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SMART SURVEYORS FOR LAND AND WATER MANAGEMENT
CHALLENGES IN A NEW REALITY

FIG NL THE NETHERLANDS

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Agricultural Drought Vulnerability Assessment of Tanahun District, Nepal

ORGANISED BY FIG GIN Geo-Informatie Nederland kadaster ITC UNIVERSITY OF TWENTE

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Drought

- A slow-onset natural hazard
- Accumulates over a considerable period of time
- Stochastic natural phenomenon originates from a deficiency of precipitation
- Results in a water shortage situation for a certain activity
- Insufficient supply of moisture resulting either from:
    a. sub-normal rainfall,
    b. erratic rainfall distribution,
    c. higher water need, or
    d. a combination of all the three factors

Drought Types

- Meteorological drought- reduced rainfall,
- Hydrological drought- reduced surface water, and
- Agricultural drought- reduced soil moisture

Agricultural Drought

- Results from the complex and nonlinear interactions between weather, soil, crop and human actions
- Requires information related to rainfall, vegetation pattern in spatial-temporal dimensions

Impacts of Drought

- Produces a complex web of impacts
- Referred as direct and indirect
- Direct impacts: reduced crop and forest productivity, increased fire hazard, reduced water levels, damage to wildlife and fish habitat
- Indirect impacts: Consequences of direct impacts- a reduction in crop and forest productivity may results in reduced income for farmers and increased prices for food and timber, unemployment etc.

Objectives

General:-

- To identify the agricultural drought risk zone of the project area.

Specific:-

- To analyze pattern of rainfall and vegetation index.
- To prepare LULC map and provide information on environmental situation of project area.

Study Area

- Project area: Tanahun district
- Lies in the UTM Zone 44 and 45
- Consists of 41.4% of agricultural area (2010 AD)
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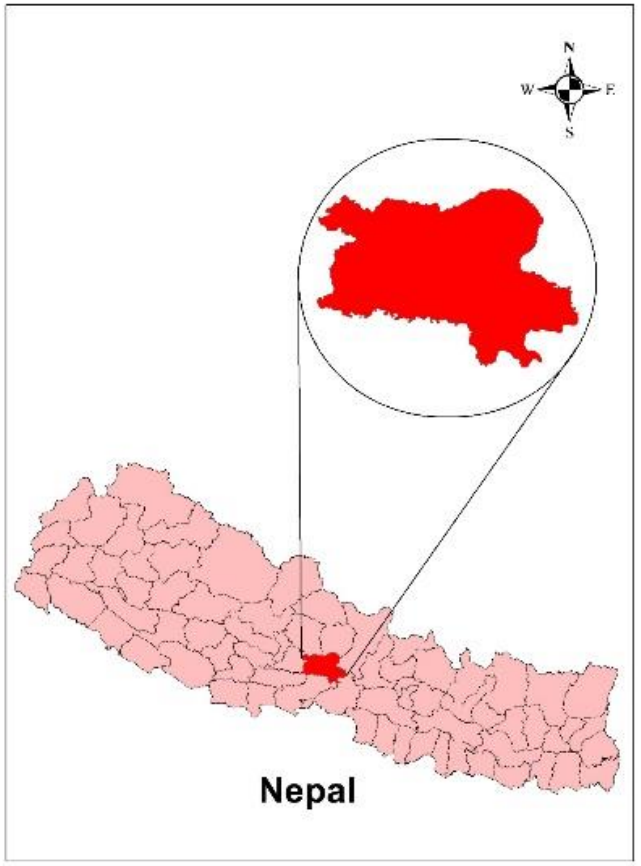
Latitude	**27° 55' N**
Longitude	84° 15' E
State	Gandaki
Headquarter	Damauli
Total Area	1546 km^2



