

# Climate Disturbance Impacts Assessment: Household Survey and Satellite Imagery Analysis in the Sahel Region of Burkina Faso

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# Outline

Introduction

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Acknowledgements

# Introduction (1/4)

## *Socio-economic context*

- Burkina Faso is a landlocked country located in West Africa in a semi-arid area with a dry tropical climate.
- The country's economy is heavily reliant on agricultural production
- The majority of active population is engaged in the subsistence farming.

34% to  
GDP

Agricultural sector

(Stalled, 2012)

90% of  
labor force

# Introduction (2/4)

## *Problem Statements*

- In this low income country, farmers depend on rainfed agriculture for their livelihoods.
- The rainfed agriculture system is vulnerable to climate variabilities.
- Assessing the impacts of climate disturbance is important to help stallholder farm to adapt.

# Introduction (3/4)

## Literature Review

### Climate Change (CC)

- There is evidence that extreme events, such as droughts and floods, have been common incidences.
- Climate change is a direct consequence of continued increase of CO<sub>2</sub> in the atmosphere.

(Belay *et al.*, 2017)



### Adaptation to CC

#### Field Survey

- Policymakers
- extension agents
- NGOs
- Researchers
- Farmers

#### Remote Sensing (RS)

The use of satellite or aircraft-based sensor technologies to detect and classify objects on Earth surface, in the atmosphere and oceans, based on propagated signals.

(Nathaniel, 2014)



# Introduction (4/4)

## *Objectives*

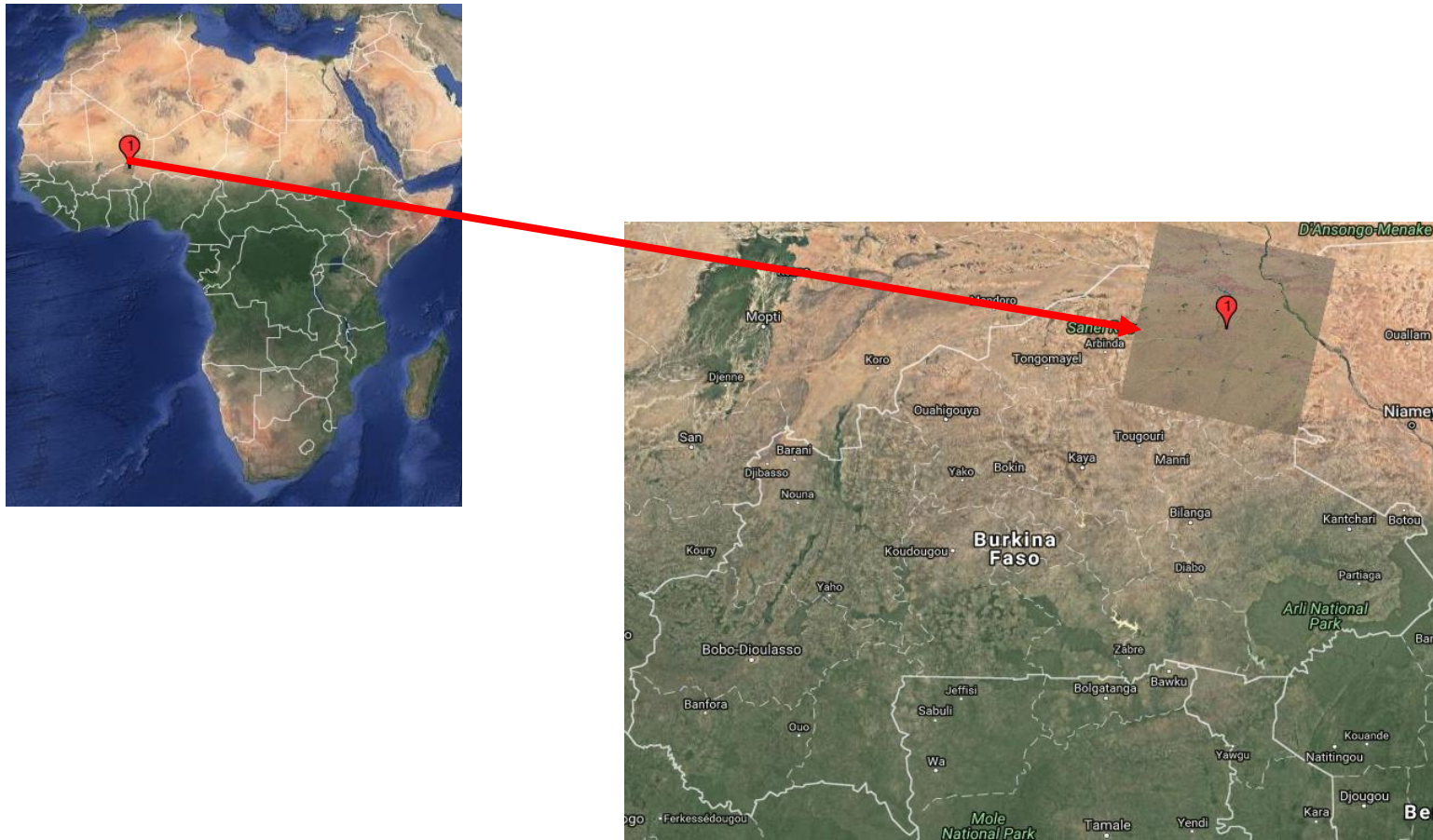
This study aims to assess the impacts of climate disturbance in the Sahel region of Burkina Faso by using field survey information and remote sensing approach.

