A RESEARCH DISSERTATION

"ASSESSMENT OF SURFACE WATER CHANGES IN JALGAON DISTRICT BY USING REMOTE SENSING AND GIS TECHNIQUES."

Submitted to

Nanasaheb Yashwantrao Narayanrao Chavhan Arts, Science and Commerce College, Chalisgaon

In partial fulfilment for the Degree of Master of Arts

IN

GEOGRAPHY

Submitted By,

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CERTIFICATE

This is to certify that Mr. Nitin Madhukar Rathod bonafide student at Nanasaheb Y. N. C. Arts, Science and Commerce, Chalisgaon in M. A/M.sc. II (Geography) has successfully completed the project work entitled **"Assessment of Surface Water Changes in Jalgaon District by Using Remote Sensing and GIS Techniques."** for partial fulfilment of the master"s degree in Geography for Gg-405: Project Work and Dissertation year 2023-2024.

Dr. A. L. Suryawanshi   Dr. A. L. Suryawanshi   Dr. S. R. Jadhav

Project Guide   **Head**   **Principal**

Acknowledgement

We express our wholehearted sense of gratitude and thanks our honourable project guide, **Mr. Nilesh S. Patil** Nanasaheb Y. N. C. Arts, Science and Commerce College, Chalisgaon who has been a source of study devotion, encouragement enlightenment and for inspiration for mobilization of the progress of our project.

We also express my grateful thanks to **Dr. S. R. Jadhav** Principal, Nanasaheb Y. N. C. Arts, Science and Commerce College for his constant support and valuable suggestions and We also sincerely thanks to **Dr. A. L. Suryawanshi,** for making critical comments and helpful suggestions throughout the project work.

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We would like to give lot of thanks to my parents for their moral as well as financial support. We will never forget our parents who provided all the needs and given divine blessing and guidance to us.

Mr. Nitin M. Rathod

M.A./M.Sc. II (Geography)

CERTIFICATE OF THE GUIDE

It is certified that the work in report entitle "ASSESSMENT OF SURFACE WATER CHANGES IN JALGAON DISTRICT BY USING REMOTE SENSING AND GIS TECHNIQUES." submitted by candidates **Mr. Nitin Madhukar Rathod** was carried out by candidate under my supervision. Such material has been obtained from other sources and duly acknowledged in the thesis.

Head, Department of Geography

Nanasaheb Y. N. C. Arts, Science and

Commerce College, Chalisgaon

DECLARATION BY CANDIDATE

We declare that the thesis **"Assessment of Surface Water Changes in Jalgaon District by Using Remote Sensing and GIS Techniques."** Submitted by us for the partial fulfilment of the degree of master"s in science in Geography is a record of dissertation work carried out by us during the period from <u>Jan 2024 to May 2024</u> under the guidance of Mr. Nilesh S. Patil, Department of Geography, Nanasaheb Y. N. C. Arts, Science and Commerce College, Chalisgaon .

We further declare that material obtained from sources has been duly acknowledged in the thesis.

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Abstract

Water is an important element and is classified as crucial for survival of life, since years of coexistence in nature, human is consistently coming across natural resources and few them have exhausted in past decades. In the current study The water bodies in Jalgaon district were mapped with the help of cloud-free Landsat _8 data sets. Surface water data sets for the year 2015, 2017 and 2020 were generated and analyzed for water and non water surfaces. Change in water bodies with respect to time was done and thus was helpful for studying the water dynamics in Jalgaon District. The technique of Normalized Difference Water Index (NDWI) was used to detect the surface water bodies. The NDWI-generated images were classified into water and non-water pixels, and an supervised classification was performed to find out accuracies of output. The NDWI method displays a good result of water surface detection with for the classified images.

The surface water-mapped images were used to classify the water into permanent water, seasonal water and new permanent water. The change detection is performed and mapped using geographic information system (GIS) operations to understand the surface water dynamics from 2015 to 2020. The results illustrated the effectiveness of the NDWI approach for surface water mapping and GIS for change detection analysis, especially in detecting the changes in different times, simultaneously.

Keywords Landsat_8 · NDWI · Surface water · GIS · Change detection

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Chapter1.

Introduction

Water scarcity is one of the most important concerns in today's world. The mankind is suffering for the potable water lot in many corners of the world. Especially in our Maharashtra most of the population relies on natural water resources which are ample for few months after monsoon. In my current project all the water bodies in Jalgaon district were studied through data downloaded from USGS portals LANSAT-8 images. The current project Includes water bodies situated in Jalgaon District. The technique of normalized difference water index (NDWI) was used to detect the surface water bodies of the basin. The NDWI-generated images were classified into water and non-water pixels, and an accuracy assessment was performed to find out accuracies of output. The surface water-mapped images were used to classify the water into permanent water, seasonal water and new permanent water. The change detection is performed and mapped using geographic information system (GIS) operations to understand the surface water dynamics Seasonally from Nov, 2017- Nov, 2020. The results illustrated the effectiveness of the NDWI approach for surface water mapping and GIS for change detection analysis, especially in detecting the changes in different times, simultaneously.

Chapter 2.

Literature Review

1.2 Study Area Extraction and Image Registration

The Landsat-8 data used in this study were obtained from US Geological Survey (USGS) portal (http://www.usgs.gov).

