Resolving a human crisis through remote sensing: equitable and sustainable use of internationally shared water resources

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Abstract & Study Region

The 1930s Dust Bowl seems like ages ago, so far in the past that we cannot imagine once again living through the pain and misery of dried up croplands and dust storms. Nevertheless, the Dust Bowl has materialized in recent decades in a remote, arid, poor region on the border of Afghanistan, Iran and Pakistan. Desiccation of the endorheic Hamun Lakes has deprived >1 million people of potable water, eradicated their only source of livelihood, and put >7.8 million people in conflict over transboundary water resources [1].

Earth's most air polluted city.

The most air polluted region in the world is in a place by the name of Zabol, Iran. Air pollution can be both human induced, as well as earth induced. In this particular region, the air is severely polluted by the immense amount of dust that permeates this territory.

severe dust storm

https://medium.com/kayla-anderson/air-pollution-c6927665f713 [2]

The transboundary Helmand river drains 41% of Afghanistan land to the Hamun lakes on the border of Afghanistan, Iran and Pakistan. The Hamun lakes have become seasonally dry in the recent decade. This not only caused food and water insecurity in the region, but also deprived people of their only source of income driving many to resort to smuggling goods and drugs with global security implications [3].

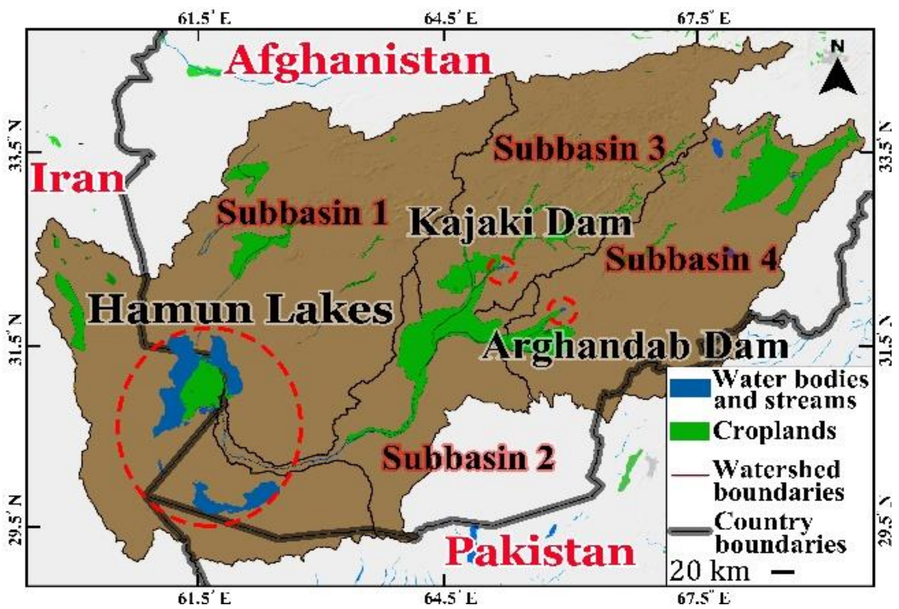
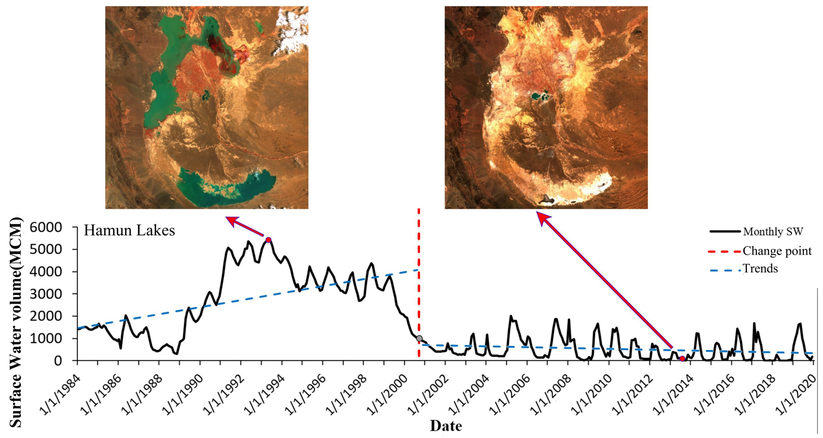


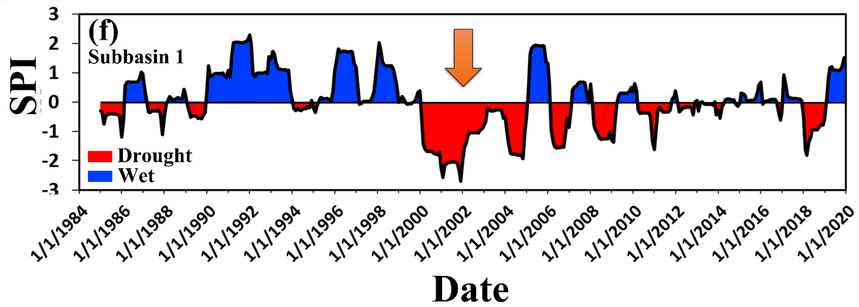
Figure 1. The Helmand River basin with marked agricultural areas (green) and water bodies (blue).