Data and Software Used

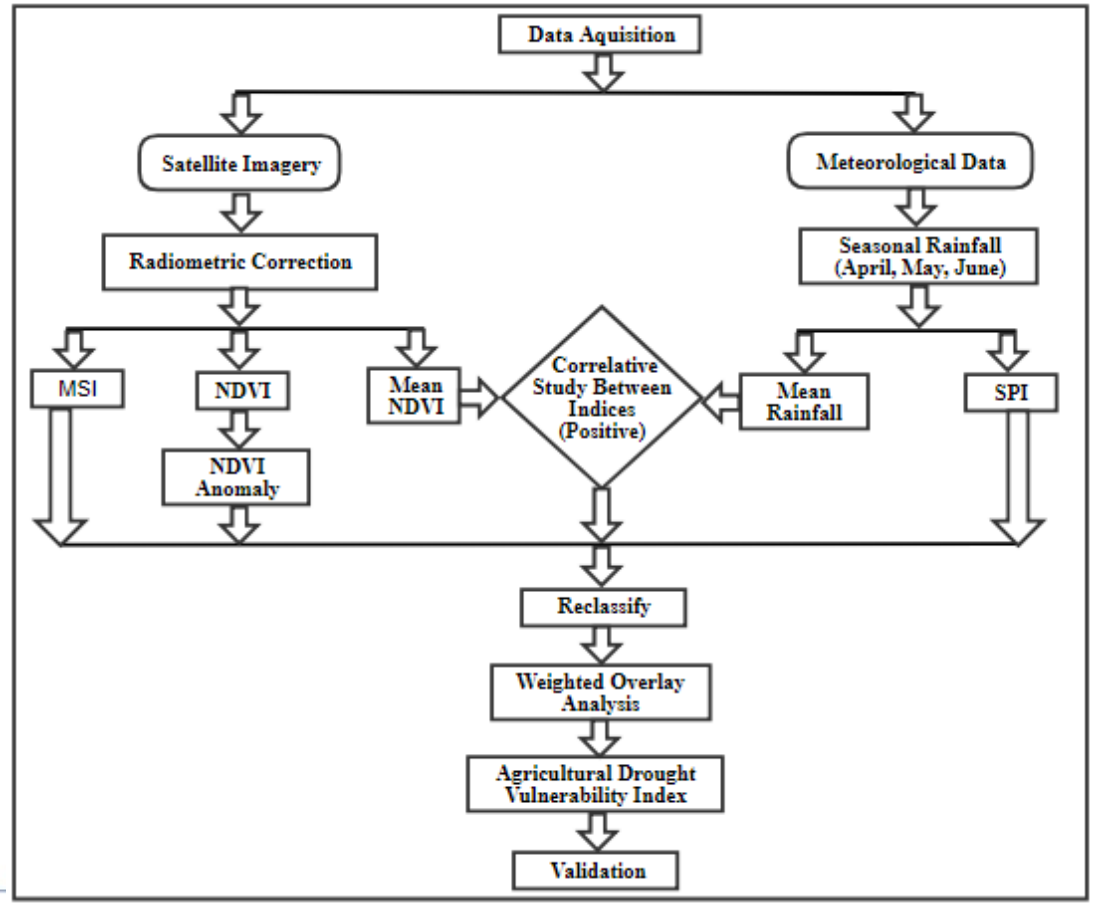
Data

- Landsat 7 and Landsat 8 imagery
- Digital maps of administration border
- Monthly Precipitation Data of 10 rainfall stations for a period of 10 years ranging from 2007-2016

Software

- GIS
- MS Office
- Erdas Imagine 2014

Methodology



NDVI

- Widely used for operational drought assessment because of its simplicity in calculation, easy to interpret
- It is calculated by: NDVI = (NIR reflectance – Red reflectance) /

  (NIR reflectance + Red reflectance)
- A function of green leaf area and biomass
- Maps produced using relative greenness are quite useful to assess drought situation and hence this indicator is being used widely.

NDVI Anomaly

- NDVI Anomaly = [(NDVI Max - Mean NDVI Max)/(Mean NDVI Max)]*100%

  Where, NDVI max = Maximum NDVI of the year and

  Mean NDVI max = Long-term mean maximum NDVI of the range of the year

- NDVI anomaly at 100% shows the low deviation from mean NDVI and NDVI anomaly at -100% shows the high.

SPI

- Used to determine a probability density function that describes the long-term series of observations
- A function of seasonal precipitation and long - term seasonal precipitation mean

$$SPI=(X-Y)/\sigma$$

where, X= seasonal precipitation,

Y= long term seasonal mean,

σ=standard deviation

MSI

- Used to determine the soil moisture condition during drought
- It has been calculated by using the SWIR band and NIR band of Landsat data.
- MSI value ranges from 0 to 4.
- It is computed as:

MSI= [SWIR Band / NIR Band]

Weighted Overlay Analysis

S.N.	Criteria	Classes	Rank	Influence (%)
1	SPI	Extremely Dry	5	50
		Moderately Dry	4	
		Normal	3	
		Moderately Wet	2	
		Extremely Wet	1	
2	MSI	Extremely Stressed	5	40
		Severe Stressed	4	
		Moderately Stressed	3	
		Low Stressed	2	
		No Stressed	1	
3	NDVI Anomaly	Very High	5	10
		High	4	
		Moderate	3	
		Low	2	
		No	1	

(Source: https://www.researchgate.net/publication/235970565)

Result and Discussion

- Drought risk map was prepared.
- Classified classes included an areas of:

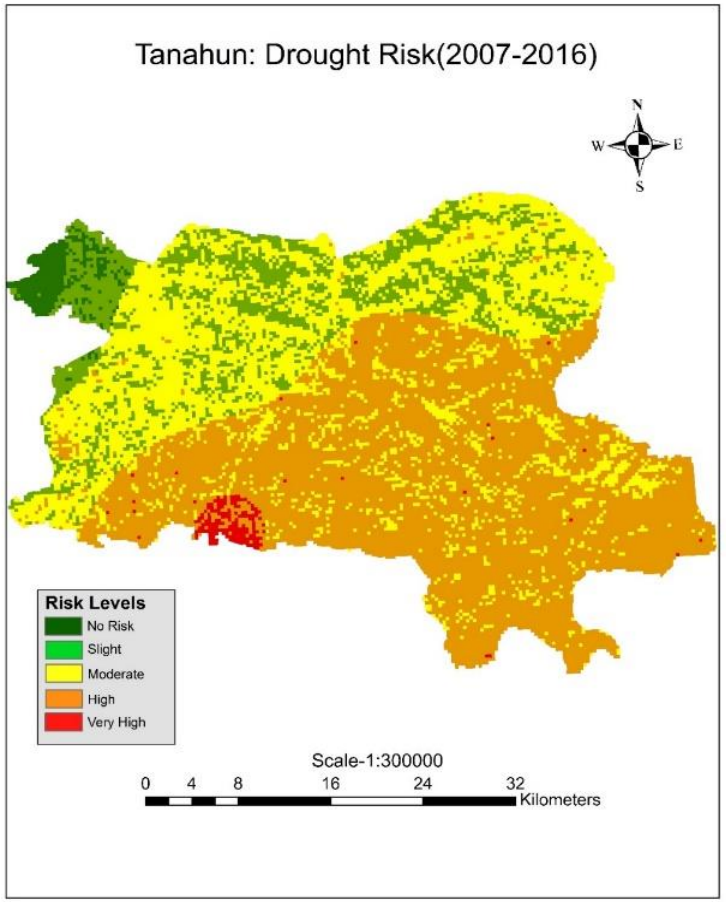
  Very Wet= 9.01 sq.km.

  Moderately Wet= 21.96 sq.km.

  Severely Dry= 54.81 sq.km.

  Moderately Dry= 215.57 sq.km.

  Near Normal= 1356.27 sq.km.



Result and Discussion

- LULC of study area was prepared.
- It had included the total area of 1546 sq.km.
- And respective features occupied areas of:

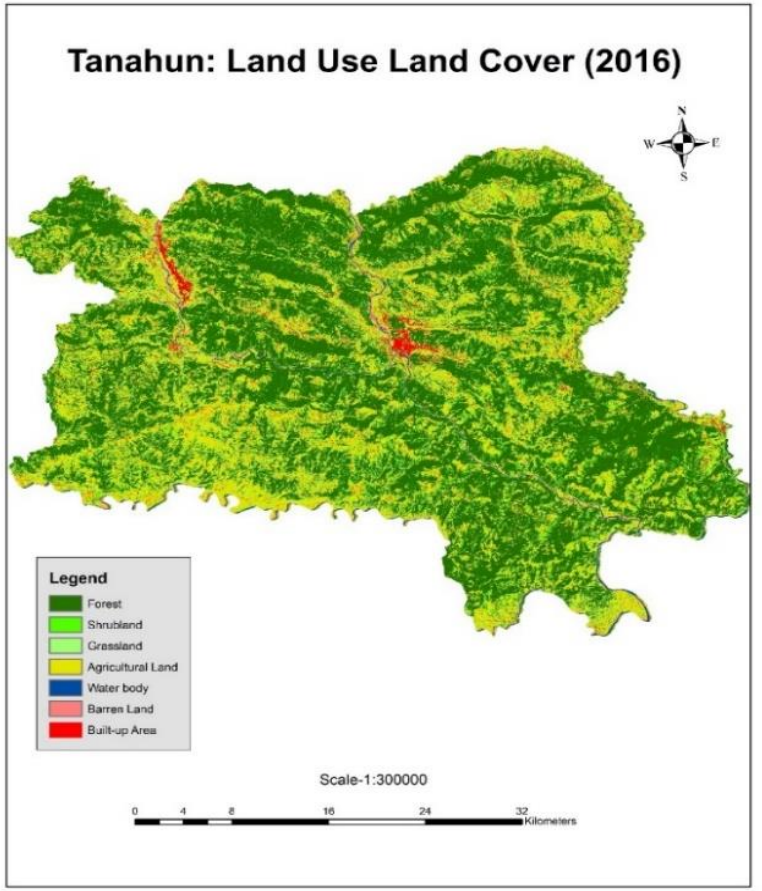
  Agricultural Land= 254.78 sq.km.

  Vegetation= 1276.65 sq.km.

  Water Bodies= 10.67 sq.km.

  Settlement Area= 12.78 sq.km.

  Barren Land= 16.11 sq.km.



Recommendation

Based on the findings of the study, the following recommendations were suggested:

1. Prioritization and implementation of site-specific adaptation should be made based on such identification of risk levels of specific locations.

2. Since the agricultural drought severity levels vary spatially, selection of agricultural technologies and information should be made to fit into the agricultural drought severity levels.

Thank You!
Enjoy!