JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

# ASSESSMENT OF STRANGE PHENOMENA USING TEMPORAL CHANGES OF LONAR LAKE

**Prof. Dr. Tribhuvan. Leena. K.**[1]
Department of Geography K. J. Somaiya College Kopargaon.Maharashtra
Email Id:leena.unipunegeo@gmail.com

**Prof. Sonawane. Akash. S.**[2]
Department of Geography K. J. Somaiya College Kopargaon.Maharashtra
Email Id:sonawaneakash0101@gmail.com

**Mr. Gawai. Rahul. O.**[3]
Research Assistant, GIS and Mapping Lab (GISML),
Department of Civil Engineering, American University of Sharjah, UAE

**Abstract**

*Lonar Lake is the third largest natural salt lake in the world. The lake turned pink in a span of 3 days in month of June 2020 and indicator of Lower water level, increased the temperature, low influx of fresh water body and no interference of human due to lock down of pandemic period leads to growth of Halo bacterium and Dunaliella Salina algae secrets carotenoid and due to increased of carotenoids levels which in turn led to colour change and it's necessary to know the why this strange phenomena is happen. The main objective of this research is to assess temporal changes using NDVI was calculated using the Landsat images to determine vegetation using Arc GIS. Top of Atmospheric radiance (TOA) correction were applied. This research is based on secondary data total 6 tiles of different month were downloaded through Landsat 8 series using band 4 and 5 from USGS with 30m resolution with using the NDVI method through Arc GIS for preparing the thematic mapping and MS excel is used for preparing the graphs.*

**(Keyword: Lonar Lake, Normalised Difference Vegetation Index, LANDSAT Satellite Image, Water Colour Change, Algae)**

## Introduction

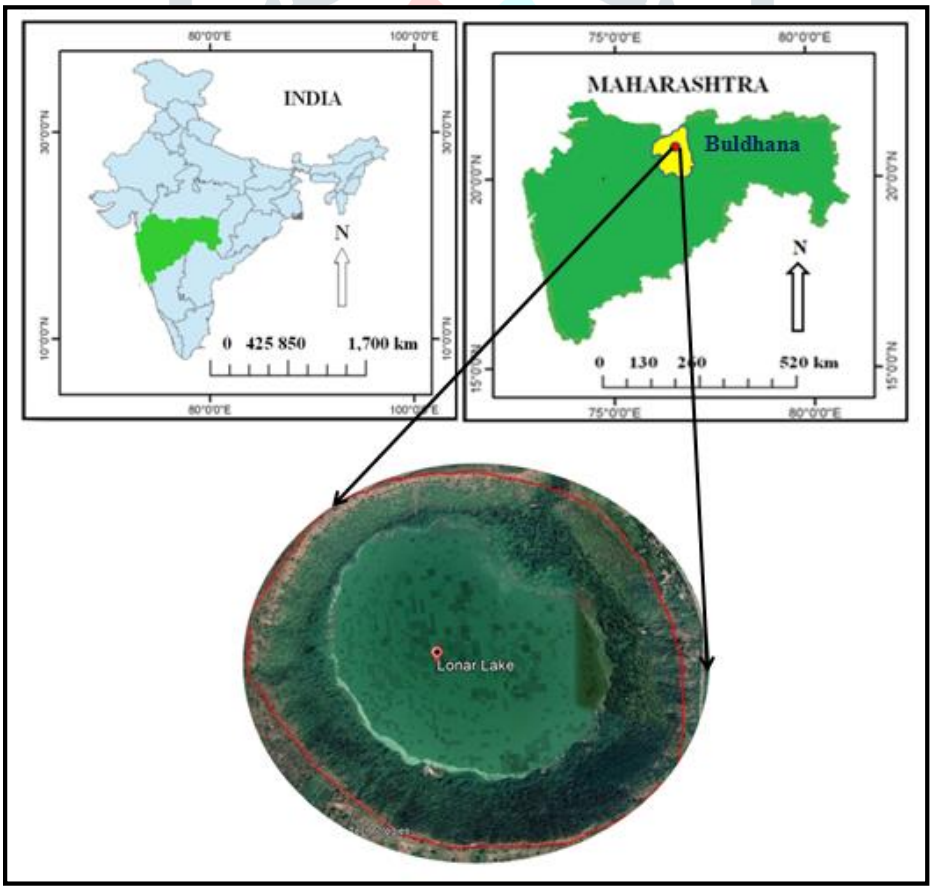
Lonar crater or lake only hyper velocity impact crater of meteorite impact that occurred 50,000 year ago, in basaltic rock of the central Maharashtra inside the Deccan Plateau. A land locked water body of the Lonar lake support micro organisms rarely found elsewhere on earth. This wetland is also known as rich biodiversity hotspot that's why this place is known as the 'Geo Heritage' and It consists different type of flora and fauna. The slopes

