

OSGeo Capacity Building Workshop

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Report on mini project

Effect of Land Use and Land Cover changes on Salim Ali Bird Sanctuary

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Abstract

The current study focuses on land use land cover changes in and around Salim Ali bird sanctuary. There is an extensive study going on across the country about fast loss of wetlands. The Salim Ali bird sanctuary in Goa is one such wetland which is an estuarine mangrove habitat which is declared as a bird sanctuary. The good thing about declaring this land as bird sanctuary is that this area has maintained its land area while most of the other wetlands have been lost to fast growing concretization.

We have used landsat images for classification of land use land cover. Two free and open source softwares namely ILWIS and QGIS were used to accomplish the task. Our results show us that concretization has increased exponentially around the concerned area with all the other classes like agriculture, mangroves etc. witnessing a sharp decline in their respective areas.

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Introduction

Salim Ali Bird Sanctuary is a mangrove habitat which is declared as a bird sanctuary and located on western tip of the Island of Chorao along the river Mandovi, Goa, in India. The sanctuary is named after Salim Ali, the eminent Indian ornithologist.

The sanctuary and island are accessed by a ferry service running between Ribander and Chorao. The sanctuary has a paved walk that runs between mangroves of *Rhizophora mucronata*, *Avicennia officinalis* and other species.

The area of the sanctuary is 1.78 sq.km.(440 acres), and has a number of canals interspersed within the sanctuary.

Several species of birds have been recorded and the common species include the striated heron and western reef heron. Other species that have been recorded include the little bittern, black bittern, red knot, jack snipe and pied avocet. The sanctuary is also host to mudskippers, fiddler crabs and other mangrove habitat specialists. A species of crustacean *Teleotanis indianis* was described based on specimens obtained in the sanctuary.[1]

The wetland attracts migratory birds like pintail ducks in large numbers in the winter months from October to February every year.[2]

Sanctuary was established in 1988 in order to protect unique habitat for birds and is located just approximately 4 km away from Capital City Panaji.

From establishment of sanctuary to till date is lot of change happened around the sanctuary due to expansion of Capital city and settlement in nearby areas. In this mini project we tried to measure the Land Use and Land Cover changes around the Sanctuary, using various Open Source tools in GIS

