SMEX03 Landsat Thematic Mapper NDVI and NDWI: Oklahoma, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Jackson, T. and M. Cosh. 2008. *SMEX03 Landsat Thematic Mapper NDVI and NDWI: Oklahoma, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. doi: https://doi.org/10.5067/8KJFN9XOV23M. [Date Accessed].

National Snow and Ice Data Center

TABLE OF CONTENTS

1   DETAILED DATA DESCRIPTION

Data were used to create large-scale maps of the NDVI and NDWI for both northern and southern Oklahoma, USA regional study areas in order to accurately estimate the surface soil moisture via microwave remote sensing.

1.1 Format

Data are presented in flat, 8-bit little-endian binary data files. Data were scaled in order to maximize the dynamic range. Users must apply Equations 1 and 2 to convert the Digital Number (DN) to NDVI and NDWI values:

NDVI	=	DN/255	(Equation 1)
NDWI	=	DN/255-0.5	(Equation 2)

The dimensions of the Oklahoma North image are 2800 rows by 1840 columns, and the dimensions of the Oklahoma South image are 3600 rows by 1920 columns.

1.2 File and Directory Structure

Data are on the FTP site in the NDWI_NDVI directory. Four binary files are contained within this directory, as described in Table 1.

Table 1. Files Contained in this Data Set

File Name	Description	File Size
071003_ON_NDVI.bin	Contains NDVI data for the Oklahoma North regional study area for 10 July 2003.	5032 KB
071003_ON_NDWI.bin	Contains NDWI data for the Oklahoma North regional study area for 10 July 2003.	5032 KB
071003_OS_NDVI.bin	Contains NDVI data for the Oklahoma South regional study area for 10 July 2003.	6750 KB
071003_OS_NDWI.bin	Contains NDWI data for the Oklahoma South regional study area for 10 July 2003.	6750 KB

1.3 File Naming Convention

Files are named according to the following convention and as described in Table 2:

`mmddyy_ss_iiii.bin`

where:

Table 2. Description of File Name Variables

Variable	Description
mm	two-digit month
dd	two-digit day
yy	two-digit year
ss	Site (OS = Oklahoma South; ON = Oklahoma North)
iiii	Index (NDVI, NDWI)
.bin	Indicates that this is a binary data file.

Example: `071003_ON_NDVI.bin`

1.4 Spatial Coverage

The data set covers Oklahoma North and South regional study areas:

Southernmost Latitude: 34.49° N

Northernmost Latitude: 35.39° N

Westernmost Longitude: 98.29° W

Easternmost Longitude: 97.76° W

A detailed geographic description of the data set is shown in Table 3. Geolocation coordinates correspond to the center of each corner pixel.

Table 3. Geolocation of the Images

Regional Study Area	Image Coordinates			
Oklahoma North	**Northing**	**Easting**	**Latitude**	**Longitude**
Upper Left Corner	4081020 N	585790 E	36.87122	-98.037441719
Upper Right Corner	4081020 N	640990 E	36.86460	-97.418273713

Regional Study Area	Image Coordinates			
Oklahoma North	**Northing**	**Easting**	**Latitude**	**Longitude**
Lower Left Corner	3997020 N	585790 E	36.11405	-98.046766559
Lower Right Corner	3997020 N	640990 E	36.10761	-97.433591947
Oklahoma South				
Upper Left Corner	3920100 N	560380 E	35.42248	-98.334881531
Upper Right Corner	3920100 N	617980 E	35.41732	-97.700496383
Lower Left Corner	3812100 N	560380 E	34.44865	-98.342696988
Lower Right Corner	3812100 N	617980 E	34.44367	-97.715762369

1.4.1   Spatial Resolution

All four Landsat NDVI and NDWI data files cover an area with interior dimensions of 30 m by 30 m.

1.5 Temporal Coverage

Data were acquired on 10 July 2003, which is assumed to be a reasonable approximation for the study period.

1.6 Parameter or Variable

1.6.1   Parameter Description

The parameters of this data set are NDVI and NDWI. NDVI is the difference between the visible red and near-infrared bands, over their sum. The NDVI is a measure of vegetation amount and condition. It is associated with vegetation canopy characteristics such as biomass, leaf area index, and percentage of vegetation cover. NDVI helps researchers determine the density of vegetation in an area. NDWI divides the difference between the mid-infrared and near-infrared bands by the sum of those two bands, thereby giving a measurement of soil moisture. Refer to Equations 3 and 4.

