

Analysis of Lake Change Using Landsat 7 ETM+ : A Case Study in Lake Enriquillo

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ABSTRACT: Lake Enriquillo is the largest lake in the Dominican Republic. It is one of only a few saltwater lakes in the world. The lake ecosystem shows the unique species of iguana the "Ricord", and is a habitat for many kinds of birds, animals and plants and a large range of others. The Lake Enriquillo covers an area of 265 km² and water level varies because of a combination of storm and high evaporation rate.

In the present study, we examined the Characteristic of lake water body difference in the Enriquillo using 2 Landsat Enhanced Thematic Mapper Plus (ETM+) imageries over a 6 years period. The Normalized Difference Vegetation Index (NDVI) and Modified Normalized Difference Water Index (MNDWI) methods were used to detect changed lake water body and bare soil ground cover. The result shows that remote sensing data can provide efficient information to support the lake ecosystem management.

1. Introduction

Recently many countries are experiencing dramatic changes in land cover and water body, because of climate change and human development. Wetland change is very important, since wetlands can protect and improve water quality, serve as habitats for fish and wildlife, store floodwater, assist groundwater recharge and maintain surface water flow during periods (Reimold 1994). Also changing water body can seriously affect the distribution and inhabitation of aquatic biota. But recently the lake water body is unusually changing. Therefore, monitoring and mapping lake water body is the very basis of the protection and management of the lake ecosystem.

In this study, we assess the feasibility of the use of multitemporal Landsat Enhanced Thematic Mapper images for mapping the spatial temporal change of Enriquillo Lake water body.

2. Materials and methods

Lake Enriquillo is a lake in the Dominican Republic and is the largest lake and lowest point in the Caribbean and the lowest point on any ocean island (Buck et al., 2005). The lake contains 3 island which are Isla Barbarita, Islita, and Isla Cabritos. The last one is the largest of all and contains a National Park famous for its crocodiles and flamingos(http://en.wikipedia.org/wiki/Lake_Enriquillo). When water levels drop as a result of dry spells, the islands used to linked to each other by sandbars. But recently the lake water body is unusually changing. There are no more sandbars to link each other. Therefore, monitoring and mapping lake water body is the very basis of the protection and management of the lake ecosystem.

This study examines the lake change in the Lake enriquillo catchment between 2005 and 2010 using Landsat ETM+ imagery. We used the modified normalized difference water index (MNDWI) and normalized difference vegetation index (NDVI) methods to detect water bodies. We then analyzed spatial change of the Lake water body.

NDVI is an excellent tool for change detection. MNDWI is simple but effective band ratio method to identify water body (Xu 2005). MDNWI was the futher development of NDWI. The index equation is following.

$$NDVI = (NIR-RED) / (NIR+RED)$$

$$MNDWI = (GREEN-MIR) / (GREEN+MIR)$$

3. Results

The present study shows that multitemporal Landsat ETM+ images can provide information about changing water body. During 6 years from 2004 to 2010, the result showed an dramatically increase in water body. NDVI showed 78.56 km² in 2004 and 102.45 km² in 2010. MNDWI showed 77.48 km² in 2004 and 101.57 in 2010. The changed water body is that NDVI showed 23.89 km² and MNDWI showed 24.09 km² from 2004 to 2010. Compared two water detection methods show almost same result. Based on these results, it was assured that water body has kept being charged in Lake enriquillo.

4. References

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