Jalgaon District was satellite images extracted using landsat 8 image from USGS (http://www.usgs.gov) All the bands of Landsat 8 data were layer- stacked to produce a single multi-band image for each date Nov 2015, Nov 2017 and Nov 2020 Images were projected to UTM Zone 43 North Project Information of the training set was used to define the mean and variance of water and non-water classes. Training sets were chosen in such a way that they covered the full range of variability within each class to enable software to accurately classify the entire image. By setting priorities for these classes, the supervised classification of image was performed by assigning a class value to all the pixels. For the classification of surface water maximum likelihood classification (MLC) algorithm was used, wherein a pixel was assigned to a class according to its probability of belonging to a particular class whose mean and covariance are modeled to form a normal distribution in multi-spectral feature space . The purpose of classifying NDWI images is to separate the surface water from land and other features so as to map the surface water correctly. Hence, the NDWI images were classified into two classes: water and non-water. The non-water pixels belong to the classes other than that of water.

Chapter 3.

Materials and Methods

Obejective

> TO extract the surface water bodies (seasonal and permanet) throgh RS and GIS techniqes

> Assessment of change detection in the seasonal and permanet water bodies in the study area

1.1 Study Area

Mapping of the surface water change selected for the Jalgaon District. It covers an area of about 6994.54 km^2. It lies between 21.0396^0 North latitudes and 75.5277^0 East longitudes. The current study has Areas of Jalgaon District compared for water availability in district in period of 5 years as studied subsequently from 2015, 2017 and 2020. Identified by USGS portal Land sat 8 images monsoon.

NDWI calculate formula [Green - band NIR ÷ Green+ band NIR]

INDIA
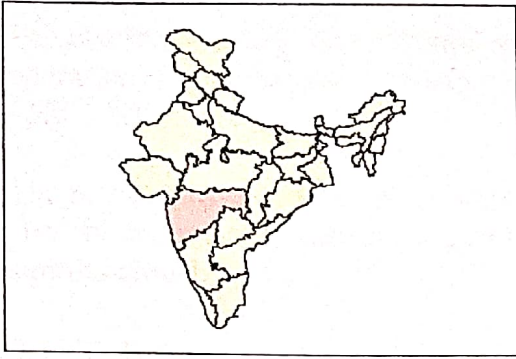
MAHARASHTRA
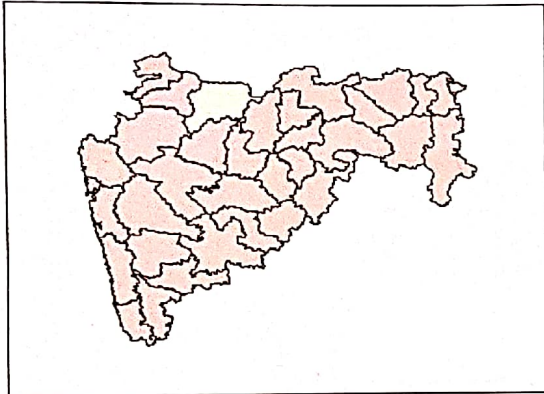
Location Map of Jalgaon Distric

Chopda
Yaval
Raver
Amalner
Edalabad
Erandol
Jalgaon
Bhusawal
Parola
Jamner
Bhadgaon
Pachora
Chalisgaon

Legend
Jalgaon District

0 5 10 20 30 40 KM

N
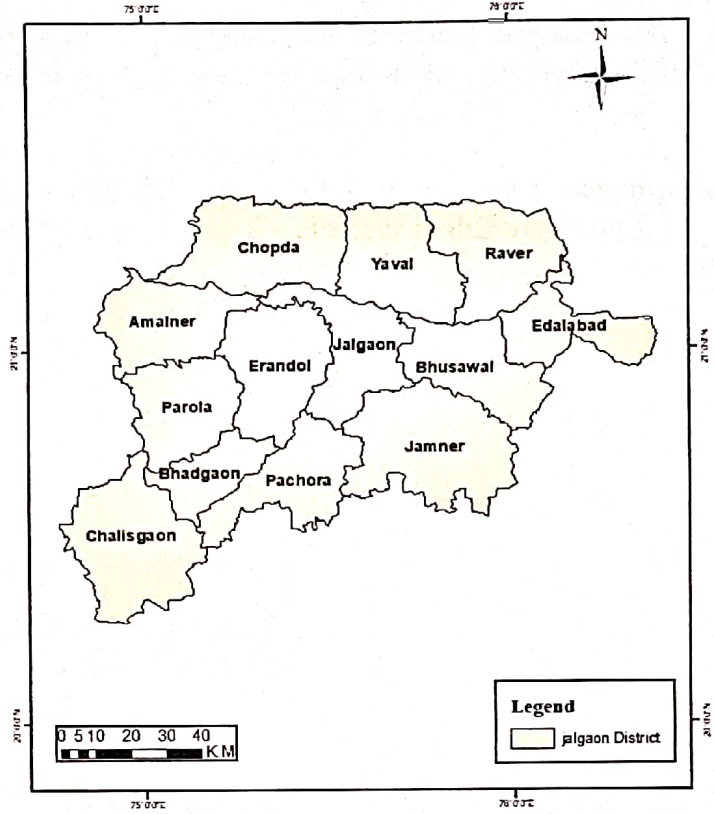
DATA AND METHODOLOGY

➤ The change detection is performed and mapped using geographic information system (GIS) operations to understand the surface water dynamics Seasonally from Nov, 2015, Nov 2017 and ◦ Nov, 2020.

➤ The results illustrated the effectiveness of the NDWI approach for surface water mapping and GIS for change detection analysis, especially in detecting the changes in different times, simultaneously.

