The Analysis of Dry Weather Aerial Photography in Sermo Kulonprogo Reservoir using DJI Spark Drone

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Abstract. Drones are a very important medium in the world of aerial photography to map military operations, agricultural areas, plantations, mining, urban planning, disaster mitigation, and outreach to remote areas and two types have been identified which are the winged and quadcopter. This research was conducted to map the drought-prone areas during the dry season in the Sermo Reservoir area, Kokap, Kulon Progo Regency between 14-15 August 2019. This involved the use of the DJI Spark quadcopter due to its more stability and wind resistance. The process involved connecting the DJI Spark drone remote controller to a smartphone, opening of DJI Go application, DJI Spark drone activation, smartphone installation on the remote controller holder, propeller installation, GPS settings in a locked position, drone flight and position adjustment, and capturing of the images on the smartphone screen. The results showed the water flow of the Sermo Reservoir has decreased by approximately 4 meters due to the dry season. This was evident in the changes from its original position of 136.6 meters above sea level to 132.6 meters and this limits the quantity of water available to irrigate rice fields. The reservoir still has the capability to supply 800 liters per second in Pengasih District but the results of the aerial photographs showed the existence of drought and a decrease in the water discharge.

Keywords: drone; multicopter; aerial photography; Sermo reservoir; DJI Spark

1. Introduction

Drones are being used for several things in the world today and have also been discovered to be in two types which are the fixed-wing shown in Figure 1 and the quadcopter in Figure 2. The fixed-wing type resembles an insect or dragonfly, makes less noise while working, and produces a good image despite its low cost. Meanwhile, quadcopter type is usually used to capture aerial photographs in dangerous and disaster-prone areas as well as military operations. It has also been used to map aerial photographs at the entrance of Radar Congot, Temon Kulon Progo.

Drones have been applied for several reasons and these include its application in mapping aerial photographs for tourism, disaster mitigation, agriculture, mining, military, and the outer regions of Indonesia as well as the landslide areas in Somangari Village, Kaligesing District, Purworejo Regency. Moreover, the increased tourist visits in Malang Regency have encouraged the Kelompok Sadar Wisata (Pokdarwis) Gubugklakah Ponokusumo to improve their tourism services using aerial photographs and videos from drones. The studies in areas with potential iron sand such as Karangwuni, Temon, and
Kulonprogo were also conducted using quadcopter drones while the Indonesian Center for Agriculture has also reported the importance of UAVs or drones in the agricultural mapping of West Java.

![Fixed-wing Drone](image1.png) ![Quadcopter Drone](image2.png)

**Figure 1.** (a) Fixed-wing Drone; (b) Quadcopter Drone

The research in Kotabaru, Lampung was conducted using fixed-wing drones as shown in Figure 2a, the mapping of the tourism area on the Congot Beach near the new Yogyakarta International Airport was also performed with drones as indicated in Figure 2b while the road to Yogyakarta International Airports on Glagah Beach was mapped by a quadcopter as presented in Figure 2c.

![Mapping in Kotabaru](image3.png) ![Mapping in Congot Beach](image4.png) ![Mapping in Glagah Lampung](image5.png)

**Figure 2.** Mapping in (a) Kotabaru ; (b) Congot Beach (c) Glagah Lampung
(Source: Suroso, I., & Irmawan, E., 2018)

1.2. The Benefits of Utilizing Drones for Aerial Mapping

The flood and landslide mapping areas in Girimulyo, Kulonprogo were studied using a multicopter drone [1] due to its great stability and wind resistance [2]. Its application for the aerial mapping of sandy areas in Karangwuni, Temn, and Kulon Progo which are the producers of iron sand showed the presence of arid soil which is considered unsuitable for agriculture [3]. Moreover, a DJI Spark's drone with a camera was used to map the arid regions in the Hargowilis Kokap region, and good aerial photographs with clear quality were produced [4]. The quadcopter drone has been found to have the ability to hold up to 15 minutes in the air while producing clear pictures as observed from its application on the road to the new YIA Kulon Progo [5]. Furthermore, aerial mapping with multi-copter drones and Xiaomi cameras was observed to have lasted up to 30 minutes in the air with 1 km visible area [6] while a study conducted to map the development and agriculture in Sukadamai Village, Bogor Regency using drones is shown in Figure 3 [7].
Drones are also used as automatic hexacopter pesticide sprayers [8] and their application in spraying natural pesticides in Sungai Besar, Selangor, Malaysia was found to be twice as efficient as manual spraying as indicated in Figure 4 [9].