Study Area

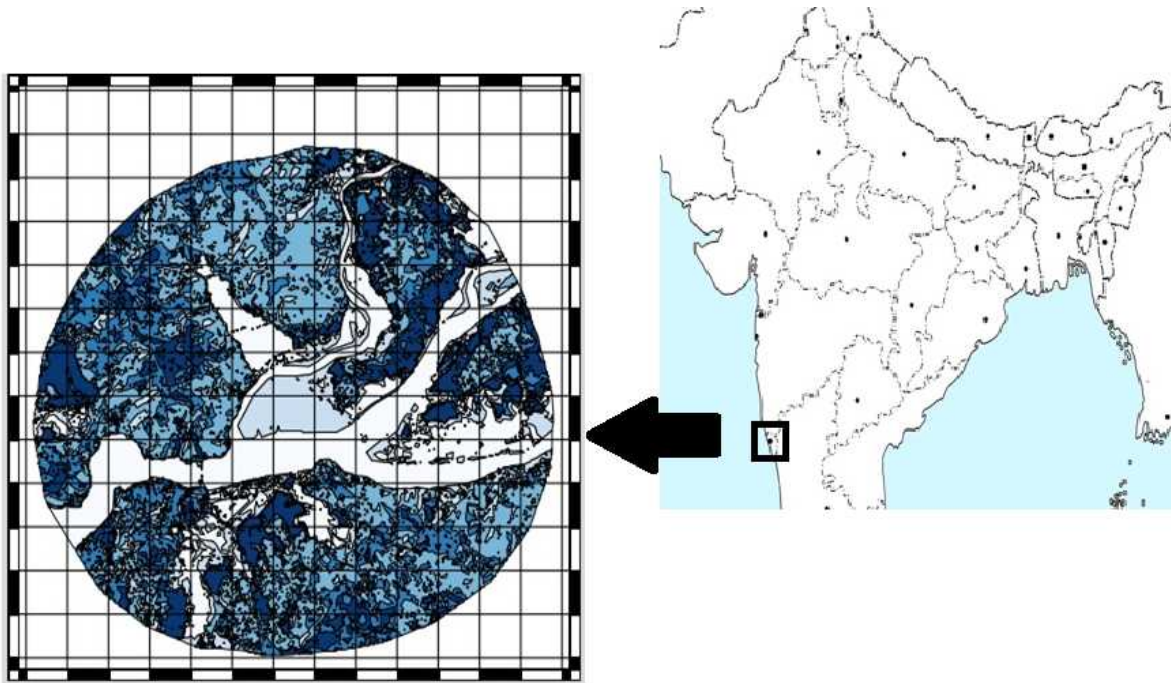


Fig 1. Study area

The above area is 5 km buffer area around Salim Ali Bird Sanctuary. Bird Sanctuary is located on the west coast of Island Charao situated in Tiswadi Taluka of North Goa District of Goa State. Sanctuary is located approximately 3.5 km away from the capital city Panaji.

Methodology

Here is a flow chart showing an overview of the methodology of our project work.

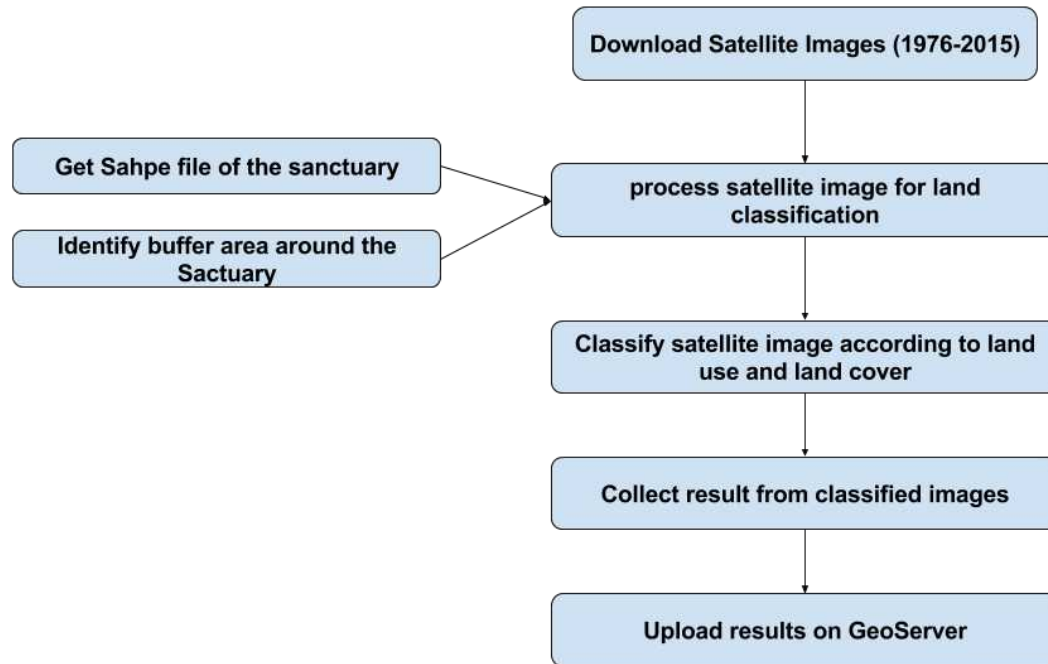


Fig 2. Workflow of project

The methodology can be explained in following steps :

- Download data from USGS LandSat look viewer etm+ starting 1976 to 2015.while doing so set cloud cover to 0%.
- After downloading LandSat images ,extract them to specified folder which gives bands present in satellite image.
- Using QGIS stack this bands to get composite image
- Using OSM get the boundary of Salim Ali Bird Sanctuary
- Create a buffer zone of 5km around the sanctuary and make a shape file for this buffer zone, so that it can be used for clipping the area of concern from all the satellite images.
- Clip the raster image to get the study area.
- Classify the study area using ILWIS 3.3.
- Present results in terms of change in area of classified fields.

Dataset:

Our dataset consists of LANDSAT images downloaded from LandSat look viewer etm+. This data is the raw data that has been used for various operations performed on it to get a tangible measure of land use land cover changes in the concerned area. Data has been downloaded for the year 1976, 1992, 1995, 2001 and 2015.