around of the lake have a multiple rings of trees and It is home to wide of migratory and resident birds. This lake is fascinating flora surrounds lake basin in the bottom is an ecological wonder of Lonar (Dabhade, et. al. 1999). This lake brings supports typical microbial flora and fauna need to access its value of wet land may be recognized as Ramsar site of India (Tandale et. al. 2014). Many type of phytoplanktons are present in this Lake e.g. spirulina, chlorophyceae (Green algae), cyanophyceae (Blue green algae), Bacillariophyceae (Diatoms). The blue green algae the major phytoplankton community and particularly Spirulina is the dominant (Dabhade, May 2015). Water is turning pink. This phenomenon is not happened first time in India only the same phenomena found in saline water lake which name is Lake of Uremia, Iran.

**STUDY AREA**

Lonar Lake located at Buldhana district, Maharashtra, India. Its extend between 19°58′35″N latitude and 76°30′30″E longitude comprising Surface area 1.13 km$^2$. Lonar Lake has a mean diameter of 1.2 km and it's about 137m. Lonar Crater is understood to be the result of a meteorite impact that occurred between 35,000 and 50,000 years ago and has an oval shape. The water in the lake is both Saline and Alkaline Lonar Crater sits inside the Deccan Plateau a massive plain of volcanic basalt rock created by eruptions some 65 million years ago. Its location in this basalt field suggested to some geologists that it was a volcanic crater.

**Fig 1:** Location map of Study Area




**(Source: C**rated by researcher**)**

## OBJECTIVE

1. To assess temporal changes using NDVI.

## DATABASE

This research is based on secondary data through Satellite images from the LANDSAT 8 series using band no 4 and band 5 of the United State Geological Survey (USGS) month of 18th January 2020, 19th February 2020, 06th March 2020, 07th April 2020, 09th May 2020 and 10th June 2020 respectively with a resolution 30m are used for the generation of NDVI for the assessing the temporal changes using NDVI.

## METHODOLOGY

For the achieving the following objective methodology were used. The specific procedures were used for data analysis.

- Pre-processing of remote sensing images is necessary for reducing the noise due to atmospheric conditions and to increase the interpretability of information from the data. Especially when conducting vegetation studies using temporal images, the images need to be spatially and spectrally compatible.
- The idea behind pre-processing the temporal images is to reduce the noise introduced into the data because of atmosphere and to make the images spatially compatible to each other.
- Thus the available temporal images of LISS-III are pre-processed with respect to image registration and atmospheric corrections for its use in the temporal study
- The total 6 LANDSAT multispectral image were downloaded from USGS website. And tiles that were rectified and pixel values were scaled of TOA of atmospheric radiance.
- The LANDSAT satellite images was converted to atmospheric reflectance value to Band 4 (Red) and band 5 (Near Infrared) allowed to standardized comparison of images taken from different mosaic method was done.
- Then masking was done to remove other features on present on the area used. After the images were masked further to calculate NDVI.
- The utilizing the index calculator model and further analyzed in ArcGIS. Normalized to a scale from -1 to +1.
- Other statistical method is done through MS Excel is used to prepare Histogram and Line Graphs.

## RESULT AND ANALYSIS

### NDVI

The Normalized Difference Vegetation Index (NDVI) is graphical indicator and quantifies vegetation that can be used to analyze remote sensing measurements through the following equation:

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

The result of this NDVI a value between -1 and +1. If Satellite image has low reflectance value in red channel and high reflectance in NIR channel then image has NDVI values close to +1 and there are high possibilities that it's dense green value. But NDVI is close to zero there isn't green leaves and it would even be an urbanized area. Then it's necessary to perform atmospheric correction. NDVI is mostly used in several sectors NDVI uses the NIR and Red channel in its formula like Agriculture, drought, forest etc.

