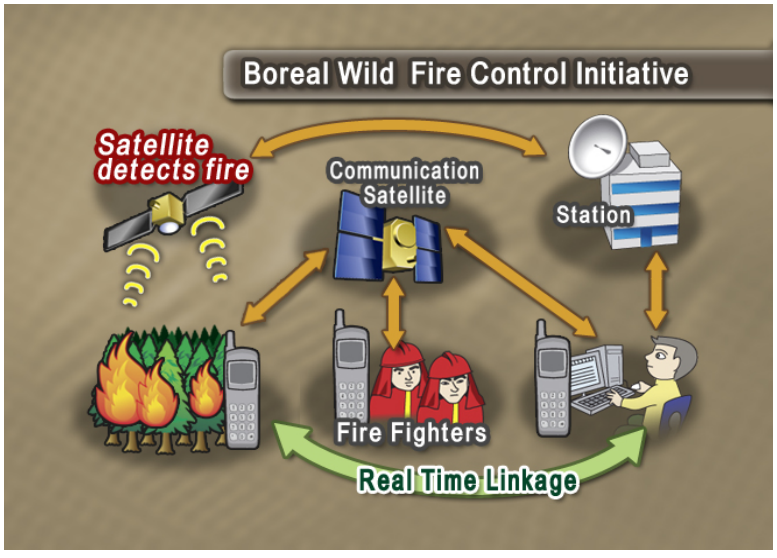

Fig.2 Operational Goal of Sentinel Asia Wild Fire Initiative

Space Applications of JAXA contribute to Earth

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Japan Aerospace Exploration Agency (JAXA) has started new 5-years term since this year, and Space Application Mission Directorate has been reorganized on April 1. It means JAXA seeks to focus on mission oriented activities rather than technology driven activities.

Space Application Mission Directorate of JAXA has three mission programs as follows.

- Environment monitoring program
- Disaster monitoring and satellite communication program
- Positioning application program

Particularly, earth observation activities have been enhanced as environment-monitoring and disaster-monitoring, and so promoted contribution to climate changes including water cycle variation, global warming and carbon cycle change, and mitigation and prevention of disasters.

Fig.1 shows these activities as for earth observation.