Data corresponding to the year 1976 has a very coarse resolution and isn't fully reliable, therefore only basic assumptions are made using that data.

Toolset:

1. ILWIS 3.3 Academic:

Integrated Land and Water Information System (**ILWIS**) is a geographic information system (GIS) and remote sensing software for both vector and raster processing. Its features include digitizing, editing, analysis and display of data, and production of quality maps.[3] In our project we have used this tool for processing of satellite data and for classifying satellite images according to land use and land cover.

2. QGIS 2.6:

QGIS is a cross-platform free and open-source desktop Geographic Information system (GIS) application that provides data viewing, editing, and analysis. It allows users to create maps with many layers using different map projections. Maps can be assembled in different formats and for different uses. QGIS allows maps to be composed of raster or vector layers. Typical for this kind of software, the vector data is stored as either point, line, or polygon-feature. Different kinds of raster images are supported, and the software can georeference images.[4] In our project we have used this software for :

- i. Raster to vector conversion of satellite images.
- ii. Getting area of Land use and Land cover in each Classified satellite image.

3. PostgreSQL:

PostgreSQL is an Object-Relational DataBase Management System (ORDBMS) with an emphasis on extensibility and standards-compliance. As a database server, its primary function is to store data securely. In our project we have used this database to store our project data.

4. GeoServer:

GeoServer is an open-source server written in Java which allows users to share, process and edit geospatial data. We have hosted our project data on the GeoServer setup at the IIIT-Hyderabad.