**TOA reflectance**

(MTL file). The following equation is used to convert DN values to TOA

Reflectance for OLI data as follows:

$p\lambda' = M\rho\ Qcal + A\rho$ ---------- (1)

Where:

pλ' = TOA planetary reflectance, without correction for solar angle. Note that ρλ' does not contain a correction for the sun angle.

Mρ = Band specific multiplicative rescaling factor from the

Metadata (REFLECTANCE_MULT_BAND_x, where x is the band number)

Aρ = Band specific additive rescaling factor from the Metadata (REFLECTANCE_ADD_BAND_x, where x is the band number)

Qcal = Quantized and calibrated standard product pixel values (DN)

TOA reflectance with a correction for the sun angle is then:

$p\lambda = \rho\lambda'/cos(\Theta SZ) = \rho\lambda' / sin(\Theta SE)$ ---------- (2)

Where:

ρλ = TOA planetary reflectance, with correction for solar angle.

pλ' = TOA planetary reflectance, without correction for solar angle.

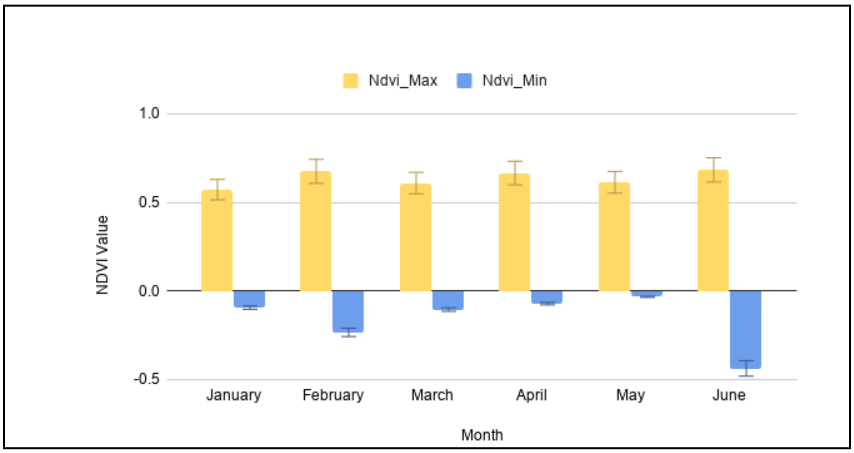
ΘSE = Local sun elevation angle. The scene centre sun elevation angle in degrees is provided in the metadata (SUN_ELEVATION).

ΘSZ = Local solar zenith angle; [ΘSZ = 90° - ΘSE]

The maximum and minimum NDVI values are shown in the Figure 3. The total 6 month January, February, March, April, May and June respectively. Yellow color showing the maximum and blue color showing the minimum value

of NDVI and Month of January is near about 0.6 and it was increasing 0.7 in the month of February. It was again showing decreasing value in the month of March. Month of June the maximum value is reached almost 0.8 and within six month the only June month.

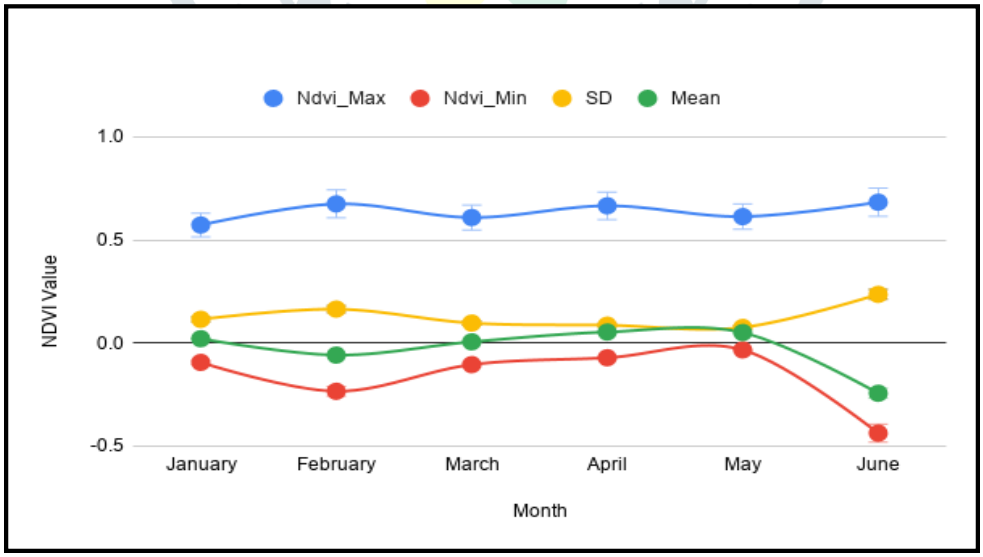
**Fig 3**: Maximum and Minimum NDVI value.