1.6.2   Parameter Range

In general, the NDVI and NDWI vary between -1 and +1. For this data set, however, the parameter range is 0 to 1 for the NDVI and -0.5 to 0.5 for the NDWI; refer to Equations 1 and 2. Missing values are set to 0.

1.6.3   Parameter Source

Two TM scenes from Landsat 5 were used to produce this NDVI and NDWI data set. The path rows are a composite of 28/25 and 28/36.
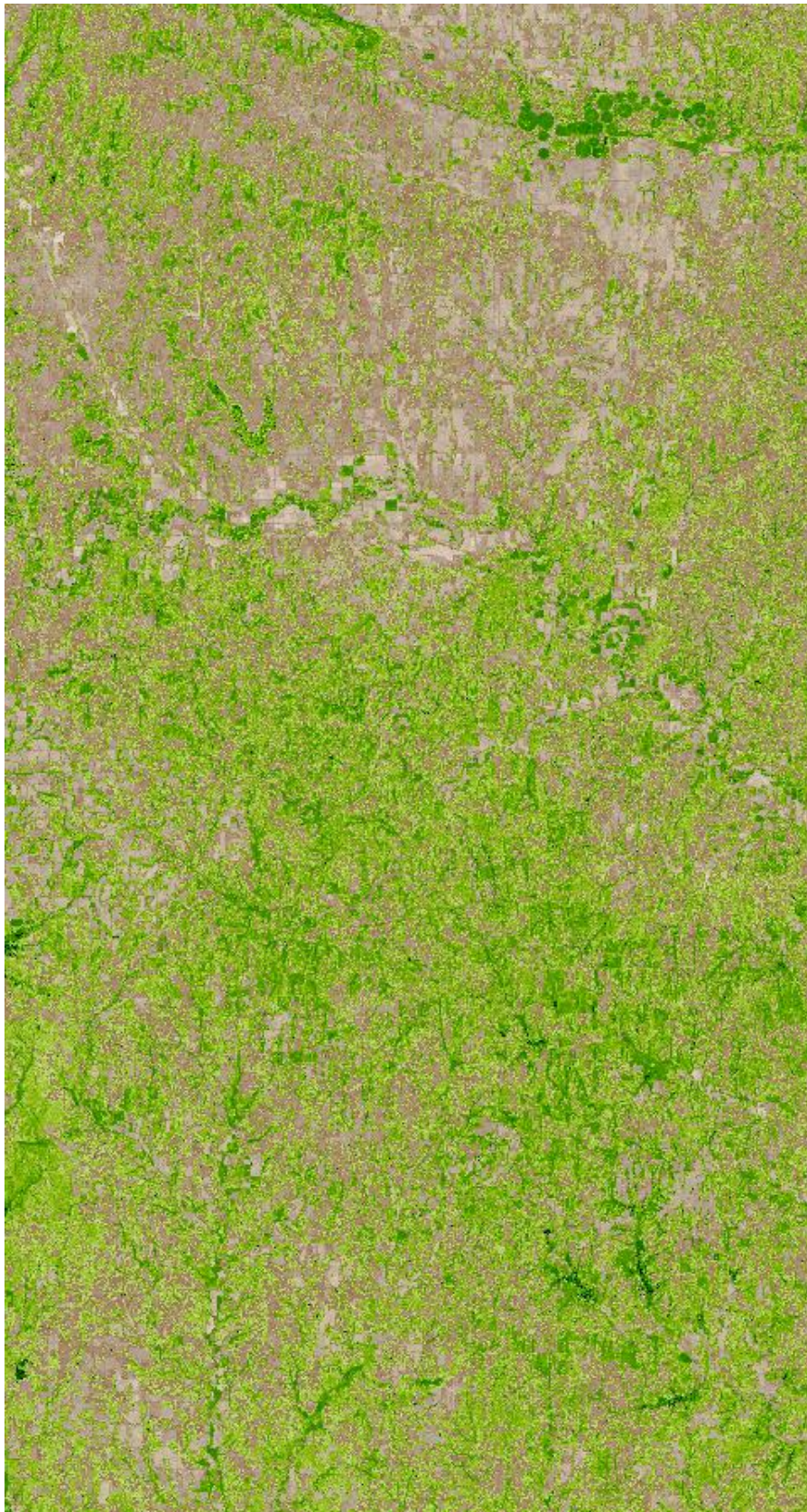
1.6.4   Sample Data Images