Results

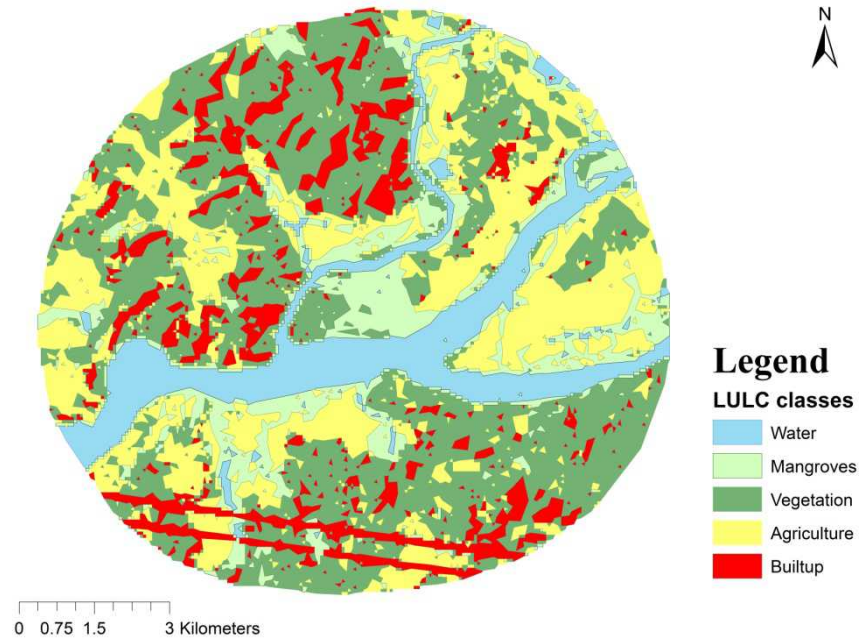


Fig3. Land Use and Land Cover map for year 1976

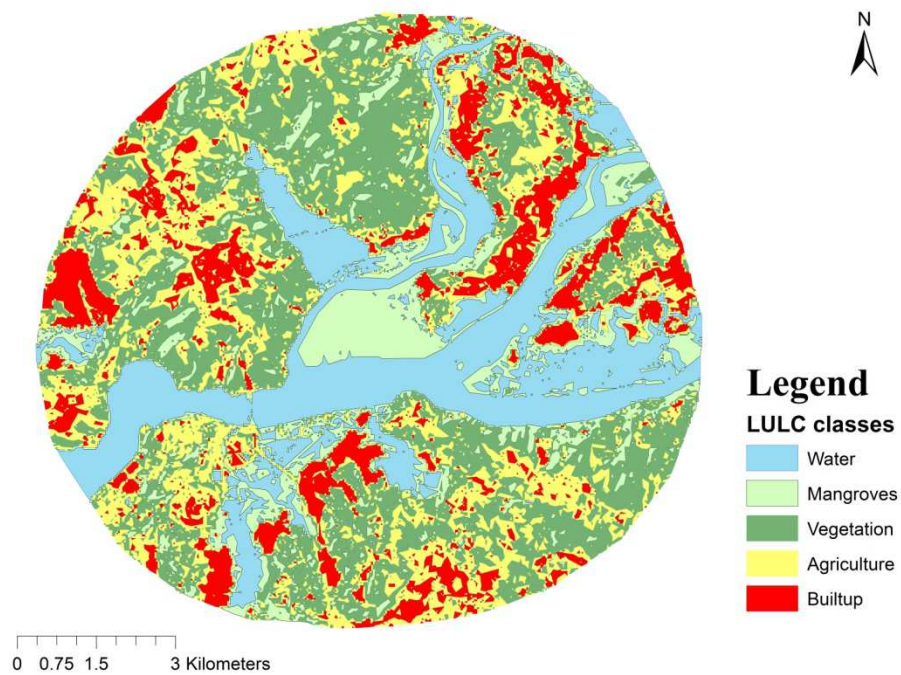


Fig4. Land Use and Land Cover map for year 1992

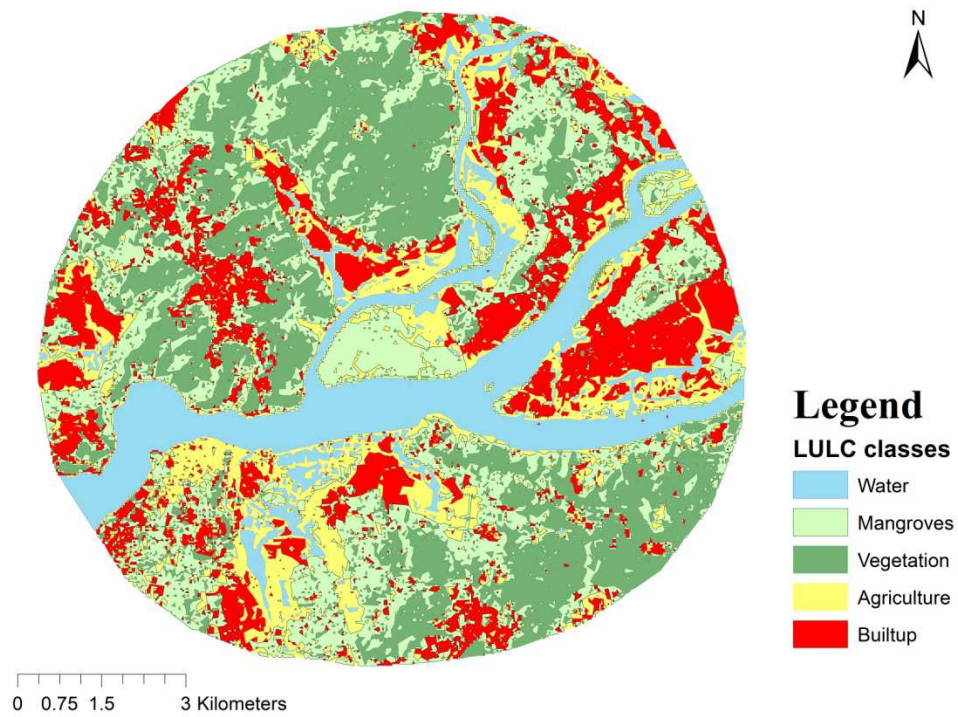


Fig5. Land Use and Land Cover map for year 1995

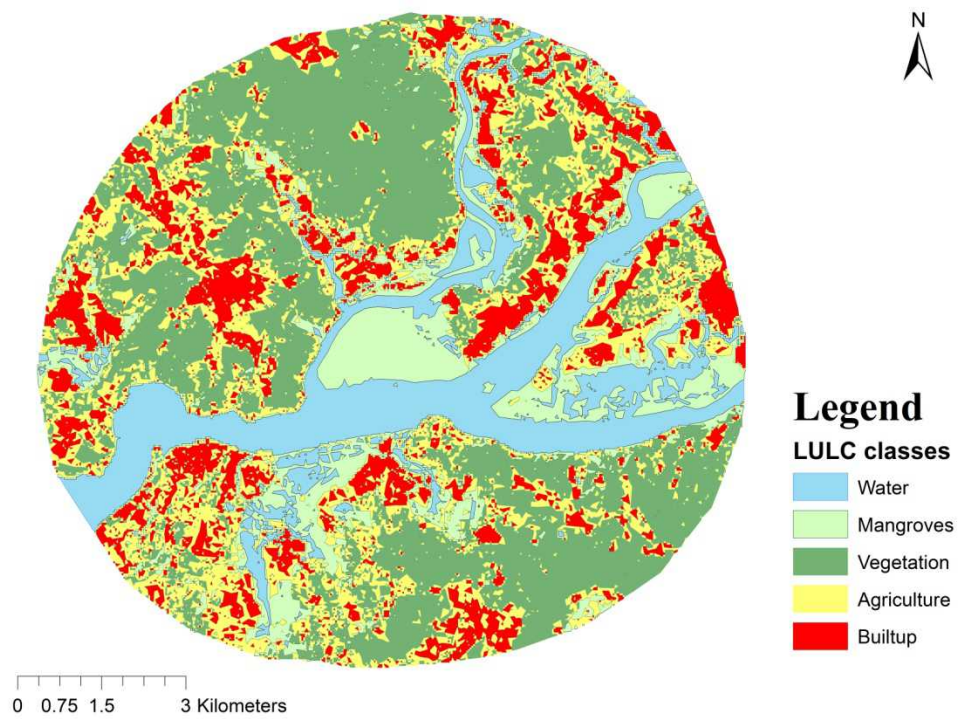


Fig6. Land Use and Land Cover map for year 2001