**(Source:** Computed by researcher**)**

**Fig 3:** A fluctuating trend of NDVI means value can be observed from the five different month datasets e.g. January, February, March, April, May and June respectively to assessing the temporal changes of month. The recorded NDVI mean value is January -0.4 resulted to standard deviation of 0. 1. There is an increased of 0.1 from January to February. Again in March, April and May month it's shown the consistency of NDVI. NDVI mean value recorded in month of May is increased relative to other month as well in month of June Standard Deviation is increased comparative to other five month it's almost 0.3 as shown as the figure: 3.

**Fig 4:** Mean and Standard deviation of NDVI




**(Source:** Computed by researcher**)**

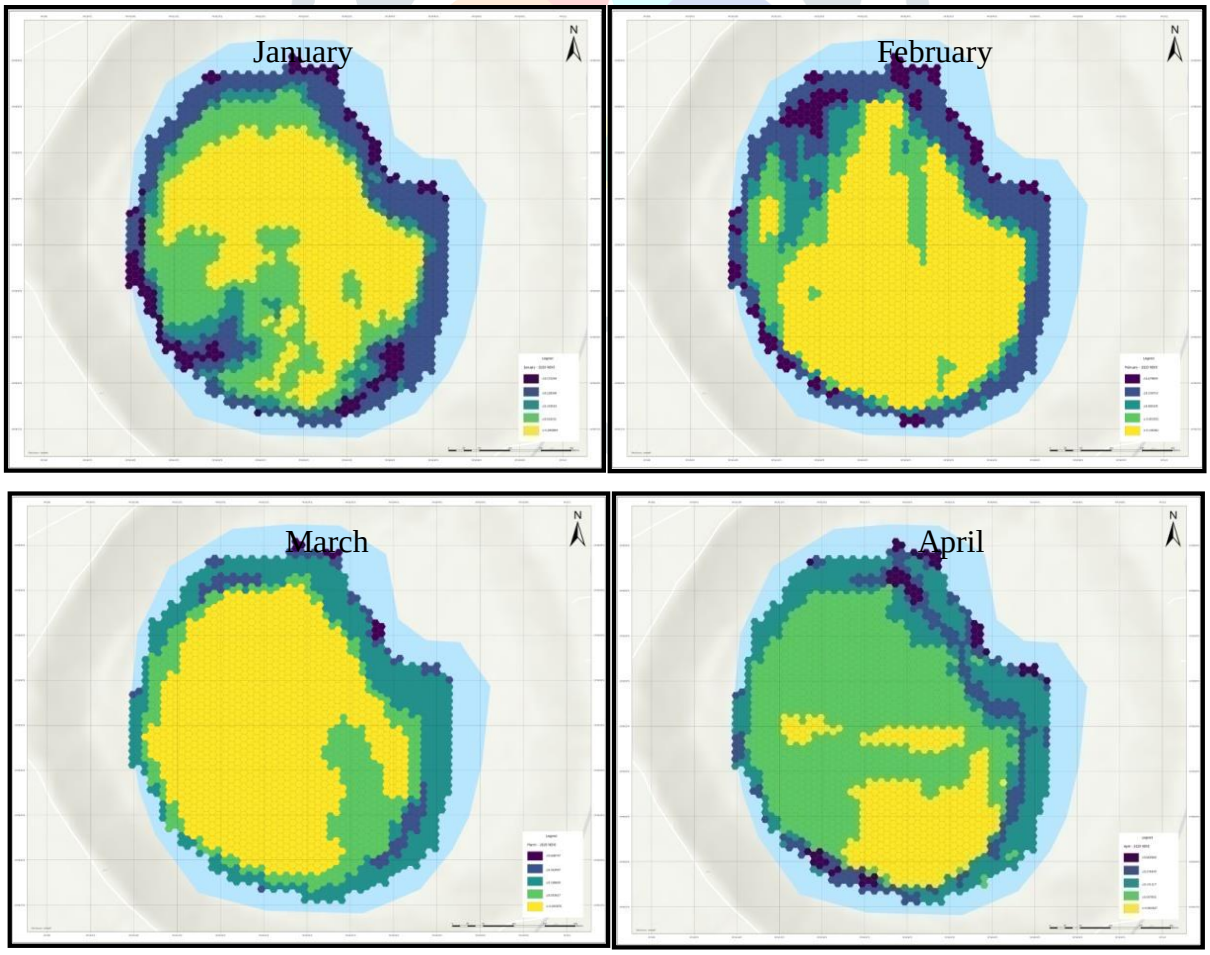
Normalized Difference Vegetation Index (NDVI) for all dataset focusing a specific area nears the lake with their corresponding true colour image and NDVI maps on the outside of lake the green colour had high values while red colour were low. High NDVI values indicator vegetation because healthy plants have high reflectance in NIR band and low NDVI value indicator vegetation because of low reflectance in NIR band. Algae's were concentrated along