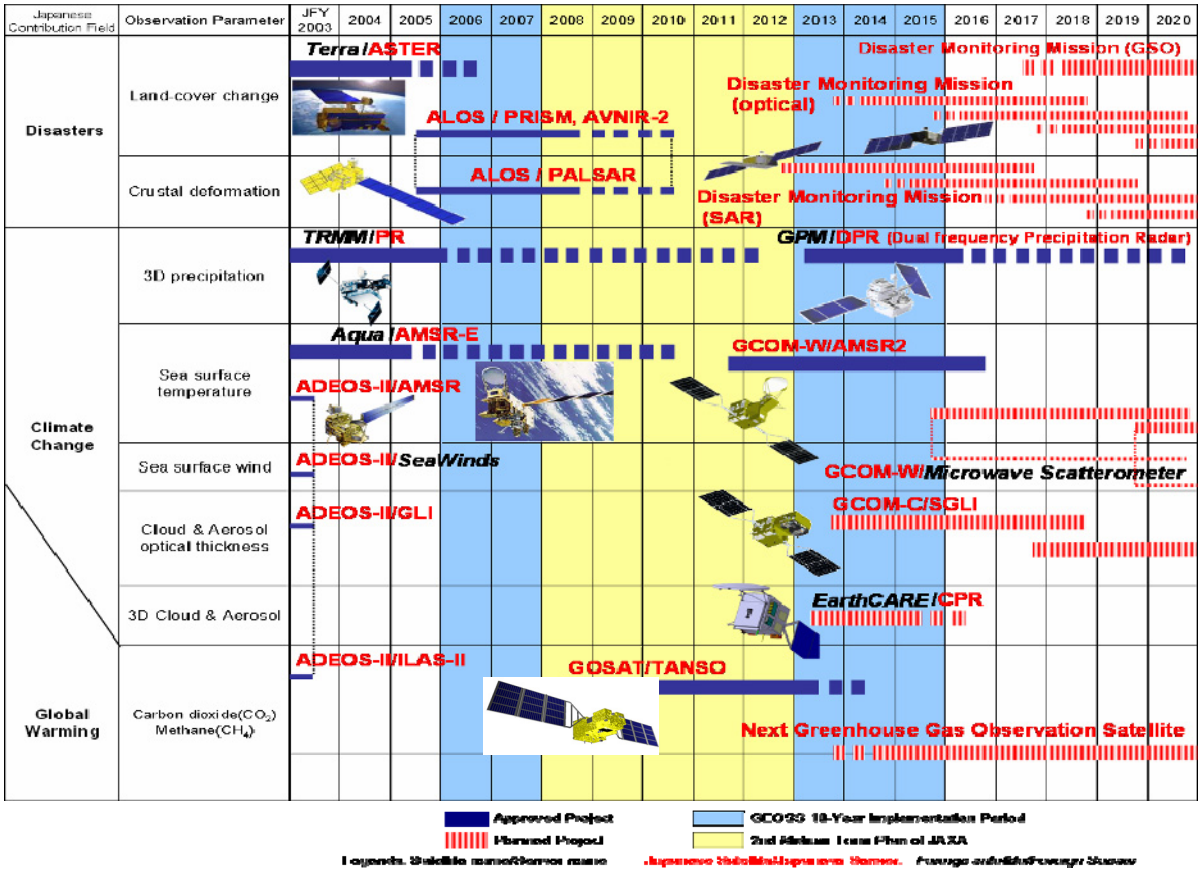

Fig.1 JAXA's long term plan as for earth observation

The Global Change Observation Mission, specifically GCOM-W and GCOM-C, will investigate climate changes including water cycle variation. Water characteristics measurement has been

conducted primarily by AMSR-E on AQUA, and will be continued by GCOM-W. In addition, cloud cover will be measured by optical sensor on GCOM-C. And, this optical sensor will have characteristics comparable to MODIS on TERRA/AQUA, so will be expected to contribute to monitoring wild fire.

The Global Precipitation Measurement mission, so called GPM, will observe the three-dimensional structure of precipitation as TRMM follow-on. This measurement mission is a joint cooperative between JAXA and NASA, JAXA will provide a high-performance dual-frequency precipitation radar, and NASA will provide a spacecraft-bus, likely as TRMM mission.

EarthCARE, which is also investigating climate change including water cycle variation and cloud dynamics, is a joint project with European Space Agency (ESA). JAXA provide a Cloud Profiling Radar.

GOSAT, greenhouse gas observation satellite, is now under integration test, and will be launched by H-IIA launch vehicle in this winter, and contribute to understanding global warming and carbon cycle mechanism.

Besides above constructing mission, JAXA has operated Advanced Land Observation Satellite : ALOS (Daichi) successfully since 2006. ALOS collects precise land data not only for 1/25,000 scale global map cartography, but also for regional observation, disaster monitoring, and resource surveying. Especially, JAXA recently highlights disaster monitoring and forest monitoring. As for disaster monitoring activities, providing observation data to Sentinel Asia regional disaster monitoring system, and to international Charter global disaster monitoring system. For forest monitoring, L-band synthetic aperture radar of ALOS playing an important roll, because of its unique wave-length.

Otherwise, data transmission and communication technology must be advanced and robust as mission data increasingly, so, JAXA has developed mobile communication satellite and wideband communication satellite.

Former, ETS-VIII(Kiku-8) geostationary satellite has large antenna for communication between handheld terminals via satellite is now under operation. Latter, WINDS(Kizuna) geostationary satellite has 1.2Gbps ultra high speed communication link launched on February, 2008. Sentinel Asia will adopt WINDS for improvement internet condition.