3.1. Tabale
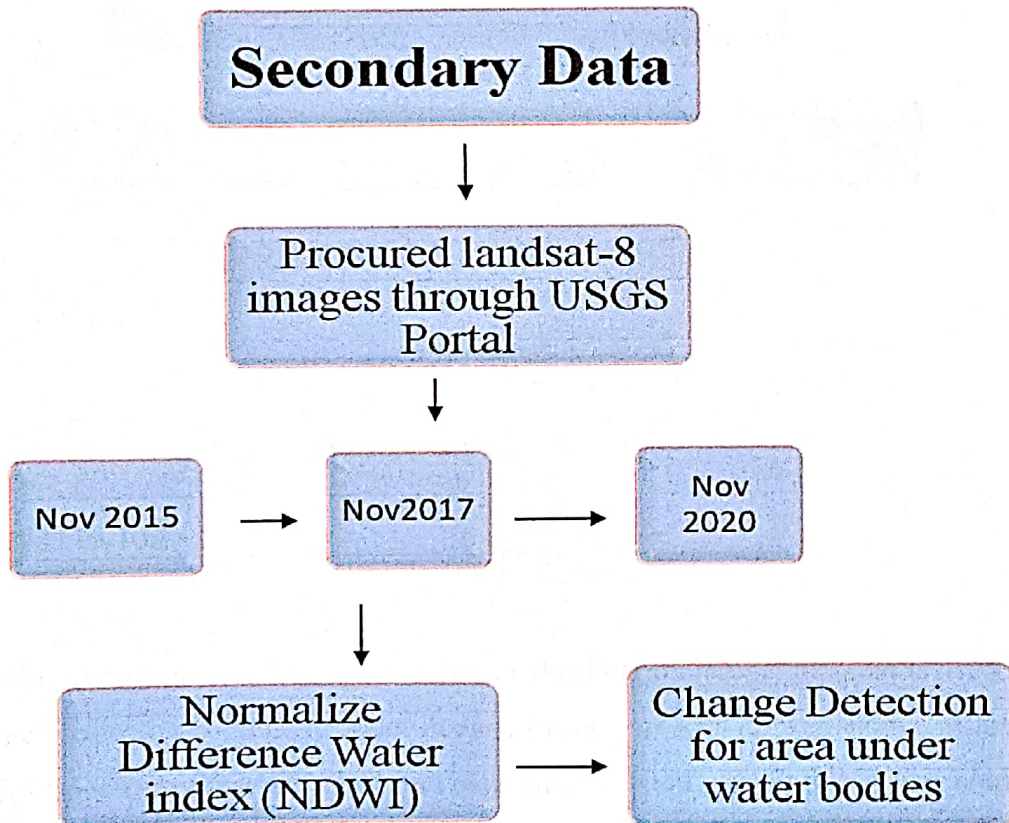
3.2Table Supervised classification

```
┌─────────────────────────────┐
│   Supervised Classification │
│   of Water bodies and Non   │
│        Watered Areas        │
└─────────────────────────────┘
              │
              ▼
      ┌─────────────────┐
      │  Land use land  │
      │      cover      │
      └─────────────────┘
              │
              ▼