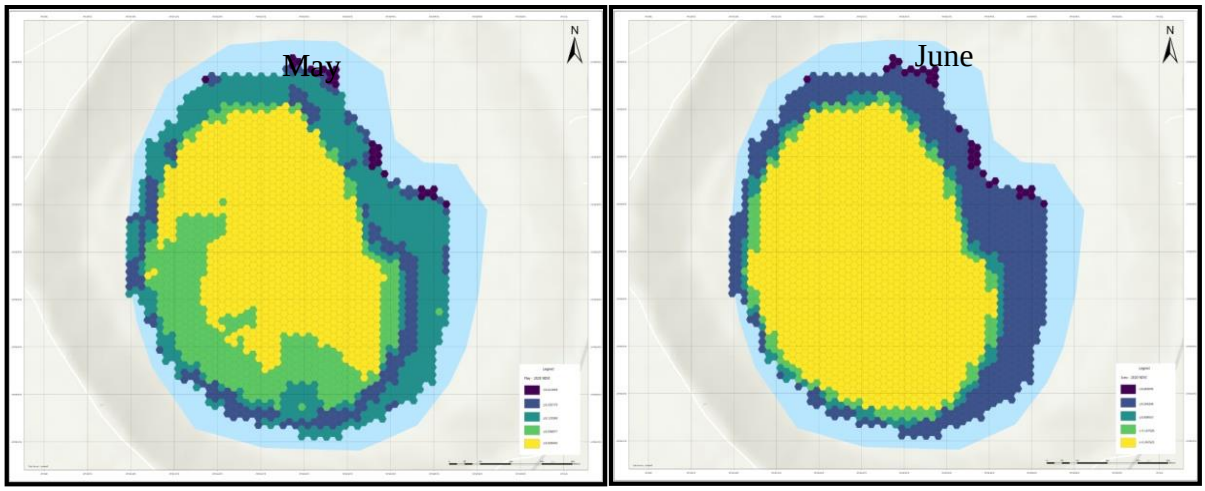
the lake area. Dark Blue colour showing the high reflectance of NIR band that's mean algae is present there and yellow colour showing the low reflectance of NIR band. If compared the six month NDVI images following January to June month and noticed that in the month of January and February outside of the lake algae are almost consistent and further in the month of March algae are identified lessen scale along with in the month of April algae were increased.

The trend on the presence of algae for six month greatly showed a increased and decreased the outside corner of around lake area observed NDVI image. It is drastic change were identified between the month of January and June. In the month of January algae were lessen as verified and in the month of June algae are prominently identified as easily shown in the NDVI maps.

In the month of June, 2020 this saline lake turned pink in the span of 3 days. There are many different algae present in the lake and in this particular time specific algae increased and the main indicator of Lower water level, increased the temperature, low influx of fresh water body and no interference of human due to lock down of pandemic period leads to growth of Halo bacterium and Dunaliella Salina algae secrets carotenoid and due to increased of carotenoids levels which in turn led to colour change and This research paper has concluded the vegetation or algae presence in the month of June through satellite image using the NDVI method.

