

Application of Land Surface Temperature in Drought Monitoring

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- Objectives of the Training
- Objective of the Task
- Methodology
- Analysis and Visualization
- Application

Motivation



“In most world regions the economic damages caused by droughts are greater than those caused by any other events such as earthquakes and volcanic eruptions”

- For a small country with food deficit, drought can be severe
- Sometimes drought is followed by famine, especially in the northern region
- Land degradation, reduction in crop productivity can also be linked with drought

Objectives of the Training



- To provide a comprehensive idea of available drought monitoring tools

Objectives of the Tasks



- Providing drought index based on land surface temperature
- User friendly tool to produce this index

Things Are Going To Be Covered In The Training



- Drought Concept
- Drought Indices (SPI, VHI, VCI)
- Components of Drought Indices
- Tools to produce all the indices

Introducing a new index based on land surface temperature



- Vegetation Condition Index, $VCI = \frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$

Where NDVI is the corresponding pixel value after filtering. NDVI_{max} and NDVI_{min} are respectively maximum NDVI and minimum NDVI of the corresponding pixels in same month for the entire NDVI records (In this study, 2015–2017).



- Temperature Condition Index, $TCI = \frac{LST_{max} - LST}{LST_{max} - LST_{min}}$

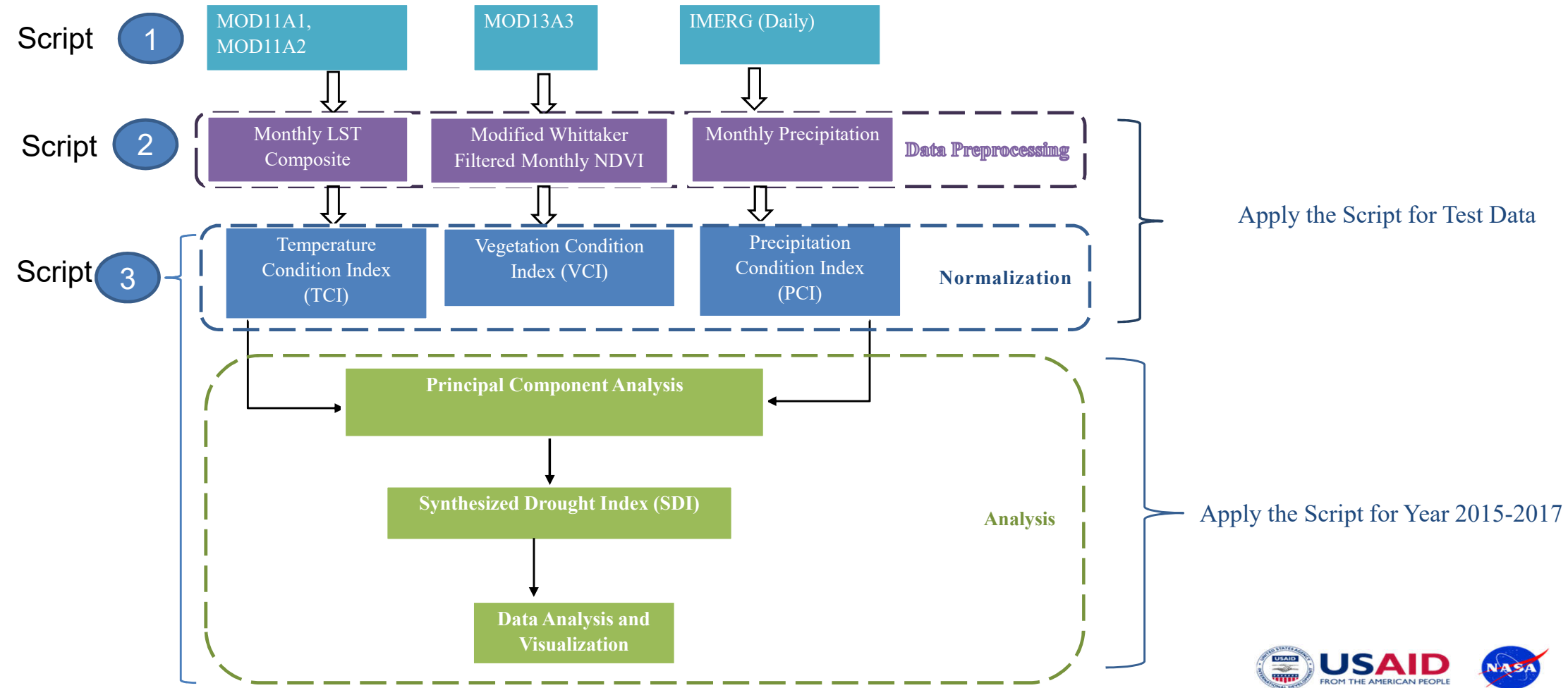
Where LST, LST_{max} and LST_{min} are the values of LST, maximum LST and minimum LST of each pixel respectively in same month during the study period (2015-2017).



