High temperature and low water level in Bolivia

Temperatures around the world have been rising for the last half-century. As a consequence, in Bolivia, glaciers have melted and lakes have dried up. Also, groundwater levels have been exposing depletions, threatening fresh water reservoirs. In such context, water resource managements and policies require proper understanding of those reservoirs, such as the case of Challapampa close to Oruro city.

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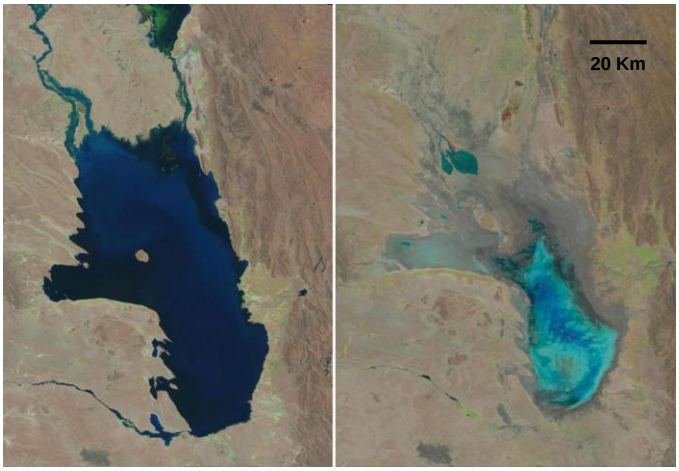
"A butterfly flutters its wing here, and it will create a hurricane on the other side of the world". That is, what the Butterfly Effect says, stating that small actions might lead to great disasters. Then, it seems like someone, somewhere, forgot to turn off the heater, because the temperature in the all over the world has been rising. The consequences of this vary around the globe, according to location; warmer summers and colder winters than they used to be years ago, or more or less rainfall than before. The truth is that climate change is everywhere and people have to learn to deal with those changes.

A research project conducted by the Universities of Lund in Sweden and San Andres in Bolivia is studying the most important groundwater reservoir in the middle-east part of Bolivia, called Challapampa. It supplies water to about 300,000 inhabitants. It is also used for agriculture, mining and in minor scale industry. The site is located within the Poopo basin, which in 2016 suffered the drying up of the Lake Poopo, the second largest lake in the country, and the natural outlet of the groundwater system in the region.

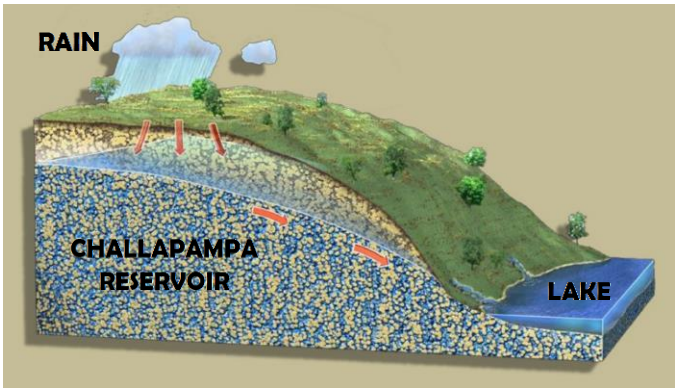


Satellite images show Lake Poopo filled with water on October 11, 1986, left, and almost dry on January 16, 2016, right.

Geology and water

Water below the ground surface is stored and flows through voids of porous materials like gravel and sand. However, other kinds of materials like clay and solid rock prevent the flow of water. In the case of Challapampa, most of the ground surface is covered by a couple of meters of clay. Below the

clay, there is a mixture of sand and gravel, the depth of this geological formation is still under investigation, however, it might be between 150 to 200 meters, on top of solid rock.



The recharge of water in the Challapampa reservoir mainly occurs in the upper part of the basin, where rain infiltrates through porous materials. Water levels in the lake and groundwater are linked. Therefore, the depletion of water in the lake also means lower levels in the groundwater reservoir.

Temperature and water

The rain season in the Poopo region lasts from December to March. Because of the presence of clay, a great portion of rainwater stays on the surface, flooding the area. However, these floods eventually evaporate and little water is being stored. As the temperatures rise, the evaporation happens faster, drying up the surficial water.

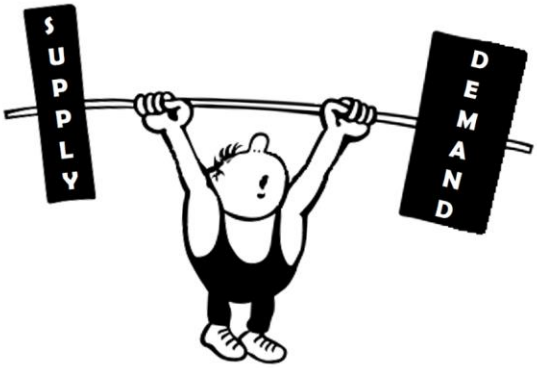
About 28% of rainwater enters in the groundwater reservoir, the rest is lost as a result of evaporation

Human impact

The inlet and outlet of water to the groundwater reservoir might find a natural balance through the processes of recharge and evaporation. However, the human intervention changes this hypothetical balance.

The growing population of Oruro is entirely dependent on the Challapampa's groundwater. At the same time, agriculture in the region, that used to canalize part of the water from rivers and ponds, now more and more commonly use wells and boreholes for irrigation, since those sources have been depleting.

Natural chemical elements in water can be used as tracers, and analysis confirm, that the majority of wells, installed in the first 100 meters below surface, are extracting water recharged in the last 30 years. On the other hand, the existing wells are extracting more and more water and new wells are installed every year, because of the lack of laws and control of the use of groundwater. If this situation continues in the future, the balance between inlets and outlets of water will collapse.



The annual rainfall is the main supply of water to the reservoir. Evaporation is reducing available surficial water, and increasing the demand for water stored in the reservoir. This situation is depleting groundwater resources.

Future perspective

Investigation into the physical features and dynamic processes within the reservoir will bring about much needed knowledge. The information can be used as a foundation of the formulation of policies and appropriate management plans of water resources in the region. It could also lead to specific actions like establishment of recharge areas limits, which should be protected, and engineering projects of artificial recharge, reducing the percentage of rainwater being lost by evaporation as much as possible.