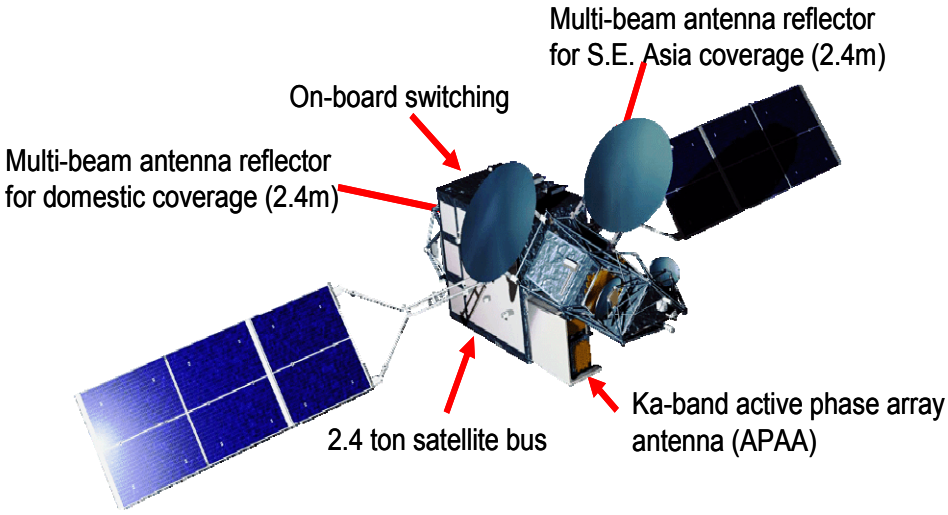

Fig.2 WINDS Satellite External View

Forest Fire Control Activities in Thailand

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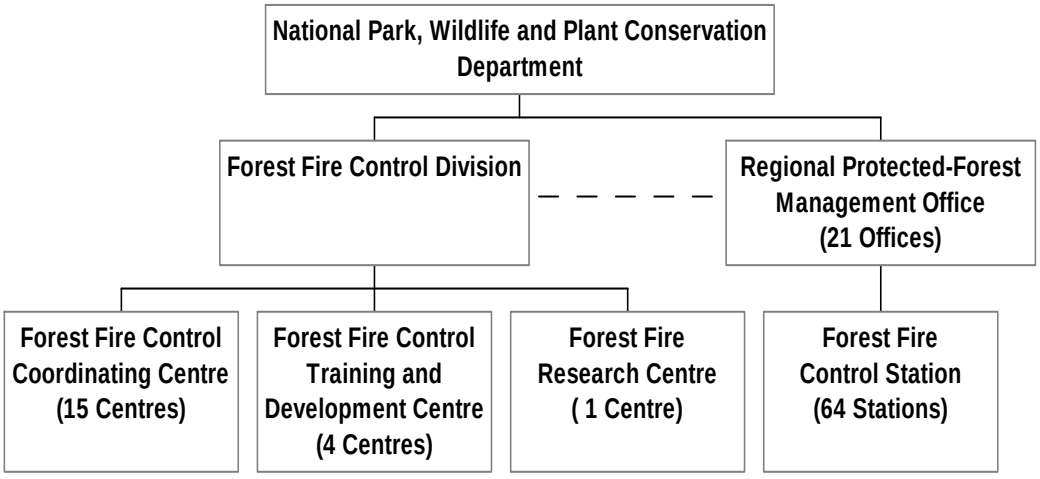
Second only to deforestation, fire plays the most destructive role in the forest ecosystem in Thailand which results in not only drastic deterioration of the environment but also jeopardy to life, health and properties of people

Forest fires in Thailand are mainly classified as surface fires, mostly taking place in Mixed Deciduous Forest, Dry Dipterocarp Forest, Secondary Growth and Forest Plantations, and to some extent into Peat Swamp Forest, Dry Evergreen Forest, Hill Evergreen Forest or event in some parts of the Tropical Rain Forest. All fires are caused by human activities such as gathering of forest non-timber products, agricultural debris burning, incendiary fire, hunting and carelessness. Statistically, about 19,000 ha of forests is affected by fire annually.

The Forest Fire Control Division under the National Park, Wildlife and Plant Conservation Department, Ministry of Natural Resources and Environment is the main agency dealing with forest fire nationwide. The activities includes fire prevention campaign, fire detection and monitoring, fuel management, fire volunteer training, fire suppression and research. Regarding fire detection, multiple system is utilized including ground patrol, look-out tower, and air patrol by helicopter. Hotspot information is recently use as back-up information and monitoring of the situation