- Precipitation Condition Index, $PCI = \frac{PRCP - PRCP_{min}}{PRCP_{max} - PRCP_{min}}$

Where PRCP, PRCP_{max} and PRCP_{min} are the values of precipitation, maximum precipitation and minimum precipitation of each pixel respectively in same month during the study period (2015-2017).

Flowchart of Methodology



Workflow



Script **1** : Download MODIS Data



Mosaic Tiles



Crop to the extent of AOI

From Command Line:

Rscript **download_MODIS.R** -i **Input directory** -r **Output directory** -s **Start Date** -e **End Date** -p **Product ID** -a **Country name**



Script 2 : Make Temporal Composites



Perform Modified Whittaker Filtering (if Necessary)

From Command Line:

Rscript temporalcomposite_MODIS_product.R -i Input directory -r Output directory -f Output file name -t Time Step

Script 3 : Make Drought Indices from Monthly Composites



Calculate Principal Component

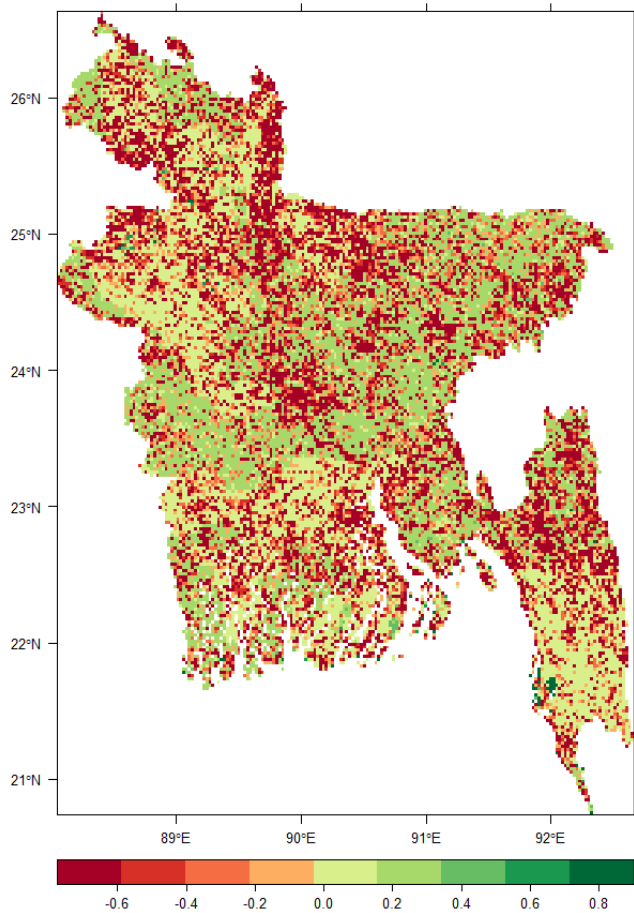


Calculate SDI

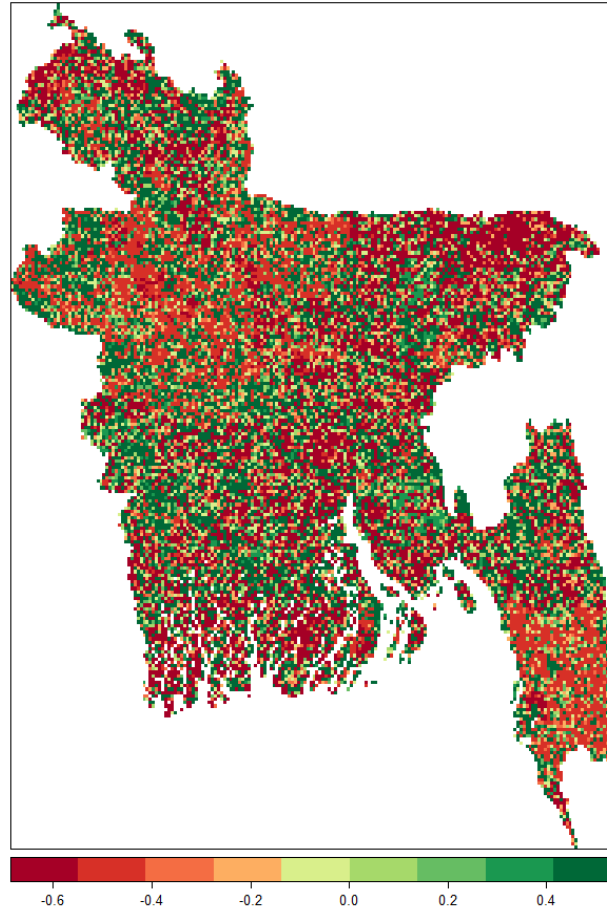
From Command Line:

Rscript Drought_indices_MODIS_product.R -i Input directory -r Output directory -Y Start Year -N End Year

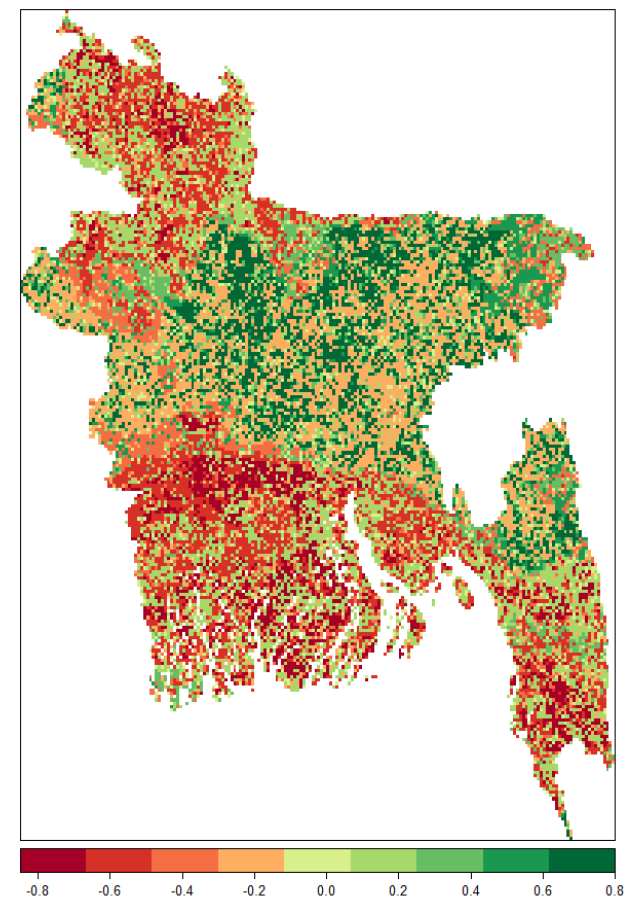
SDI for Drought Monitoring (Month of August)