**Fig 4**: NDVI image of January, February, March, April, May and June Month)






**(Source:** Map created by researcher**)**

## CONCLUSION

This study has been carried out to detect the change in the colour of Lonar lake with the help of satellite imageries. The lake turned pink in a span of 3 days in month of June 2020. Due to high temperature, absence of rain, increased salinity and less human interference because of the lockdown. The increased salinity and pH facilitated the growth of halophilic microbes, mainly Haloarchaea. Halophiles are a group of microorganisms that can grow and often thrive in areas of high salt (NaCl) concentration. Haloarchaea or halophilic archaea is a bacteria culture which produces pink pigment and is found in water saturated with salt. Because of the biomass of Haloarchaea microbes, the surface of the water turned red or pink. As the biomass subsides, the colour will disappear. The colour of the lake is now returning to original as the rainy season has kicked in, allowing dilution of the water. The salinity and pH/alkalinity levels have also come down and green algae have started growing in the water body. Further, it was noted that Haloarchaea microbes were ingested by Flamingos. These microbes acted as carotenoid (pigment) rich food for the birds. Flamingos get their red-pink colour from special colouring chemicals called pigments found in the algae and invertebrates they eat.

## REFERENCES

**Alaguraja,** P., Yuvaraj, D., & M, S. M. M. P. M. (2010). Remote Sensing and GIS Approach for the Water Pollution and Management In Tiruchirappli Taluk , Tamil Nadu , India, 1, 66– 70.

**Buccat, R**. (2017, March 21). Slimy algae in Boracay stir debate among locals, experts. Retrieved October 5, 2018, from https://news.abs-cbn.com/life/03/21/17/slimy-algae-in-boracaystir-debate-among-locals-experts.

**Chen, Sh. P**., Lu, X. J., Zhou, Ch. H. 2000. Principles of Geographic Information System. Science Press, Beijing, pp. 3-4.

**Garcia, R.,** Fearns, P., Keesing, J., & Liu, D. (2013). Quantification of floating macroalgae blooms using the scaled algae index. *Journal Of Geophysical Research Oceans*, *118*(1), 26-42. doi: 10.1029/2012jc008292.

**Harun-Al-Rashid**, A., & Yang, C. (2018). Improved Detection of Tiny Macroalgae Patches in Korea Bay and Gyeonggi Bay by Modification of Floating Algae Index. *Remote Sensing*, *10*(9), 1478. doi: 10.3390/rs10091478.

**Jensen, J**. (2014). Remote sensing of the environment. 2nd ed. India: Dorling Kindersley, pp.418-431.

**Kheiralla KM**, Eshag A, Elzien SM, Saud SA, Al-Imam OA (2014) Seasonal Variation of Algae Types, Counts and their Effect on Purified Water Quality Case study: Al-Mogran and Burri Plants, Khartoum State, Sudan. J Biodivers Endanger

Species 2:122. doi:10.4172/2332-2543.1000122.

**Lee, J.**, Cardille, J., & Coe, M. (2018). BULC-U: SharpeningResolution and Improving Accuracy of Land-Use/Land-Cover

**Lim, H. S**., MatJafri, M. Z., Abdullah, K., Alias, A. N. and Mohd. Saleh, N., (2008). Water quality mapping using remote sensing technique in Penang Straits, Malaysia. Proceedings of SPIE - The International Society for Optical Engineering.

**Ranada, P.** (2015). Gov't to crack down on water-polluting Boracay resorts. Retrieved from https://www.rappler.com/science-nature/environment/92068boracay-water-pollution-crackdown-resorts.

**Trescott, A.** (2012). Remote Sensing Models of Algal Blooms and Cyanobacteria in Lake Champlain. Environmental & Water Resources Engineering Masters Projects. Retrieved from https://scholarworks.umass.edu/cgi/viewcontent.cgi? article=1045&context=cee_ewre

**Wicaksono, P.**, & Lazuardi, W. (2018). Assessment of PlanetScope images for benthic habitat and seagrass species mapping in a complex optically shallow water environment. International Journal Of Remote Sensing, 39(17), 5739-5765. doi: 10.1080/01431161.2018.1506951.

**Zhang, B**., Qin, Y., Huang, M., Sun, Q., Li, S., Wang, L., & Yu, C. (2011). SD–GIS-based temporal–spatial simulation of water quality in sudden water pollution accidents. Computers & Geosciences, 37(7), 874-882. doi: 10.1016 /j.cageo. 2011.03.013.