Results and discussions

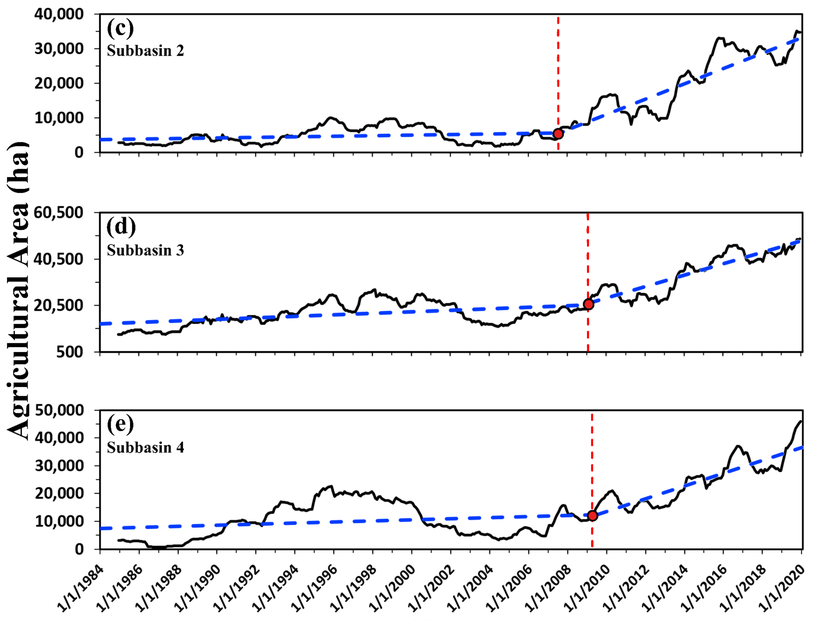
In this study, we compile monthly time series of factors that impact the Hamun lakes storage using multispectral satellite imagery and global climate data over the past 40 years. Figure below shows the time series of Hamun lakes surface water area and a change point (red dash line) showing a decreasing trend in surface water area after year 2000.



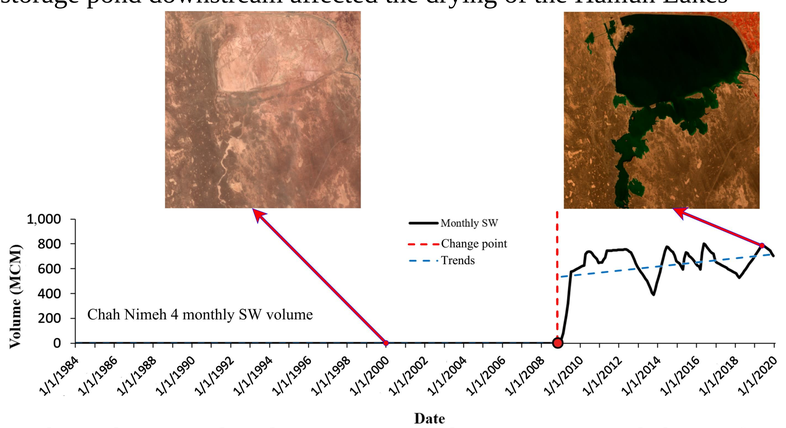
The exposed area of dry lakebed now is a major source of severe dust storm that sweeps across south eastern Iran, southern Afghanistan, and northern Pakistan. Our results show that lack of precipitation initiated the drought in the beginning of year 2000 as demonstrated in figure blow.



On the other hand, expansion of agricultural area upstream of the Hamun Lakes and along the Helmand River has increased irrigation water use that contributes to drought persistency even after having normal and wet years after 2005. The next figure shows the development of agriculture and increasing trend in different agricultural sites upstream of the lakes.



The final anthropogenic factor was the construction of an artificial storage pond downstream affected the drying of the Hamun Lakes



Without the agricultural expansion in the upstream, and the artificial storage pond even in the presence of the recent severe droughts in the region, the Hamun lakes would not have dried out. Our results determine the sustainable water resource usage levels in this contentious, transboundary basin.

References

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