2015



2016



2017

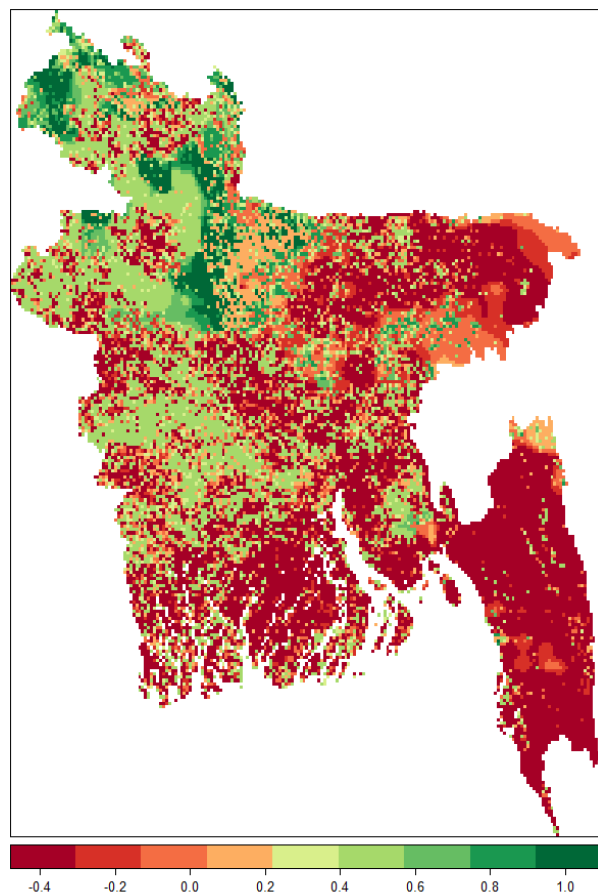


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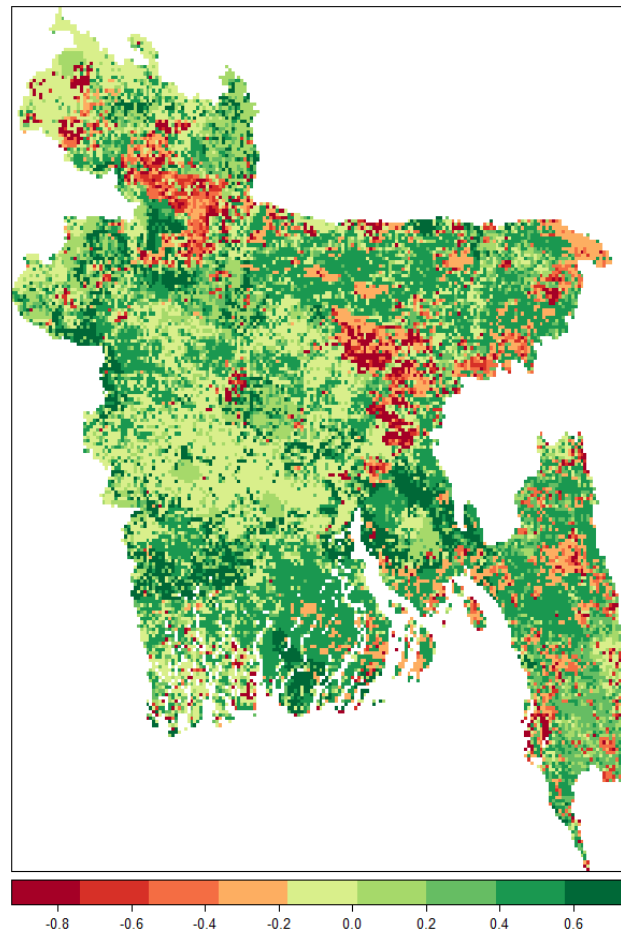


SDI for Drought Monitoring (Month of March)