   ┌───────────────────────────┐
   │  Water bodies extracted   │
   │  supervised  Classification in │
   │      Jalgaon District     │
   └───────────────────────────┘
              │
              ▼
┌───────────┐   ┌───────────┐   ┌───────────┐
│ Nov 2015  │ → │ NOV 2017  │ → │ NOV 2020  │
└───────────┘   └───────────┘   └───────────┘
```
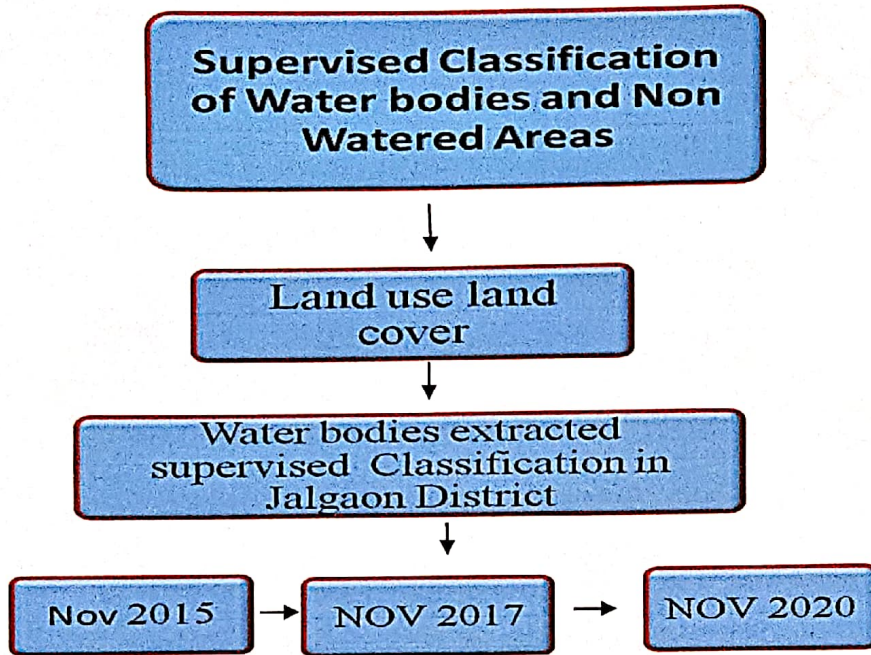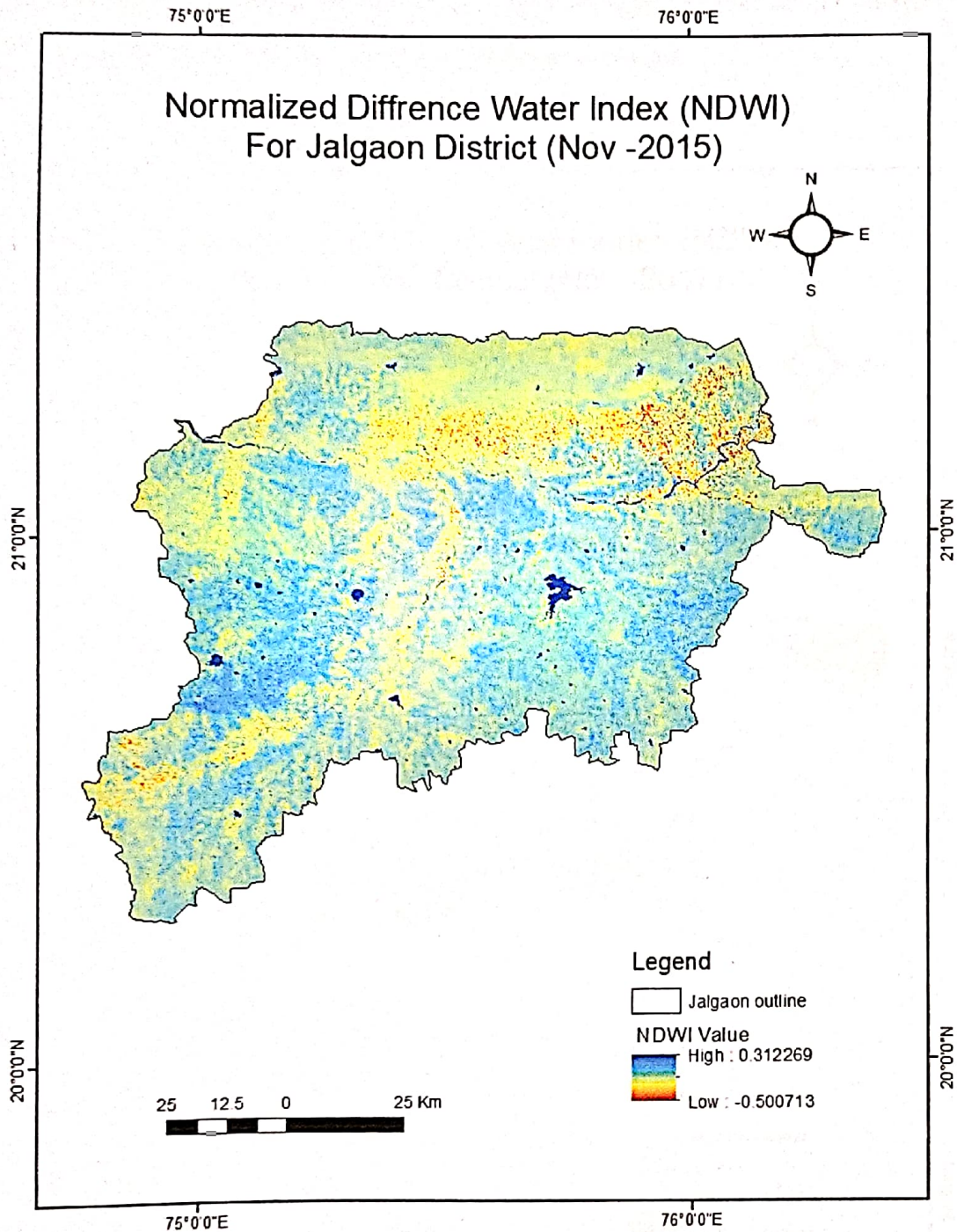
Image Interpretation

