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LOW-COST METHODOLOGY FOR MONITORING MUNICIPAL
LAND FILLS, BASED ON THE USE OF SATELLITE IMAGES

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ABSTRACT

Caring for the environment is one of the main criteria in the administration of cities, therefore it is necessary to have places where waste generated in cities is managed, between the optimal and the real there is a lot of difference This is why in many countries and with emphasis on large cities, there are unofficial places where they are used as municipal dumps, where large tons of solid waste are disposed of daily without going through a selection and recycling mechanism. These dumps are growing out of control and are almost becoming able to live with people. In the present work it is proposed to present a methodology to be able to monitor these dumps and be evaluated from space through the eyes of the observation satellites, which generate satellite images, the methodology proposes a temporary review of the area where the dumps are located In order to monitor its growth and analyze when it puts the urban population at risk, the results are evaluated in the municipal dump called "El Milagro" located in the vicinity of the city of Trujillo located north of Lima, Peru , the City of Trujillo is one of the main cities of Lima, located to the north, it is in the vicinity of this city where one of the largest dumps in Peru is developed. The results show that with the use of satellite images, the growth of these dumps and their impact on the community can be verified.

Keywords: Landfills, satelliteimage, city, solid waste, temporal analysis.

Introduction

In 1987 the Doña Juana Sanitary Landfill was inaugurated, which has presented different problems, one of them was in 1997 when the collapse occurred, which is why they paid compensation to the residents who were affected by said collapse. In which it caused health problems to the inhabitants, the event to one, norms or modifications have been applied for the application of delimitations to this dump using Landsat 5 TM images which were obtained in 1997 and Landsat 8 OLI of 2015, method by which it is sought to determine the level of growth of the areas which were affected by the landslide of 1997, for which, since it has created a database with images which will be processed to determine its modification in a way annual taking into account the dates and times in which they were taken to make a comparison of location modifications, obtaining the affected area year by year [1]. We found studies related to the degree of knowledge of people to be able to find the levels of perception about the knowledge of the dumps and if people know its implication in the health of people and the environment [2].

Las imágenes satelitales son muy utilizadas en el manejo de las converturas terrestres y su evolución en el tiempo, podemos indicar que en la Subcuenca del Río Llavircay, cuyas ubicaciones en la Cordillera de los Andes Satellite images are widely used in the management of land conversions and their evolution over time, we can indicate that in the Llavircay River Sub-basin, whose location is in the Andes Mountains in the Ecuadorian part of which the Paute River Basin belongs, which is currently a source of growth and life for the population of said area, for which the objective is to carry out the analysis of the use and processing of satellite photos to provide actions for their management and management, on the vegetation cover of the soil of the Llavircay River Sub-basin, the images will be analyzed using the ENVI and ArcGIS software, pre-processing was carried out and the dynamics of the changes on the vegetation cover and land use of the Sub-basin could be known.[3].

Sanitary landfills continue to be a very special issue for the management of municipal governments, that is why there are many studies on their design, we can indicate that a sanitary landfill and a material segregating plant can be designed that are reusable and environmentally safe on solid waste from the urban area of the Santiago de Chuco - La Libertad district. The present study begins with an investigation on bibliographic data and satellite images of the area. In parallel, basic studies were carried out, such as an evaluation of the integral management of municipal solid waste, a characterization study, a reference study of the site and an identification, evaluation and mitigation of the possible environmental impacts of the project as a

result of this investigation, we proceeded to the design of the sanitary landfill and segregation plant, using the trench or trench method, with a total area for the landfill of 14407 m², 1.5 hectares, with 29 trenches [4].

Another of the topics studied in the location of the best location of the dumps, for this objective we found as socio-environmental problems that were generated in the project SNIP - 146148 "Improvement and expansion of the integral management of municipal solid waste in the district of Chachapoyas, Chachapoyas province, Amazonas region", the main objective of the location of an area that complies with standards to create the sanitary landfill for which we employ a geographic information system - GIS, integrated into the site selection criteria as pending, geology, distance to roads, hydrology, forests, distance to the urban-rural population, distance to an airport and the volume of storage. To determine these criteria, evaluations were carried out by means of multi-criteria evaluation and the weights for each criterion were 0 for places not optimal and 1 for optimal locations, using GIS, four optimal zones were obtained within the area study. The methodology used had a field phase, in which the collection of information and the taking of control points with GPS was in situ, and in the office phase the characterization of solid waste management, the criteria of site selection, the elaboration of thematic maps, after carrying out this analysis the maps are superimposed and later the analysis and interpretation are carried out. The district of Chachapoyas has a population of 23,399 inhabitants according to the population growth rate, for which the population growth should be planned as well as the amount of consumption [5].

The objective of this work is to be able to use the Landsat 8 OLI satellite images to monitor the growth of landfills, making a temporal analysis, to know their dynamism with respect to time, in this way to be able to know their impact on society and the effects that these may cause on people's health.