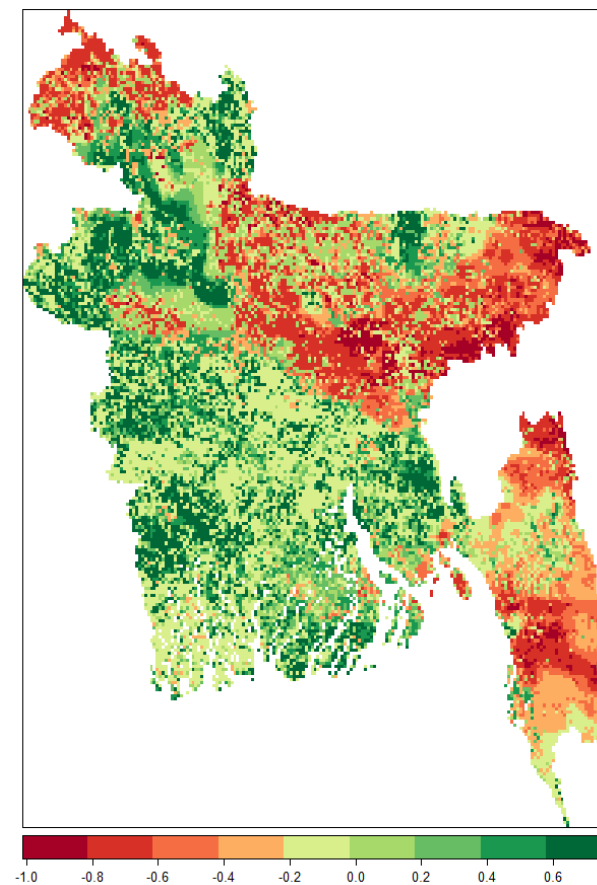
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2015



