

Participatory Land Cover Change and Forest Fire Monitoring using Un-Manned Aerial Vehicle (UAV) Technological Innovations

Cooperation among:

- Ministry of Environment and Forestry (KLHK)
- National Aeronautics and Space Institute (LAPAN)



2015 fires and carbon emissions

Research from the Centre for International Forestry Research (CIFOR) states that more than 90% of Indonesia's carbon emissions in 2015, or 884 million tonnes of carbon dioxide, were the result of forest and land fires. According to Ministry of Environment and Forestry (KLHK) data, the 2015 forest and land fires in Indonesia covered a total area of 2.6 million hectares, almost 40% of which were in South Sumatra province. The 2015 forest and land fires, similar to those in 1997, were caused by human activity and natural conditions exacerbated by climate change and the El Niño phenomenon.

South Sumatra Forestry Office data for 2015 shows more than 90% of burned areas to be in two districts: Musi Banyuasin (Muba) and Ogan Komering Ilir (OKI). More than 70% of the burnt land constitutes peatlands that are highly vulnerable to fire. Post-fire land conditions have impacted heavily on the land uses Bioclimate documented in 2014 as baseline data for its project site in Muba district.

The Government of Indonesia, through its National Development Planning Agency (Bappenas) and related ministries/institutions, is designing a Monitoring Reporting and Verification (MRV) system for assessing land cover change and calculating carbon emissions. Two recommendations from forest and land fire monitoring activities already carried out, and worthy of participatory follow up by stakeholders at the central and regional levels are: (1) harmonization of land-based programs and spatial data in reference to the One Map policy, and (2) transparent and participatory use of technological innovations to improve work systems.



Figure 1. High levels of fire vulnerability on the ground following the 2015 forest fires

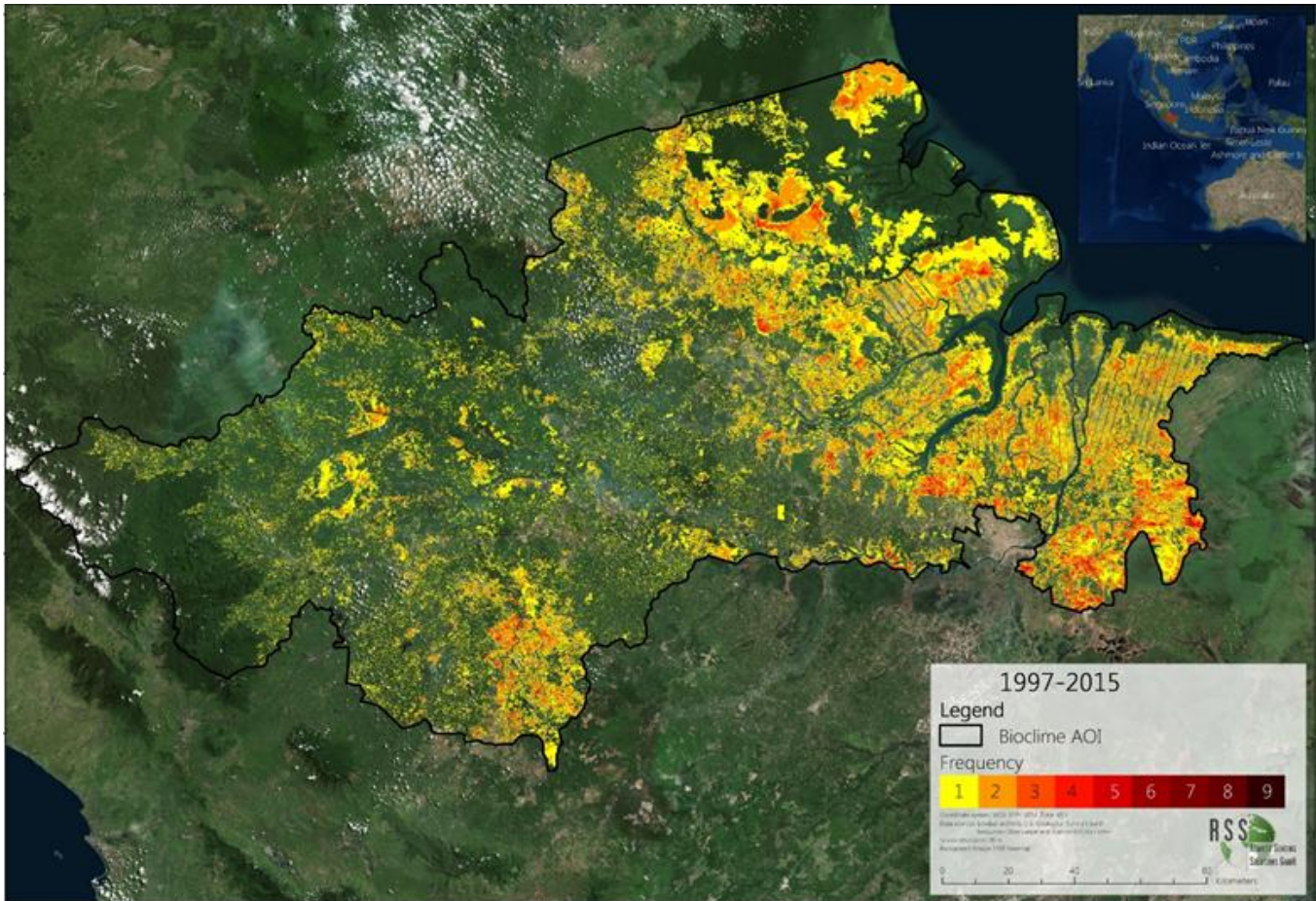


Figure 2. Fire frequency from 1997 – 2015, and the monitoring area target location in South Sumatra province