A study was also conducted using drones to capture shallow-water habitats in Lancang and Sebaru Besar Island. [10] and they were also used to have an overview of the administrative city in Langsa such as Sidodadi, Serambi, and Mulia Villages using aerial photographs. The region was selected due to its high population density [11]. Moreover, research has been conducted on the use of drones in mass media coverage by some journalists to facilitate reporting on television [12] while the report has also been made on its application in the surveillance of Indonesian territorial and patrol fishing areas [14]. There is, however, a Smart Flight in the country which is created as a form of drone piloting training by the Bogor Indonesia Drone Forces [13]. Meanwhile, the aerial photographs obtained with Geographic Information System (GIS) at the Muhammadiyah University of Gorontalo were used in imaging the Green Spatial Plan (RTH) [15] while the techniques involved in drone railway monitoring system are shown in Figure 5 [16].
The quadcopter UAV platform is capable of spraying 2 m\(^2\) agricultural land within 5 minutes with a liquid mass of 0.5 kg at a height 10 cm above the rice plant [17] and this indicates the use of drones in mapping paddy fields [18]. Moreover, drone media have been studied by students in SMAN 9 Tasikmalaya to help the learning process of remote sensing [19]. Another study was also conducted to eradicate rice pest attacks, especially White-capped munia, Pekingese, and sparrows, through the use of simple audio system drones [20]. They are also used with an exploder in the military as a target destroyer in an enemy area [21]. The use of drones in mapping Pancajaya District ecotourism areas was reported to have led to an improvement in the community’s economy [23] while the flood mitigation efforts were discovered quickly using the drone rapid mapping method in Waygalih Village [24]. A quadcopter drone was also used to determine the landslide mitigation areas in Girimulyo, Kulon Progo Regency [25]. This study was, therefore, conducted to determine the effect of drought on Sermo Reservoir in Kokap, Kulon Progo regency using drones.

2. Method

A. **Instrument:** Drone Quadcopter DJI Spark  
B. **Material:** Regional Areas of Sermo Reservoir, Kokap, Kulon Progo  
C. **Location:** Drought areas in Sermo Reservoir, Kokap, Kulon Progo  
D. **Time:** 14-15 August 2019  
E. **Method:** A smartphone was connected to the DJI Spark drone remote controller, DJI Go application was opened to activate the DJI Spark drone after which the smartphone was installed on the remote controller holder, the propeller was installed, GPS position was locked, and the drone was flown and positioned to capture images on the smartphone screen.  
F. **Condition of Sermo reservoir**  
G. The Sermo Reservoir in the Kulon Progo area is located on the Kokap plateau, a winding road from the city center of Wates, about 3 km west of Wates, this sermo reservoir is the icon of Kulon Progo and the water in this Sermo reservoir for irrigation flows all the rice fields around Kokap, Pengasih, Tiemon, Panjatan and surroundings. If the Sermo Reservoir experiences a drought, it is certain that the rice fields will experience drought  
H. **Map of Sermo Reservoir in Kokap, Kulon Progo**  
Map of Waduk Sermo can be seen Figure 6.
Figure 6. Map of Sermo in Kulon Progo

Figure 7. Flowchart
3. Results

The water flow in the Sermo Reservoir was observed to have decreased by approximately 4 meters due to the dry season. This is evident from the original position which was 136.6 to 132.6 meters above sea level. This reduction caused limitations to the irrigation for the paddy field even though the reservoir was found to be capable of providing 800 liters of supply per second in the Pengasih District. The description of the Sermo Reservoir at a height of 30 meters and from several cardinal directions is shown in Figures 8 through 15. What distinguishes this research from others is that the research on the Sermo reservoir is highly anticipated by the Kulon Progo regional government because the local government wants to see the condition of the Sermo reservoir aerial photographs when the water flow decreases. This is because the Sermo Reservoir is a producer of irrigation for rice fields in Kulon Progo. If the discharge of the sermo reservoir water decreases, the government will prepare a way to overcome it by using irrigation from Kalibawang, Kulon Progo.

![Figure 8](image1)  
(a) The northwest side aerial photograph of Sermo Reservoir, Kokap Kulon Progo at 30 meters height  
(b) DJI Spark quadcopter Drone

![Figure 9](image2)  
(a) The southwest side aerial photograph of Sermo Reservoir, Kokap Kulon Progo at 30 meters height  
(b) DJI Spark Device
Figure 10. (a) The west side Aerial photograph of Sermo Reservoir, Kokap Kulon Progo at a height of 30 meters and (b) DJI Spark camera device

Figure 11. (a) The north side aerial photograph of Sermo Reservoir, Kokap Kulon Progo at 30 meters height and DJI Spark remote control
Figure 12. a) The southern side aerial photograph of Sermo Reservoir, Kokap Kulon Progo at 30 meters height and (b) DJI Spark Drone

4. Conclusion
Drones are a very important medium in the world of aerial photography and useful in military operations, agricultural areas, plantations, mining, urban planning, disaster mitigation, and remote areas. This research was conducted on August 14-15, 2019 in Sermo Reservoir, Kokap, Kulon Progo Regency to map areas prone to drought during the dry season. The results showed the water flow of the Sermo Reservoir has decreased by approximately 4 meters due to the dry season. This was evident in the changes from its original position of 136.6 meters above sea level to 132.6 meters and this limits the quantity of water available to irrigate rice fields. The reservoir still has the capability to supply 800 liters per second in Pengasih District but the results of the aerial photographs showed the existence of drought and a decrease in the water discharge.

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