2016



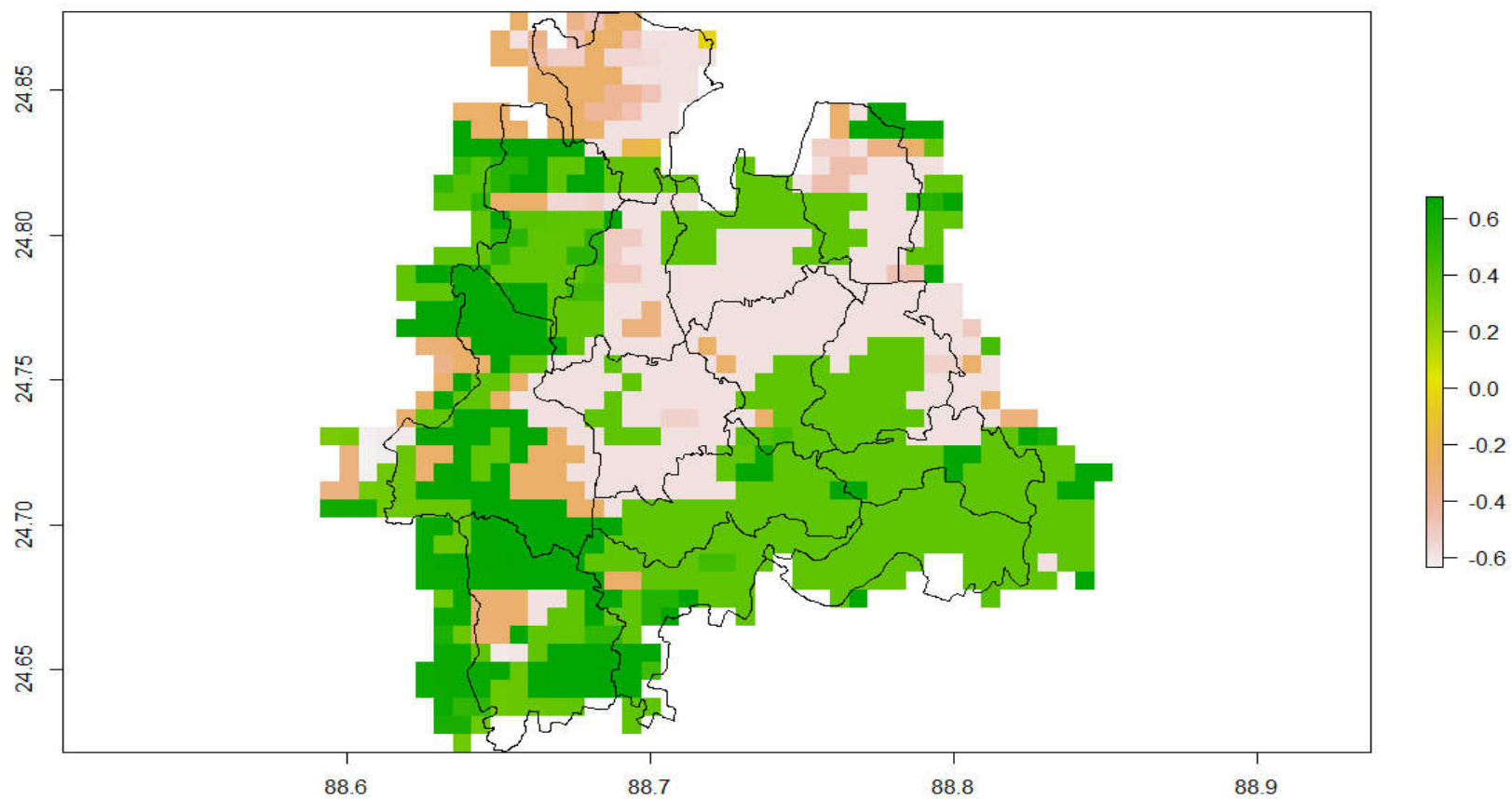
2017



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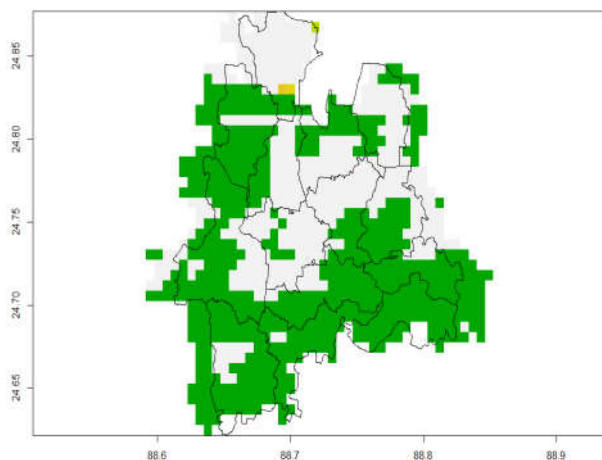


SDI for Manda Upazilla (Month of April in 2016)

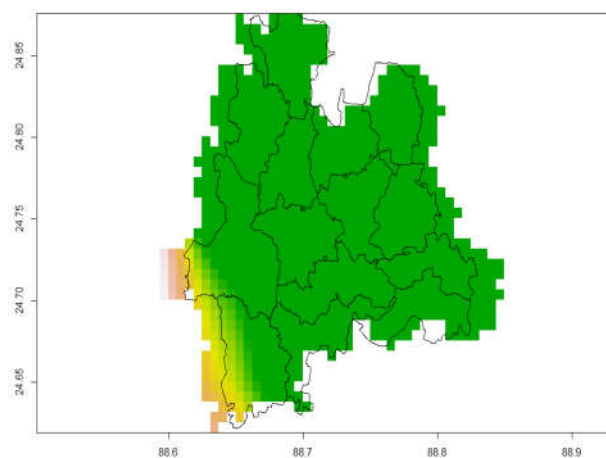


Other Indices for Manda Upazilla (Month of April in 2016)

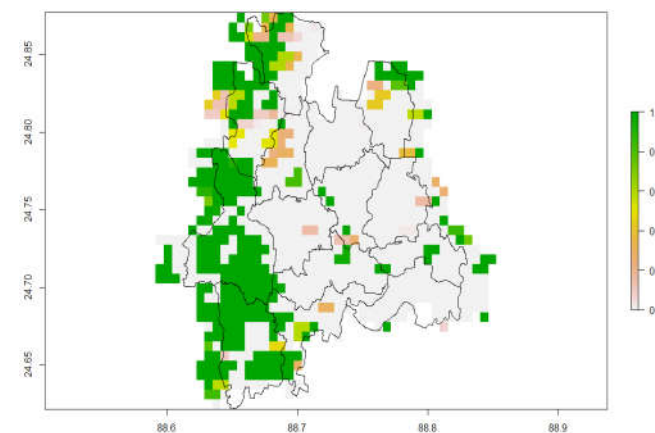
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TCI



PCI



VCI

Conclusion



- SDI gives an idea of precipitation deficits, soil thermal stress and vegetation growth status in drought process.
- It contributes to the understanding of drought in a comprehensive way.