Forest fire situation and main study activities in South Korea

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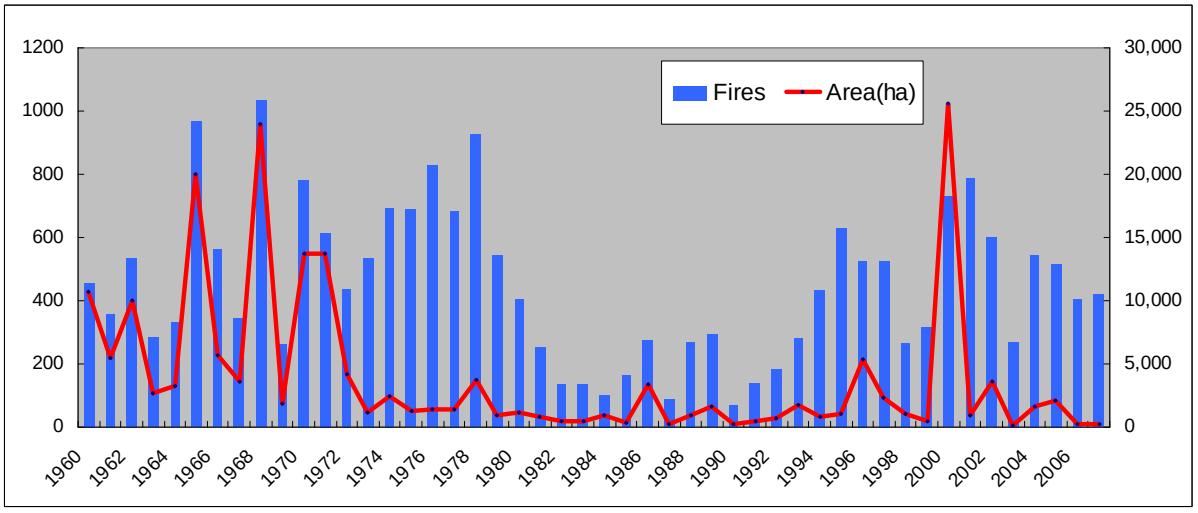
Throughout South Korea from 1998 to 2007, there were 485 mean annual forest fires and 3,714 ha of mean annual burned area. The maximum forest fires year was 2001, with 785 forest fires, and the minimum year was 1998 with 265 forest fires. The year with the largest burned area was 2000, with 25,607 ha burned when several forest fires occurred simultaneously in the East Coast region. The year with the smallest burned area was 2003, when only 133 ha burned . The statistics of the resent 3 years (2005~2007) showed that both fires and burned area decreased in relation to the last 10 years with 8%, and 77%, respectively.



Despite the mean annual precipitation of 1,000~1,500mm, most of the seasons except summer are rather dry because of the monsoonal climate with 50~60% of the precipitation concentrated during summer. About 65% of forest fires occurred during the dry season of 3 consecutive months, March through May. In this reason, forest fire precautionary periods were set up from 1st February to 15th May and 1st November to 15th December.

Most forest fires in Korea are known to be caused by human activities. Only 5 fires were ignited by lighting in 1997, 2005, and 2006. Main fire causes were carelessness, weed burning, and tobacco with 43%, 19%, and 12%, respectively.

Once fire starts, the forest fire authorities take action of immediate suppression to protect human lives, and properties. Thanks to this policy, the mean suppression time per fire reached 121 minutes and burned area per fire was 7.7ha.

For the quick extinguishment, South Korea has the many kinds of suppression resources such as helicopters, fire engines, and firefighters etc. The most powerful resource was the helicopter which attacks the head fire. On the other hand, firefighters extinguish the flank or back fire. There are 47 helicopters in the 8 aero stations.

For the prevention of forest fires and rehabilitation of burned forests, the following researches are carrying out in the department of forest fire, Korea Forest Research Institute.

- Development of the forest fire management system with the aim of detecting and suppressing forest fires in an early stage
- Understanding of forest fire behavior and prediction of how a forest fire spreads
- Development of effective and safe fire suppression technologies
- Design of a forest fire response system to make the best use of fire fighting resources
- Ecological rehabilitation of the fire-damaged forests

For the effective allocation of resources and prevention of fire occurrences, Korean forest fire danger rating systems (NFFDRS, http://forestfire.kfri.go.kr) has developed and is running in the fire precautionary periods. The NFFDRS is consisted of daily weather index (DWI), fuel model index (FMI) and topography model index (TMI). Also, the scale for each index ranges from 1 to 10. The DWI was induced using meteorological characteristics such as humidity, temperature, and wind speed of 8 local regions.

Forest fire behavior prediction program simulates the fire and determines spread velocity, fire intensity and burnt area over time associated with terrain slope, wind speed and direction, effective humidity and such fuel condition factors as fuel depth, fuel loading and moisture content for fire extinction.

A variety of suppression techniques based on information-communication system were developing for the firefighter’s safety and effective acquisition field information. First, Mobile GIS system for firefighters has some functions notifying the current situation and location of forest fire, mobilizing fire fighters in fire engines, approaching fire site on foot after arrival in fire engines, notifying current situations on fire site, sending information on fire line location, and sending field image, etc.