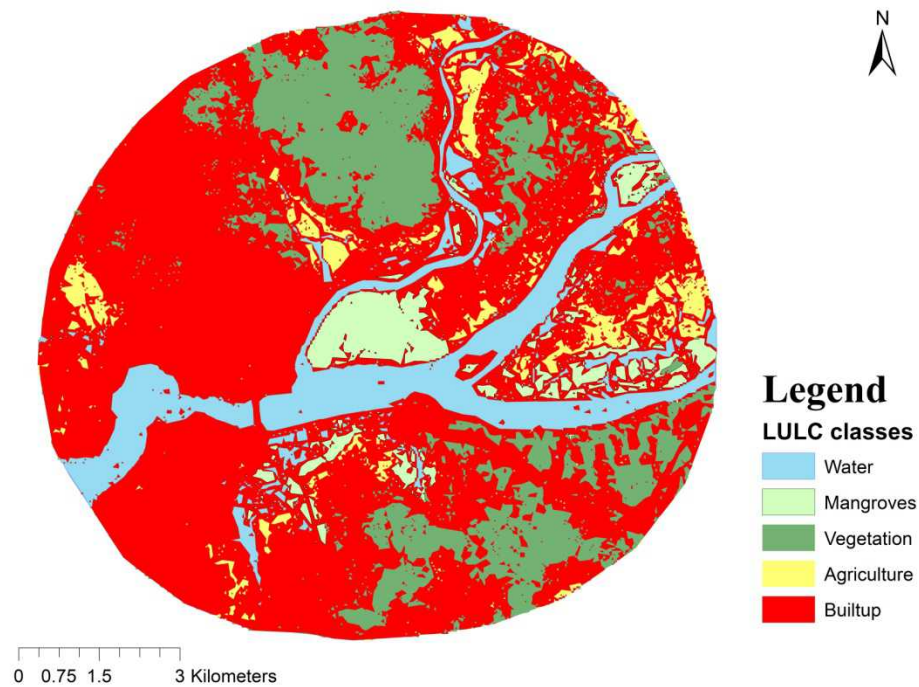


Fig7. Land Use and Land Cover map for year 2015

Land Use and Land cover matrix					
		Year			
		1992	1995	2001	2015
Land Use	Water bodie	19.42	17.03	18.50	13.31
	Builtup area	14.81	21.21	25.33	73.14
	Vegetation	39.67	38.96	38.90	19.16
	Agriculture	25.67	18.31	16.74	5.04
	Mangroves	16.63	20.70	16.73	5.55
Total(sq. km)		116.20	116.20	116.20	116.20