landsat_8 satellite image nov 2015 jalgaon district calssification iamge the ndwi is used monitor changes relatedb to water contend in water bodies. strongly absorb light in visible infarated electromagnetic spectrum ndwi use green and near infarted band to high light water bodies it is sensetive to build up land can result in over estimation water bodies show Water body colour sky bule high light and land cover orange of colour. and red paches water body hight light. green nir band wavelangth micrometer 0.53_0.59 and 30 meter resoulation and near-infarded 0.85-0.88 wavelagth micrometer rseoulation

high water body value 0.311269

land cover value 0.500713

Normalized Diffrence Water Index (NDWI)
For Jalgaon District (Nov -2015)

Legend

Jalgaon outline

NDWI Value
High : 0.312269

Low : -0.500713

25   12.5   0   25 Km
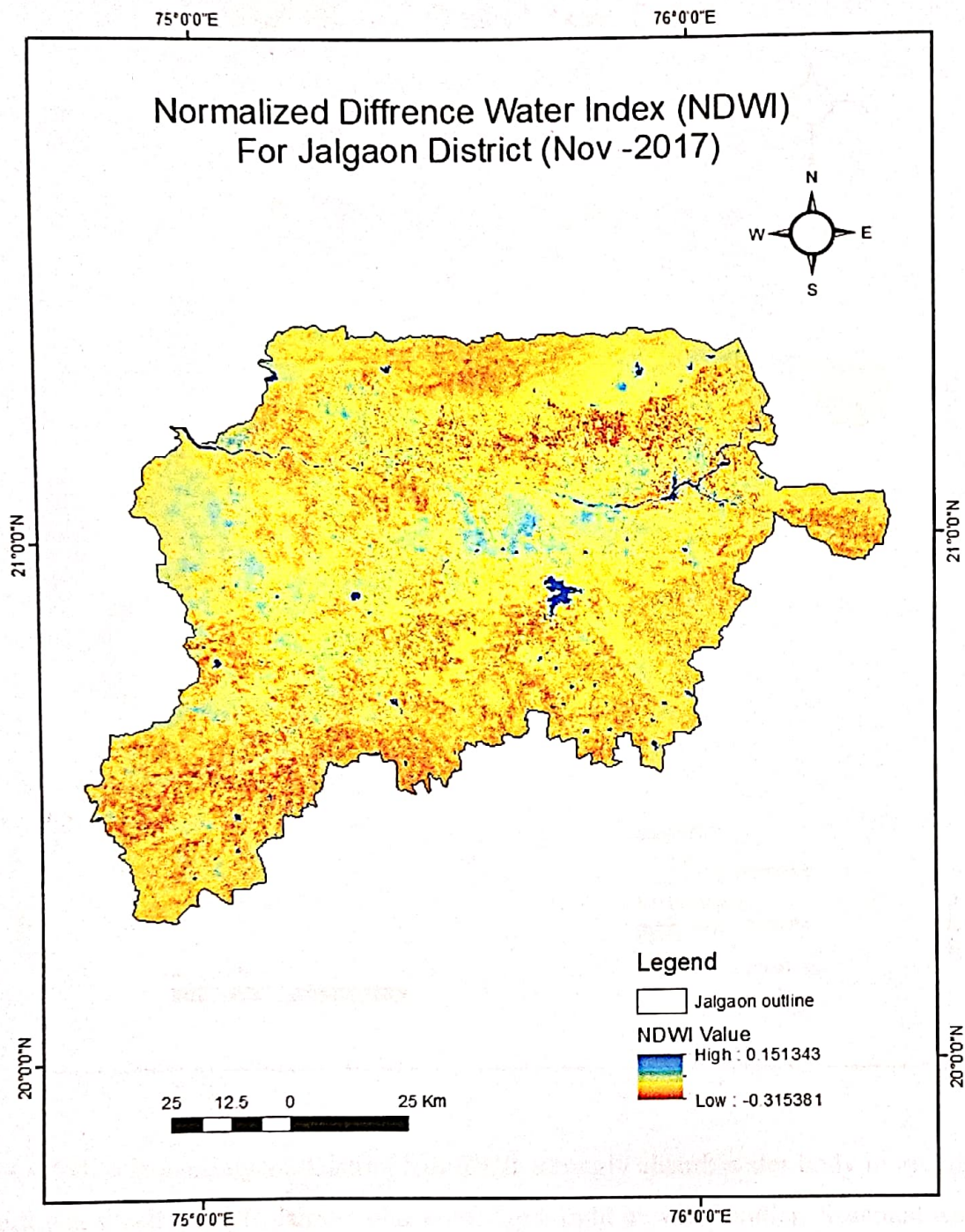
landsat_8 satellite image Nov 2017 Jalgaon district classification image the NDWI is used

monitor changes related to water bodies. Strongly absorb light in visible infrared

electromagnetic spectrum (NDWI) use green and near infrared band to high light can

result in west side, decrease water bodies drought prone thasil Parola, Erondol,

Dharangaon and ,Amalner, decrease water level and north side saturated increase water

thasil Raver and Yaval buildup water logged area over estimation water bodies. Water body shows the color blue high and land cover shows yellow color.

Normalized Diffrence Water Index (NDWI)
For Jalgaon District (Nov -2017)

Legend

Jalgaon outline

NDWI Value

High : 0 151343

Low : -0 315381

Normalized Diffrence Water Index (NDWI)
For Jalgaon District (Nov -2020)