Second, Forest Fire Occurrence Point Recognition System using Wireless Network composed of wireless telegraph, GPS, and digital compass has developed for the acquisition of quick and accurate ignition point from the watching tower. Ignition point transfers automatically to the forest fire center.

Finally, litter layer smoldering fire detection system was aimed for the finding of remained heat and fire that can cause re-fireing after entire containment of main fire. This system is composed of infra-red sensor, and display monitor.

Comparison MODIS data with NOAA data in case on spring time of 2008 of Mongolia

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Abstract

We are just few months ago setup new receive station from MODIS. For us very new and very interesting work with MODIS data.

We want to compare wild fire detecting by NOAA with by MODIS in this spring by our country. For this reason we want also to compare statistical data from ground observation.

Before installation a receive station from MODIS we are detecting wild fire just once for day for daytime by NOAA. Today we are detecting wild fire 5 times for day for daytime. We hope it will decrease the difference between data from ground observation and data from space.

2008_05_30

Satellite-based wildfire monitoring and tracking in Australia

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Abstract – Several natural disasters, including fires, floods and droughts are observable in real-time by earth observing systems. When efficiently combined with modern information-distribution methods, including future data-relay satellites, such data can be processed and sent rapidly to affected communities and local emergency agencies. For instance, satellite-based detection and tracking of wildfires ('bushfires') across the Australian continent is regularly performed by CSIRO, Geoscience Australia and Western Australia Landgate agency through the use of several polar orbiting and geostationary satellites. This information is rapidly processed (less that 1-hour after overpass) and delivered via public webGIS systems such as Sentinel Hotspots and 'Firewatch' to local emergency agencies, farmers and the Australian public. In addition, research programs by the Bushfire Cooperative Research Centre, a partner with CSIRO and the Bureau of Meteorology, is leading to a widely applicable "grassland curing index' derived from satellite imagery to identify climatic and vegetation dryness conditions of high bushfire risk. This paper provides a summary of these various ongoing operational and research programs.

LAPAN's Activities in Supporting Wildfire Early Warning and Detection in Indonesia

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ABSTRACT

Wildfire is an increasingly important issue in Indonesia because it has many social, economic and environmental impacts. Wildfire represents a natural hazard which, in many cases, can be predicted, controlled and prevented. In order to support forest/land fire management in Indonesia, LAPAN provides information related with wildfire early warning and detection. The main data used for this purpose are the satellite remote sensing of NOAA/AVHRR and Terra/Aqua MODIS.

Including in the wildfire early warning is the monthly rainfall prediction and daily Fire Danger Rating monitoring. Indirect and influencing factors such as climate variation caused by El Nino/Southern Oscillation (ENSO) often play a significant role in the setting off of wildfire and associated haze. Therefore, prediction of climatological conditions, particularly rainfall, that is likely to result in fires and haze is very important. Moreover, the Fire Danger Rating presents information on the ability or potential of a fire to start, spread and do damage. In the case when the fires occurred, the fire hotspots are monitored to get their positions and locations. In addition, mapping the burnt scars was done when the fire has serious impacts.

In order to improve the quality of the above information along with the near-real time information dissemination, cooperation with related institutions/organizations has been conducted nationally and internationally. JAXA-Japan (Sentinel Asia) and Landgate-Australia (FireWatch Indonesia) are amongst the international institutions that have long-term cooperation with LAPAN in fire activities in Indonesia.

Regional Vegetation Fire monitoring in CRISP

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The regional vegetation fire monitoring in CRISP dated back in 1997/98 when large scale vegetation fire broke out in Indonesia. The haze produced had affected many countries in the region, such as Singapore, Malaysia and Brunei. Since then, CRISP has engaged in daily fire monitoring with SPOT satellite imagery.

The daily fire monitoring is carried out by first determine the possible fire area from the "hot-spots" of previous day Terra/Aqua MODIS. SPOT images are then acquired over the "hot-spots" area. Full resolution SPOT passes are visually inspected to locate individual fires and to determine the nature of the fire. The locations of each detected fire are annotated in the image. The geographical locations and the nature of the fire (whether it is forest or plantation fire) are recorded as well. A report of the fire observations and the annotated images is sent to the National Environmental Agency of Singapore on the same day.