Figures 1 and 2 show sample thumbnail images from this data set.
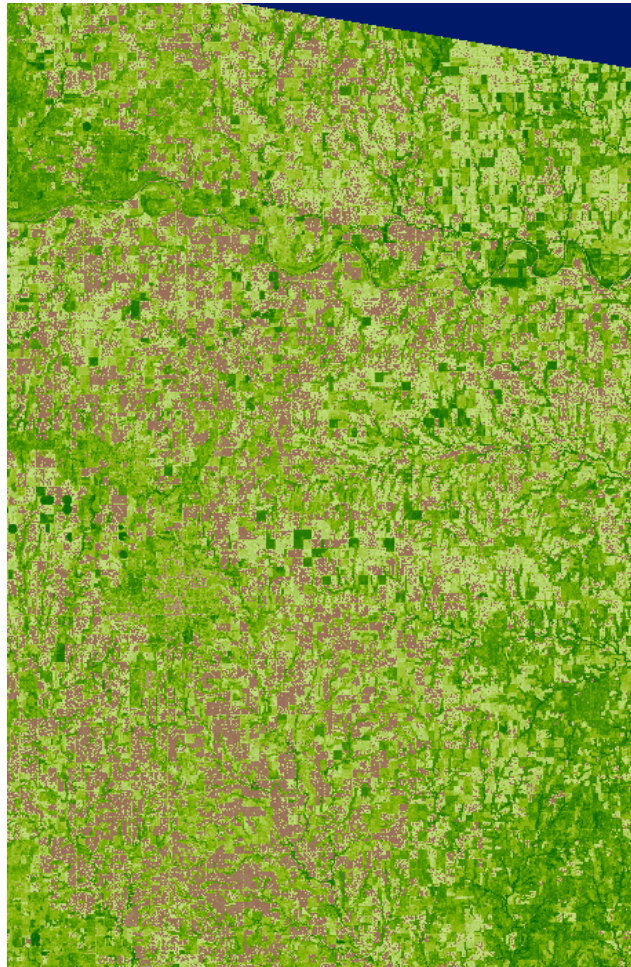
Figure 1. Oklahoma North NDVI 10 July 2003 Sample Image

Figure 2. Oklahoma South NDWI 10 July 2003 Sample Image

2   SOFTWARE AND TOOLS

2.1 Software and Tools

Tools appropriate for viewing these data are ArcView, ENVI, or other similar software package.

3   DATA ACQUISITION AND PROCESSING

3.1 Data Source

Data were derived from bands 3 (red), 4 (near-infrared), and 5 (mid-infrared) of the Landsat 5 TM sensor.

3.2 Derivation Techniques and Algorithms

NDVI and NDWI calculation

The NDVI and NDWI were computed for each pixel using the following equations (Gao, 1996):

$$NDVI = \frac{\rho(band\ 4) - \rho(band\ 3)}{\rho(band\ 4) + \rho(band\ 3)} \qquad \text{(Equation 3)}$$

and

$$NDWI = \frac{\rho(band\ 4) - \rho(band\ 5)}{\rho(band\ 4) + \rho(band\ 5)} \qquad \text{(Equation 4)}$$

3.3 Sensor or Instrument Description

The TM instrument is a multispectral scanning radiometer carried on Landsats 4 and 5. It has seven spectral bands with a spatial resolution of 30 m for most bands.

4 REFERENCES AND RELATED PUBLICATIONS

Please refer to the USDA SMEX 03 Web site for in-depth information on the science mission and goal of the SMEX project.

4.1 Related Data Collections

https://nsidc.org/data/amsre: AMSR-E standard products available at NSIDC.

5 CONTACTS AND ACKNOWLEDGMENTS

Thomas J. Jackson

Michael H. Cosh

USDA ARS Hydrology/Remote Sensing Laboratory

Bldg. 007, Rm. 104, BARC-West

Beltsville, MD 20705 USA

Acknowledgments:

The investigators would like to acknowledge the numerous graduate students and volunteers who collected the field data, in addition to the SMEX03 Science Team and Grazinglands Research Laboratory for their assistance. The investigators would also like to thank NASA for their generous contributions to the study. This work was supported by the NASA Aqua AMSR, Terrestrial Hydrology, and Global Water Cycle Programs.

6 DOCUMENT INFORMATION

6.1 Publication Date

February 2008

6.2 Date Last Updated

30 March 2021