Legend

Jalgaon outline

NDWI Value

High : 0.21484

Low : -0.499153
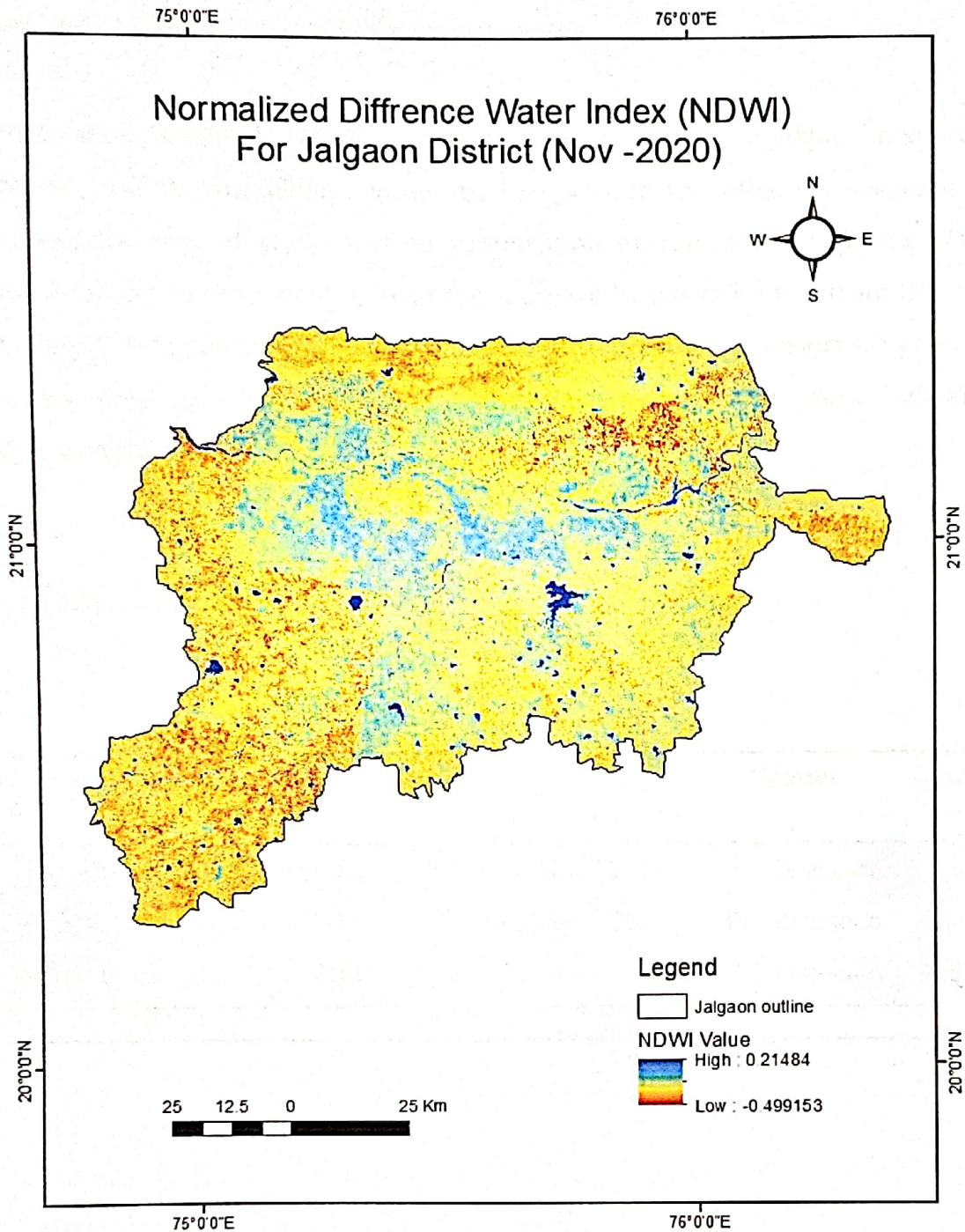
land sat 8 satellite image Jalgaon District Nov 2020 strongly absorb water body increases water level south side thasil Pachora Jamner blue color high light in water bodies. Seasonal water level increase with developed water dam and nearby river .
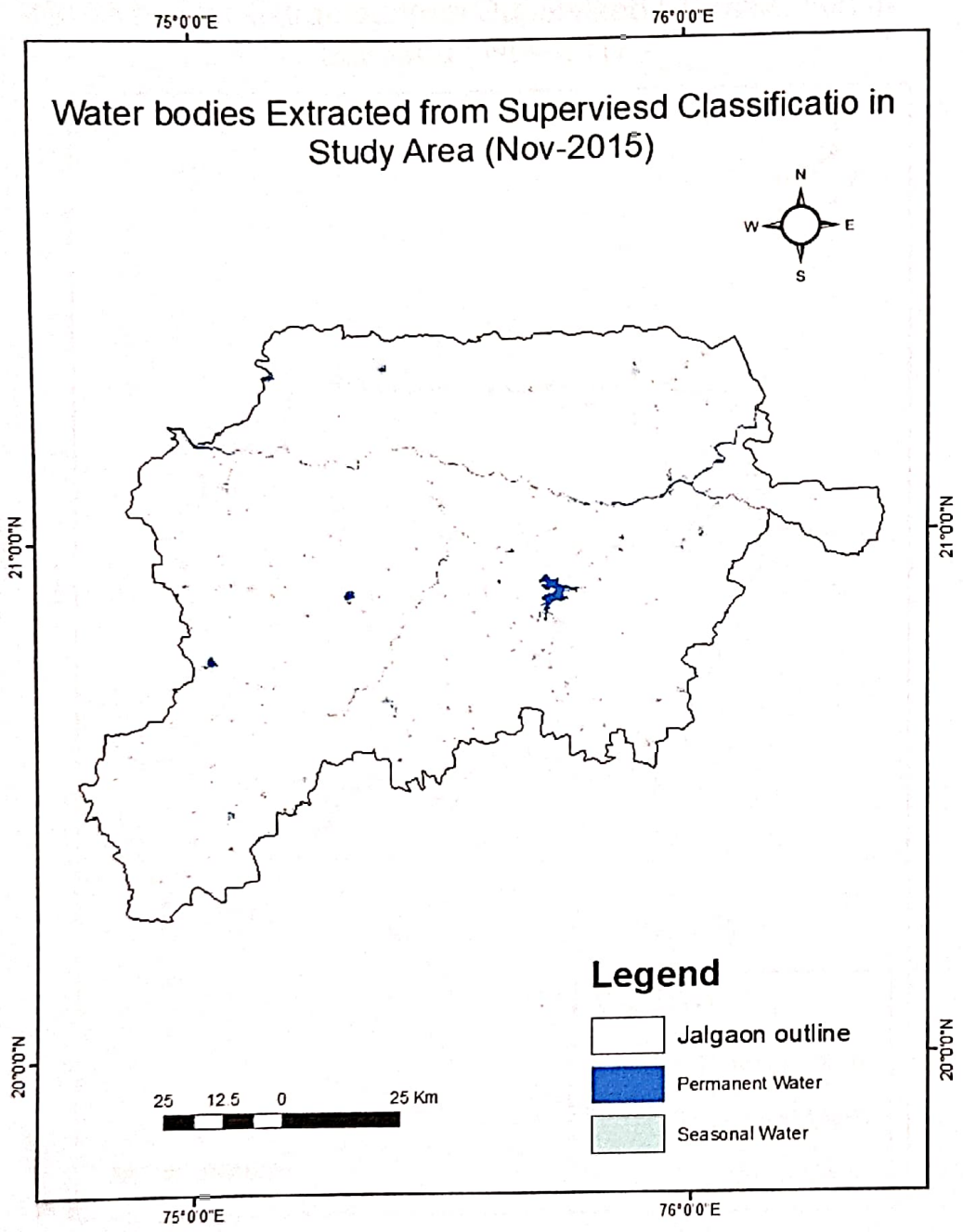
 Wavelength micrometer 0.53_0.59 and 30 meter resolution and near-inferred 0.85-0.88 wavelength micrometer resolution.
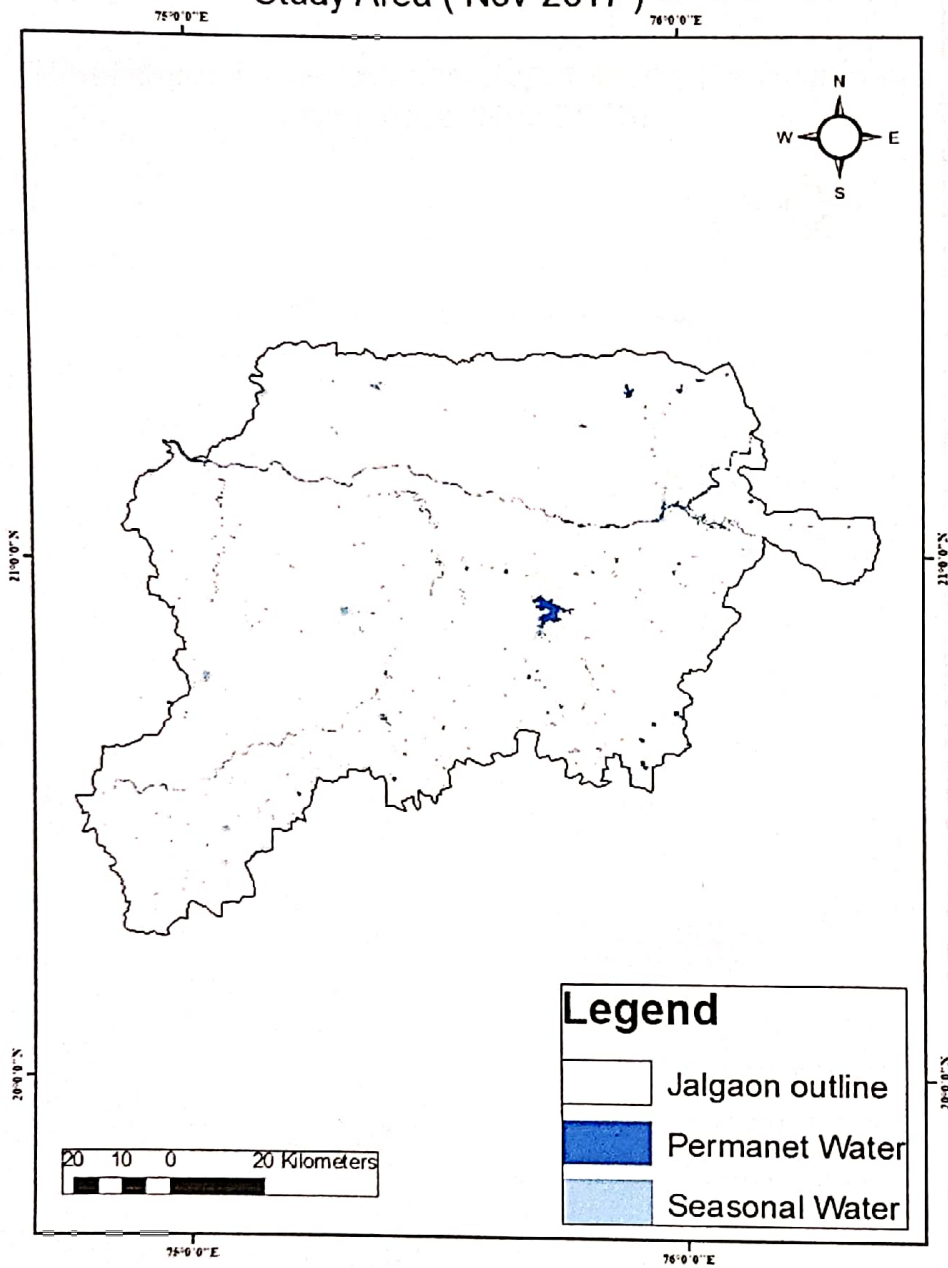
The pre-monsoon season is taken into consideration to extract Jalgaon district drought prone tahasil analyze the surface water to compensate the effect of seasonal water of monsoon and the loss of water due to evaporation during summer. The surface water dynamics observed in the basin showed the increase in water bodies from 2017 to 2020, with the year of being an exception as surface water depletion was observedin this year. The water bodies were classified into four categories pertaining to long-term availability and seasonal availability water bodies

