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**The effect of the Kajaki dam in the upstream of the
Hirmand river on the changes in vegetation and water
resources in the downstream areas**

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Abstract

The construction of dams usually leads to a reduction of water downstream of the dam, and the water ecosystems and economic development of the downstream areas of the dam face sometimes irreparable challenges. This issue has caused countries to pay special attention to the issue of border waters. The Hirmand International Watershed is shared between Iran and Afghanistan, and the extreme economic, social and environmental sensitivity of the eastern part of the country to climate changes and the lack of attention of Afghanistan to the laws of the border waters upstream of this basin and unilateralism in the exploitation of water resources. Hirmand Basin has doubled attention to water distribution in Hirmand Basin. This research examines the effect of Kajaki dam operation upstream of Hirmand river in Afghanistan on the vegetation and water level of Lake Hamon in Sistan and their relationship with snow cover, rainfall and vegetation upstream. For this purpose, the water level and volume of Kajaki Reservoir, snow cover, rainfall and vegetation cover and the water level of the river bed and Hamon Lake during the years 1985 to 2022 using the time series images of Landsat satellites and Moody's sensor in the time period from 1985 to 2020 and in cross section The time of April and September was calculated on the Google Earth Engine platform. To investigate the effect of the distance of the Kajaki Dam from the downstream vegetation, the river course was separated into 11 zones (zones) at intervals of 40 kilometers, and one zone was also separated as a control with no effect from the Kajaki Dam, and then the vegetation and surface The riverbed water in the area was analyzed with the above parameters. The results showed that the amount of precipitation in the upper reaches of the Kajaki dam has been increasing since 1984 (1363) until now, but this trend has been very slow for the downstream of the dam. In the years between 2000 and 2004 (1379 to 1383) downstream of the Kajaki Dam experienced a period of several years of drought, but this period was shorter in the watershed of the Kajaki Dam and included only the years 2001 and 2002 and shows The upstream of the basin is less affected by drought. The water volume of the dam reservoir has a weak significant relationship with the vegetation cover in the months of May to June, August and the water level of Hamon Lake. In the period of 2000-2004, which coincides with the widespread drought in Southwest Asia. The volume of Kajaki Dam, the water level of the lake and the vegetation cover of the Sistan region have decreased, while the vegetation changes around the dam are increasing. This shows the role of Kajaki Dam in controlling the water level of Hamon Lake and vegetation outside the rainy season. Therefore, the managers of the country are expected to take effective measures to prevent the continuation of the drought crisis of Lake Hamon and the damage caused to the economy of the Sistan plain. Checking the amount of snow upstream of Kajaki Dam shows that the amount of snow has fluctuated a lot in recent years. The trend of snow changes from 2000 to 2021 is increasing. The slope of the changes also shows that the vegetation cover in the region had an increasing and positive trend and it shows that the vegetation cover has increased in the downstream area near the Kajaki dam. This slope is higher in April. Investigating the amount of vegetation development in the summer season from April to September (April to September) shows that there is an increasing trend during the studied period. In these years, the vegetation cover in April and September has also decreased. It can be said that almost no new vegetation (e.g. agriculture) has been created in the summer season. But since 2010, summer vegetation has been increasing and it shows that in these years, summer agricultural activities have increased in the region, and it seems that there is a direct relationship with the amount of water released from behind the dam, as well as spring rains. has it .

Keywords: Kajaki Dam, Snow level, Vegetation, Hydrographs of water surface