

EVALUATION ON HIGHT MOUNTAIN VEGETATION UNDER THE GLACIER AREA, TUNI RESERVOIR IN BOLIVIA

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1. ABSTRACT

It is important to vegetation function as water resources management because vegetation have evapotranspiration (ET) and soil erosion mitigation. We tried to estimate vegetation function in basin under the glacier area. Applying the method to estimate analysis vegetation cover to use satellite image, and Festuca evapotranspiration experiment research due to temperature change. To learn the pattern of evapotranspiration (ET) we experiment research due to Festuca (Grass land) and temperature change. We retrieved Landsat 5 remote sensing images of the area of 2011.

2. STUDY AREA

As study area, we select Tuni watershed basin(Fig1). This basin includes some land cover, and important water source in La paz and El alto. Installed peaks are located close to the Condoriri hill, located 30 km from the city of La Paz. Its highest peak reaches 5,700 m in elevation. More than 80 percent of the annual precipitation (from 350 to 400 mm) occurs during summer months, commonly during the afternoon and night, effects of thermal convection, due to the high solar radiation of the Altiplano.

3. VEGTATION INFORMATIONS

Festuca kind of grassland, growth limit altitude is between. From 4800m to 5000 m Height growth height Festuca Dolichophylla is 20cm(1ststep), 50cm(2ndstep), 80cm(3rd step)¹⁾.

4. EXPERIMENT ANALYSIS

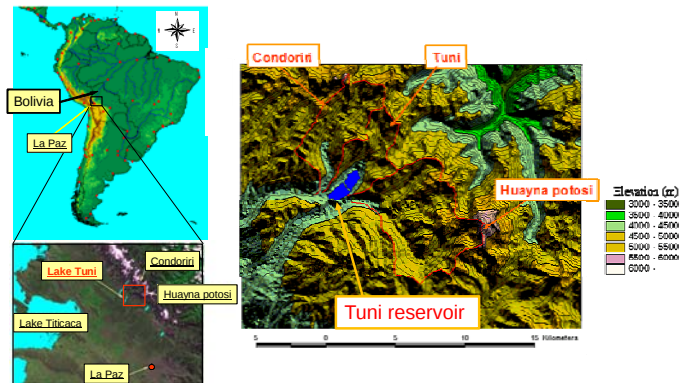


Fig 1 Study area



(1) Tank1 and Tank2



(2) Tank3 and Tank4

PH 1 ET verification experiment system

Experiment systems are monitored from March 2013 to July 2013: We set up 4 type experiment system in Institute of Hydraulic and Hydrology, University Mayor

de San Andres (IHH, elevation=about 3500m). According to this set up, we are able to understand effect of increase in temperature (PH 1).

- a) Tank 1: Monitoring the temperature of water, evapotranspiration.
- b) Tank 2 : Monitoring growth of Festuca and soil temperature.
- c) Tank 3: Monitoring of the life time of the Festuca.
- d) Tank 4: Monitoring water evaporation (it is Pan evaporation system).

Fig 3 shows Festuca ET observe results. Monitoring the experiment we got average result of ET is 5.1 mm/day and 0.1 mm/day of the Festucas and Deyeuxias, those are the species that growth in high glaciers, these results had got at IHH Max Temp 10.39 C. Comparison Tuni Reservoir the ET is 6.11 mm/day and Real temperature in situ (Tuni Reservoir) 0.1 mm/day Max Temp 8.66 C. Precipitation 2.5 mm/day average at an EL 4400-4800m.

5. SATELITE IMAGES ANALYSIS

We try to obtain the Normalized Difference Vegetation Index (NDVI) from Landsat 5, and to understand land cover change, Normalized Difference Snow Index (NDSI) NDVI distribution, Spread vegetation change is almost similar to the rainy season (from November to April) and the dry season (from May to October). Time period is from 1990 to 2011. And we pick up satellite image in each month.

Fig 4 shows Difference of the NDVI distribution relationship Between February (rainy season) and August (dry season). As result, it shows similar to vegetation distribution. This result indicate low vegetation change in each season. However, according to comparison with vegetation area in some year, Land cover of Tuni reservoir upstream shows decrease in glacier area and increase in vegetation covering as tendency during recent years. Festuca is poorly seasonal change. However it expands in Tuni reservoir basin under the glacier. As vivificated relation to elevation, it shows number of grid cells according to altitude to arrange NDVI distribution February (rainy season) and August (dry season). This verification indicate vegetation boundary line is EL 4,800m.

6. CONCLUSIONS

This study results is as fellow.

- a) Large vegetation cover changes ET average 5.1mm/day-0.1mm/day.
- b) Valley of around the rainy season shows remarkable high vegetation activity degree.
- c) Land cover of Tuni reservoir upstream shows decrease in glacier area and increase in vegetation covering as tendency during recent years.

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Reference:

- 1) Beck S. 1998. Ecología y fitogeografía de las gramíneas de Bolivia. En: Renvoize S.(ed.). Gramineas de Bolivia. Kew Royal Botanic Garden, Kew. pp.1–10.

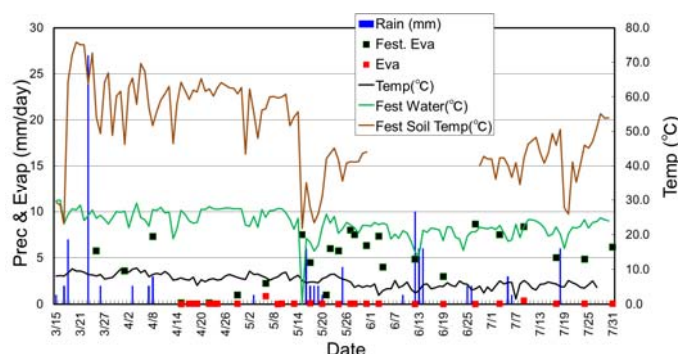


Fig.3: Festuca ET (Evapotranspiration) results

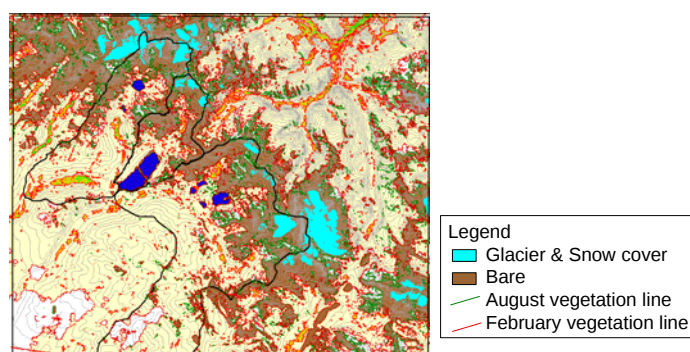


Fig 4: Difference of the NDVI distribution relationship between February and August (Average value from 1990 to 2011)