Materials and methods

The methodology that is presented is based on the use of satellite images where it is temporarily analyzed to verify the growth of the dumps, below we present the block diagram of the proposed methodology:

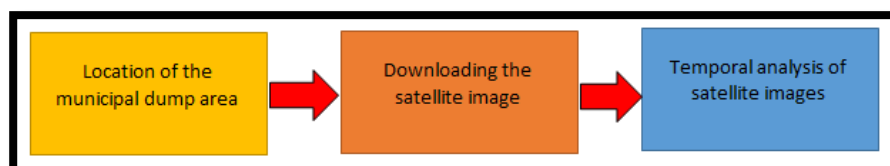


Figure 1. Block diagram of the proposed Methodology

Location of the municipal dump area:The first task to apply the methodology is to locate the area where it is required to have the satellite image, in the following figure, you can see the image search map of the Lansat catalog, where we can visually locate the image region that you want to obtain.



Figure 2. SatellitesSearchcatalog of areas of interest for satellite images

In figure 2, the map is presented to find the areas of interest and to be able to download satellite images from the Lansat satellite.

Download the satellite image: After locating the area of interest in the catalog of the satellite image, we proceed to download, in figure 2, it is possible to observe the downloaded and segmented image in the area of interest to be analyzed, due to a fundamental characteristic of the resolution of the image that has a metric characteristic, the image cannot present levels of detail of the image, therefore if we can have a greater coverage of the terrain.

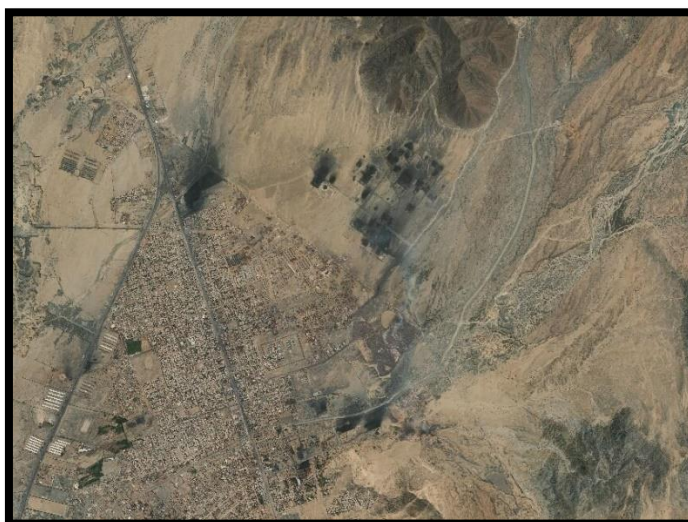


Figure 3. Satellite image in natural color configuration, segmented by the area of interest to be analyzed

In figure 3, the satellite image is presented in the Natural Color configuration, where the dump is seen, one of the characteristics of the dumps is the constant burning of the waste, which can be evidenced in the image, a problem for people's health is the smoke that it generates as well as the aerosols that are emitted into the air at the time of incineration.

Temporal Analysis of satellite images: The temporal analysis of the satellite images is carried out by searching, downloading and analyzing images on different dates of the same area of interest, depending on the dynamism of the dump and the availability of the images, the temporal analysis can be carried out, it is at this stage that The perimeters of the dumps must be analyzed to calculate the affected area and how it is moving towards the nearest population.

Results

The results that are presented below are based on the steps of the methodology, where the dumps were recorded in the satellite image, one of the most used mechanisms is Google Earth images, but it has a small disadvantage, which is difficult to have. a collection of images on different dates, the images only present an image of the area of interest, which is why the importance of the work of satellite images, firstly because of the coverage of the area and secondly because we can have several images of the same area of interest at different times.



Figure 4. Google Earth image of the area of interest

In figure 4 you can see the area of interest marked in red circles, in order to analyze the coverage of the dumps in the image provided by Google Earth.



Figure 5. Imagen Landsat de la zona de interés



Figure 6. Imagen Landsatsegmentada de la zona de interés

In figure 5, you can see the satellite image of the area of interest, where the markings of the areas of interest were made, where there is the presence of the dump, it is important for the methodology, to be able to corroborate the information presented with the image, with a register of the area in order to confirm the use of land cover, as well as to calculate an index related to solid waste.

In figure 6, you can see one of the advantages of satellite images compared to Google Earth images, where the image can be enlarged without affecting its resolution, it is with this feature that the perimeter of the dump can be delimited in order to be able to calculate the area that is affected, as well as the registration of the perimeter and the area it occupies, it is important to indicate that a new image of the area of interest should be sought in the image catalog for analysis with respect to the image analyzed with an earlier date.

In the analysis of the satellite images, it is necessary to take into account the color model to be used, for which in a normal situation it is possible to work with the natural color model, but depending on the record, combinations can be made between the different bands and be able to analyze them to determine which of the combinations is the most suitable for the analysis of the dumps.

Conclusions

The conclusions reached at the end of the research is characterized by the use of satellite images to analyze the process of the use of land cover, in our particular case, the issue is related to the study to analyze the dynamism of the dumps, more known as municipal garbage dumps,

it is concluded that in cases where cloud cover cannot be recorded in the area of interest, the image with the closest date should be located.

It is recommended that the analysis be carried out taking into consideration a combination of standard bands so that subsequent analyzes can be performed with the same color configuration, it is an important issue to be able to delimit the area of interest, as indicated in figure 6, Because you want to analyze the dynamism of the image, for this reason being able to determine a special area and be able to weaken it helps its subsequent analysis to be able to check if it is growing or in another trend, due to a characteristic of the populations, the presence of the increase in solid waste produced by cities, which is why it is important to be able to know to what degree the dump is growing and even more so how it may be impacting people's health.

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