3.3Table Image specification

Sr. no.	Data type	Path/row	Date	Season	Satellite/sensor
1	Satellite image	147/48	1 to 30 Nov2015	Pre-monsoon	Landsat-8(OLI)
2	Satellite image	147/48	1 to 30 Nov 2017	Pre-monsoon	Landsat- 8(OLI)
3	Satellite image	147/48	1 to 30 NOV 2020	Pre-monsoon	Landsat 8(OLI)

Water bodies Extracted from Superviesd Classificatio in Study Area (Nov-2015)

N

W—E

S

21°0'0"N

21°0'0"N

20°0'0"N

20°0'0"N

75°0'0"E

76°0'0"E

75°0'0"E

76°0'0"E

Legend

Jalgaon outline

Permanent Water

Seasonal Water

25   12.5   0   25 Km

Water bodies Extracted from Supervised Classification in Study Area (Nov-2017)

75°0'0"E   76°0'0"E

N
W   E
S

21°0'0"N   21°0'0"N

20°0'0"N   20°0'0"N

20 10 0   20 Kilometers

75°0'0"E   76°0'0"E

Legend

	Jalgaon outline
	Permanet Water
	Seasonal Water

Water bodies Extracted from Superviesd Classificatio in Study Area (Nov-2020)

Legend

Jalgaon outline

Permanent Water
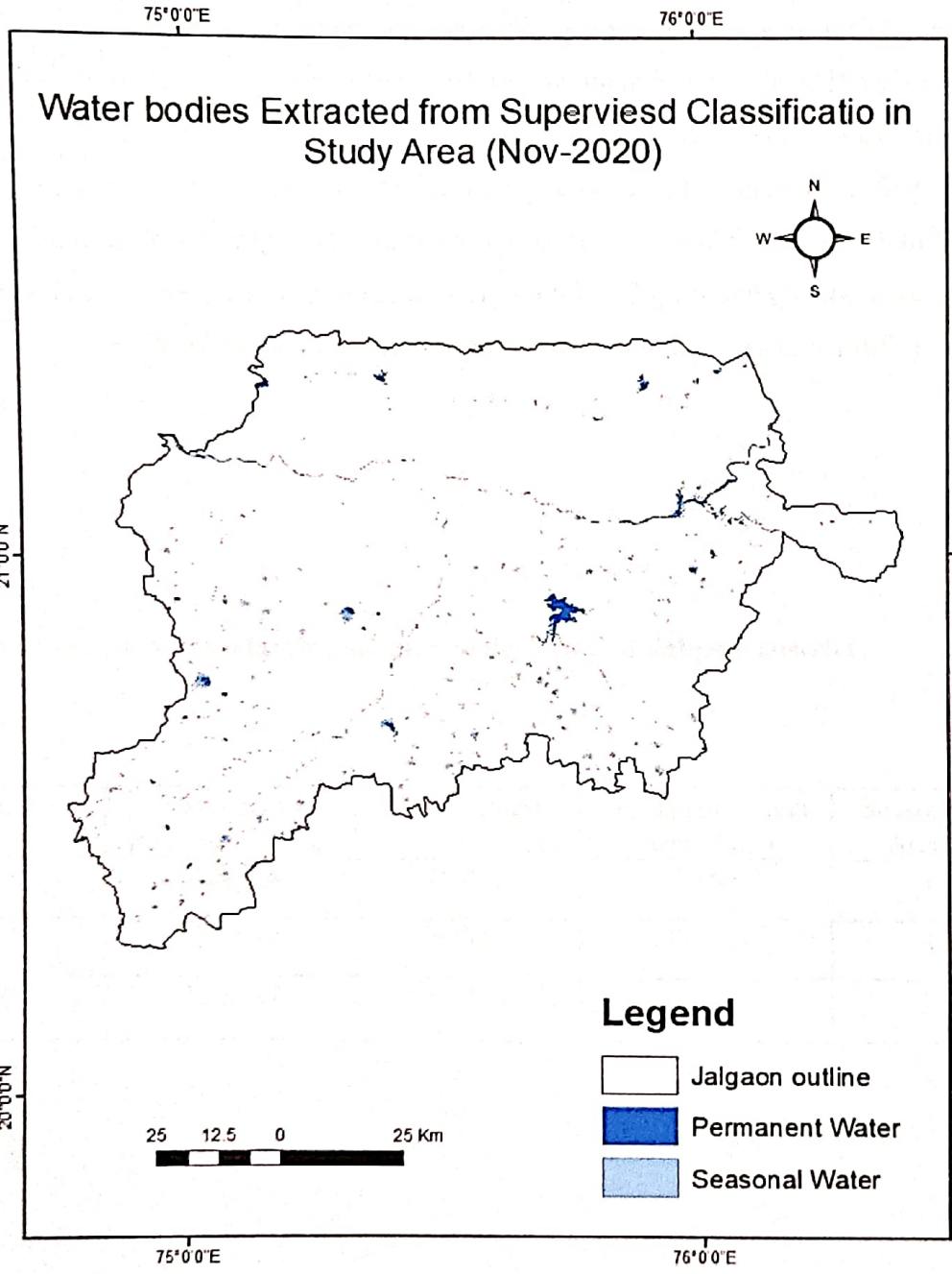
Seasonal Water

Surface water bodies and seasonal water bodies different supervised classification

Water bodies Jalgaon district the Girna, tapi, bori, anjani, titur, and waghur are important river,with girna dam being a major it is as permanent water bodies in jalgaon district and seasonal water village small river Supervise classification is the process of sorting pixels into a finite number of individual classes or categoriesbased on their digital values. If a pixel satisfies a certain setof criteria, then the pixel is assigned to the class that corresponds to that criterion (In this process, the pixels that represent certain patterns are selected or can be identified with the help of other sources. Knowledge of the data, the classes desired and the algorithm to be used is required to be planned before selecting the training samples. Supervised classification of NDWI images involves the identification of surface water bodies in the imagery to identify pixels with similar characteristics.

3.4 Table

Summary of surfacewater classes and change detection of Jalgaon District

Year	Pixels count Permanent water	Pixels count Seasonal Water	Permanent Water Area (km²)	Seasonal Water Area (km²)
2015	108,824	13,315	97.94	11.98
2017	130,630	52642	117.56	47.37
2020	128,127	66,649	131.20	59.98

Chapter 4.

Results and Discussion

➤ Surface water bodies change detection seasonal water and permanent water bodies saturated water level increases with the year 2020 as shown in table i.e. permanent water area

➤ Seasonal water saturated level increases with year 2020 as shown table i.e. seasonal water area

➤ Seasonal water level Decreases and Nov 2015 and Nov 2017 show table permanent water 2015 changes decreases permanent water bodies

Conclusion

This study is related to Jalgaon district surface water dynamics. The Data was found in the years from Nov2015, Nov 2017 and NOV 2020. The NDWI performed better in detecting the surface water area and useful in understanding the dynamics of surface water in the basin. This study integrated the advantages of both NDWI and supervised classification technique to develop an approach for surface water extraction and classification. This approach has an advantage of simultaneously detecting the surface water changes in permanent water and seasonal water. NDWI and supervised classification. Summary of surface water classes and change detection of Jalgaon District Specification.

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