The UAV forest and land fire monitoring initiative

GIZ BIOCLIME has been working with the South Sumatra Province Forestry Office since 2014 and has introduced the use of Un-manned Aerial Vehicles (UAVs). In 2015, through intensive collaboration with Forest Management Units (FMUs), BIOCLIME produced a simple guide to monitoring forest and land fires using UAV applications in combination with hotspot data from the National Aeronautics and Space Institute (LAPAN).

Based on the One Map policy and the forestry MRV system implementation plan, KLHK coordinated with LAPAN to carry out forest and land fire monitoring activities using UAV technology. The main aim of these activities was to help the government with the latest technologies in order to prevent forest and land fires. Activities were focused on burned peatland area locations in the Musi Banyuasin and Banyuasin districts in the Air Hitam Laut Peatland Hydrological Unit (Figure 2).

UAV implementation for forest and land fires

The main concepts of activities from August – September 2016 were hotspot data validation and air patrols over high fire vulnerability burned areas. The monitoring system applied was LAPAN's LSU-02 technology in combination with the forestry office's Forest and Land Fire Information System (*Sistem Informasi Kebakaran Hutan dan Lahan* (SIKLAH)).

Through the SIKLAH One Command concept, data/information can be reported quickly to facilitate forestry management decision making processes. Technically, this technology is more efficient and effective than land patrols for monitoring remote areas.

The results of these activities were highly beneficial in generating important near real time data for validating hotspot data in less than 2 hours. Further, air patrols were able to map the latest conditions with highly detailed 20 cm resolution images that clearly identify information on the ground. Data interpretations clearly identify human activities that are threats in relation to forest degradation and fires, such as burned over areas, encroachment locations, illegal logging trails, wood piles and tarpaulin structures. Aerial photo mosaics also show a distribution of around 30 small, less than 10 ha burnt areas in 2016. The absence of stable internet connections in remote areas, however, can be a major obstacle, and necessitates reporting to the chairman via telephone. Pictorial evidence is sent later from the nearest concession office when an internet connection is available.



Figure 3. The UAV team and its output; forest fire threats (burn scars, encroachment, illegal logging)

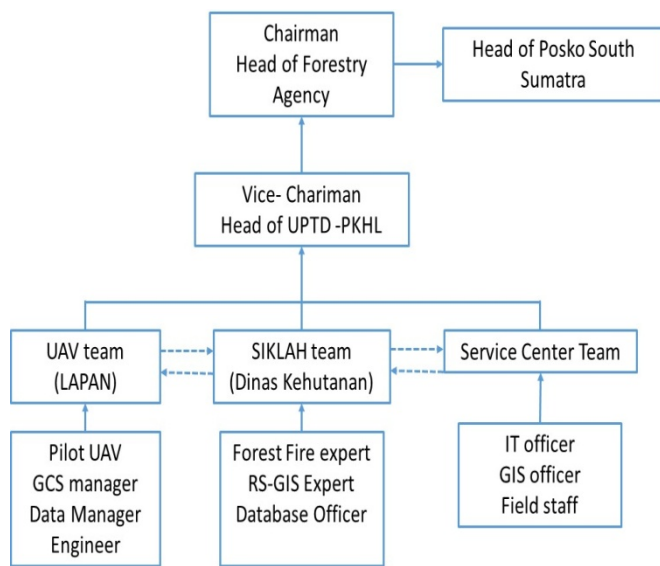


Figure 4. UAV system work flow

Outcomes and recommendations

As the LSU-02 has a flight range of up to 200 km with a maximum range of 100 km on auto-pilot, in a single mission it can quickly validate hotspots that are not fires spots up to 50 km away. The outcomes of air monitoring show the latest conditions in detail for areas of 8 x 10 km² (Figure 3). In combination with the One Command system shown in Figure 4, this system is highly efficient for decision making by applying the SIKLAH work flow, which connects operators on the ground with the data information centre in the South Sumatra Province Forestry Office.

Providing there is a terrestrial telecommunications network available, this system is highly recommended for monitoring forest and land fires in remote areas with difficult overland access, or in conflict regions. The central government, through KLHK, and regional governments through forestry offices and FMUs should collaborate in setting up teams that can accelerate the implementation of MRV systems and combine technologies in the interests of monitoring forest and land fires and land-use change as data for calculating carbon emissions and for sustainable natural resource management.

In a nutshell, GIZ is continuing to support local authorities in South Sumatra with human resource capacity building and a monitoring system for forest fire prevention and sustainable forest management.

Authors: Dudy Nugroho, Nyimas Wardah, Berthold Haasler

Correspondence : dudy.adi@giz.de

Website : www.bioclimate.org