Table 1: Land Use and Land Cover matrix around the Bird Sanctuary

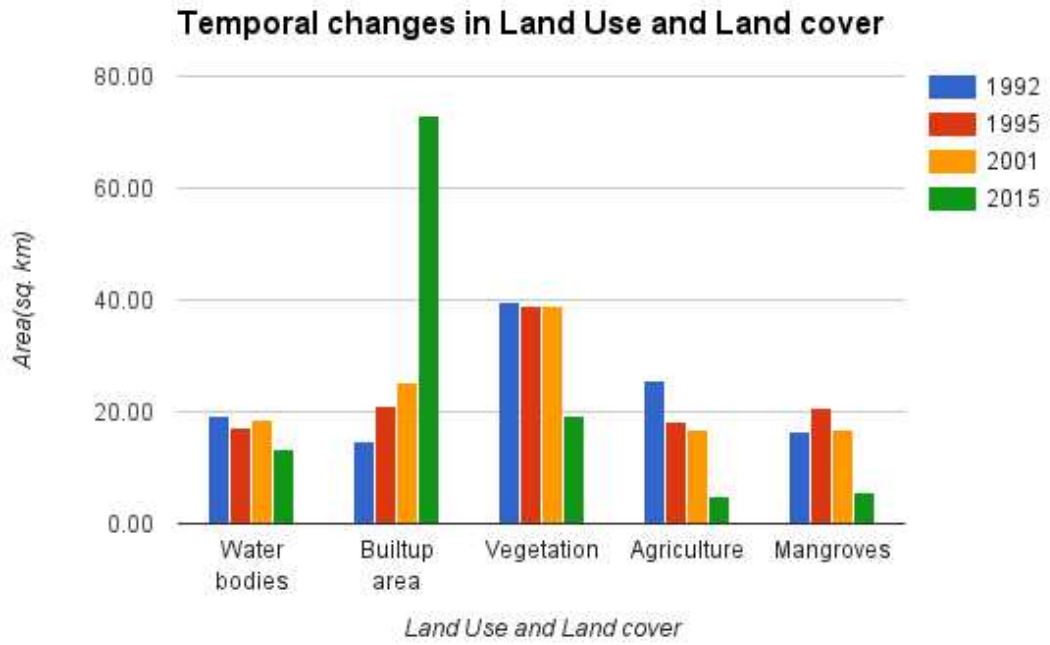


Fig 8: Temporal changes in Land Use and Land Cover around the Bird Sanctuary.

Discussion

A comprehensive study of the concerned area shows us that before inception of the bird sanctuary this area was a combination of a mangrove and other vegetation. Later it was developed as a bird sanctuary by the government and in doing so the area got converted into a complete mangrove. The good part about making it a bird sanctuary is that whereas most of the mangrove area has been lost to built up area in 2015 as is evident from the LandSat classification, this area has maintained itself as a mangrove.

The worrying part of the studies is that built up area has increased by 188.7% over a span of 14 years (from 25.33sqkm in 2001 to 73.14sqkm in 2015) for the concerned area which in turn has lead to a sharp decrease in area under mangroves, vegetation and agriculture.

Results of the study can be referenced in future if at all a land use land cover analysis is to be done for this area. The pattern of various land use land cover changes can also be referred.

Future Scope:

Accuracy assessment has not been done for the presented studies, so this can be improved in future work. In current project land is classified in only 5 classes which again can be increased. for example **Build_up_area** can be sub classified into two sub groups: **Built_up_area_urban** and **Built_up_area_rural**.

References:

1. https://en.wikipedia.org/wiki/Salim_Ali_Bird_Sanctuary(14/12/2015)
2. <http://www.goanjourney.com/Bird-Sanctuary-Dr.Salim-Ali-Bird-Sanctuary-Goa-COI-141-0.html>(16/12/2015)
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4. <https://en.wikipedia.org/wiki/QGIS>(11/12/2015)
5. <http://boundlessgeo.com/products/opensuite/geoserver/>(16/12/2015)
6. <http://earthexplore.r.usgs.gov> (12/12/2015)

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