The most recent outbreak of large scale vegetation fire is in year 2006. It coincided with the El Nino Southern Oscillation (ENSO) effect in which the monthly rainfall during the second part of the year is significantly lower than non-El Nino year. The monthly average number of fires detected in Sumatra during the months of August to October exceeded 100. However, the total number of fires detected in the entire year of 2007 is only 91. This is because from 2007 onward the effects of El Nino faded and gave way to La Nina. The monthly rainfall during the later part of the year picks up momentum and return back to the normal non-El Nino year. According to NOAA, a moderate La Nina is developing in mid-2007 and is likely to continue into 2008. Therefore, we believe that it is quite unlikely that a large scale vegetation fire will break out in this year.

AIT Near-Real Time Automatic MODIS Fire Information System for Active Fire Monitoring in Southeast Asia

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Nowadays, the global environment has been changed. The change is related to one of the world-hot issue of the global warming. Many disasters have been occurred such as flood, typhoon and wild fire, cause damage the natural resources, the environment as well as to the human life. In this research, we are focusing to the forest fire disaster. The lost due to the fire occurrence in the forest area affect the stability of the environment and could cause other serious natural disaster such as drought, flood and landslide. In order to protect the forest from such disaster, the application of MODIS data is considered to be one of the solutions to this issue. As MODIS data is receiving daily in AIT, it is used to generate the fire pixels for the region. However, only generating MODIS fire pixels based on the MODIS Active Fire Product (MOD14) Production Code version 4.3.2 which was developed by NASA is not enough for efficient monitoring of forest fire. Therefore, the AIT MODIS Fire system has been developed based on the algorithm as mentioned and upgraded to Fire Information System, which includes the generation, data statistical analysis, database archiving, visualization, and validation modules to serve the research activities on forest fire disaster as well as for forest fire protection activities in the countries of the region.

Independence Forest Cover Monitoring and Wildlife information: Field survey of Pathumphone Product Forest Area in Champasak Province, Lao PDR

Virany SENGTIANTHR and Bounmany KEOSITHONG

The Environment Data Center-EDC, Environment Research Institute-ERI of the Water Resources and Environment Administration-WREA has the responsibility to conduct independent monitoring for the Sustainable Forest and Rural Development-SUFORD project. The Independence Forest Cover Monitoring-IFCM is one of the technical working groups within the SUFORD project. The IFCM technical working group responsible for monitoring forest cover, spatial analysis and field verification. The main objective of the IFCM technical working groups: To independently monitor and assess the changes in the forest cover in the product forest area of SUFORD project province, Lao PDR. The Methodology based on change detection done by using satellite images and field survey to monitor and asses the forest cover on site.

Phathumphone PFA has a total area of 31.744 Hectare and consists of 4 sub Forest Management Area-Sub FMAs: Keng nang ang, Thongpha, Kele and Nong bung. The Phathumphone PFA of 36 the villages. In May 2008, survey work was accessed of the 10 villages (Km 40, Thong xay, Phapho, Sanod, Namom, Kheat gnong, Km 37, Km 36, Km 35 and Km 34) in Pathumphone PFA. The field survey was done by using satellite image (SPOT), topographic maps and GPS with described detail coordinate of location and the photos to described the field verification. The detection of general changes in the area such as new roads, constructions, shifting cultivation, plantations etc.

The report from the field work are as follows:

1. General description of the area
    - Area name and location (e.g. PFA)
    - Area size (total in hectares)

2. Recording of activities in the area related to forest
    - Logging (also selective)
    - Second landings
    - New infrastructure

3. Recording the impact of the activities in the area
    - Slash and burn, plantations, shifting cultivation , etc. to the villages)

4. Verify the results from change detection using satellite images
    - Checking some of the areas where changes were detected
    - Major cause of the change e.g. slash and burn for plantations

5. Record the impact from the natural disaster
    - Lightning

- Forest fire (Forest fire found in the Thong xay village, Pathumphone, Champasak province . They are mostly observed during the dry season (February to April)

The Water Resources and Environment Administration targets to do independent forest cover monitoring in macro level as a part of overall environment.

Need to consideration of the following activities in the near future:

1./ Training in the provinces on Remote Sensing and Geographic Information System and GPS application.
2./ Development of the remote sensing methods to monitor and assess the forest cover and wildfire information.
3./ Promote and development of the use of RS&GIS in to the natural resources management, environment quality monitoring and disaster mitigation;