The specific objectives are

- To describe smallholder farmers' perception on the impacts of climate disturbance in the Sahel region of Burkina Faso;
- To map out the changes of vegetation surface in the Sahel region of Burkina Faso over the last 30 years.

# Methodology (1/4)

## Field Surveys: *Study Areas*



- Extending over 34,766 km<sup>2</sup>
- 1.2 million inhabitants in 2015

Figure 1. Map of the Sahel Region of Burkina Faso

Source: USGS



# Methodology (2/4)

## Field Surveys: *Sample Size*

Table 1. Household Surveyed in Sahel at Northern Burkina Faso

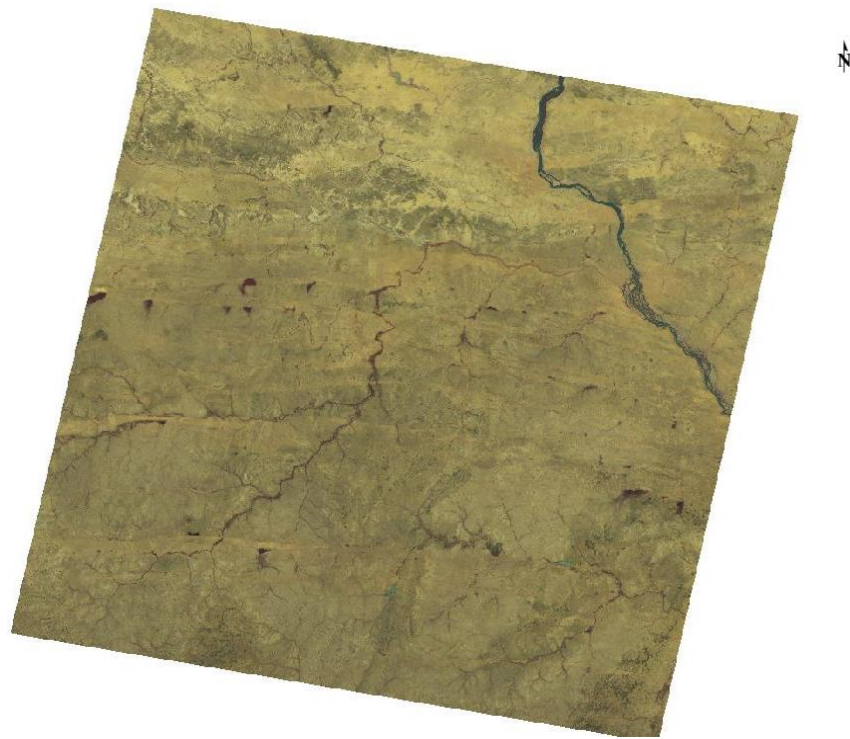
Province	Village	Total households	Sampled households	Representation (%)
Oudalan	Bagawa	179	27	15.08
	Darkoye	256	37	14.45
	Tin-akoff	355	55	15.49
Séno	Sambonaye	278	42	15.11
	Yakouta	358	55	15.36
Soum	Lelly	472	70	14.83
	Arbinda	1,563	50	3.20
	Tongomayel	512	50	9.77
Yagha	Boundore	337	33	9.79
	Titabé	450	46	10.22
<b>Total</b>		<b>4760</b>	<b>465</b>	<b>9.77</b>

National Institute of Demography and Statistics INSD, 2015; Community Building Group-West Africa (CBG-WA), 2013)

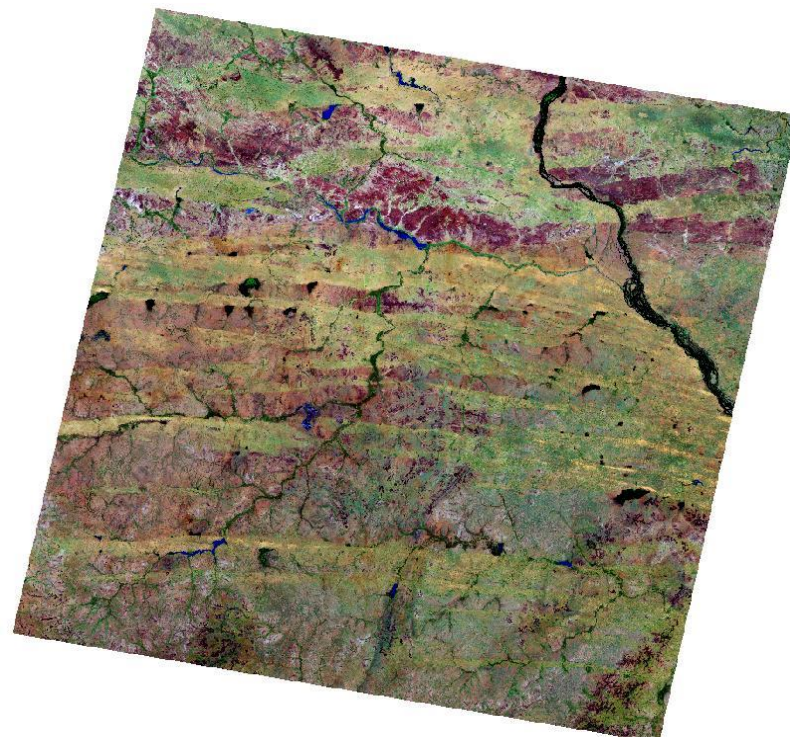


# Methodology (3/4)

## Remote Sensing Data Acquisition



*TM5 MSS:1986/12/29*



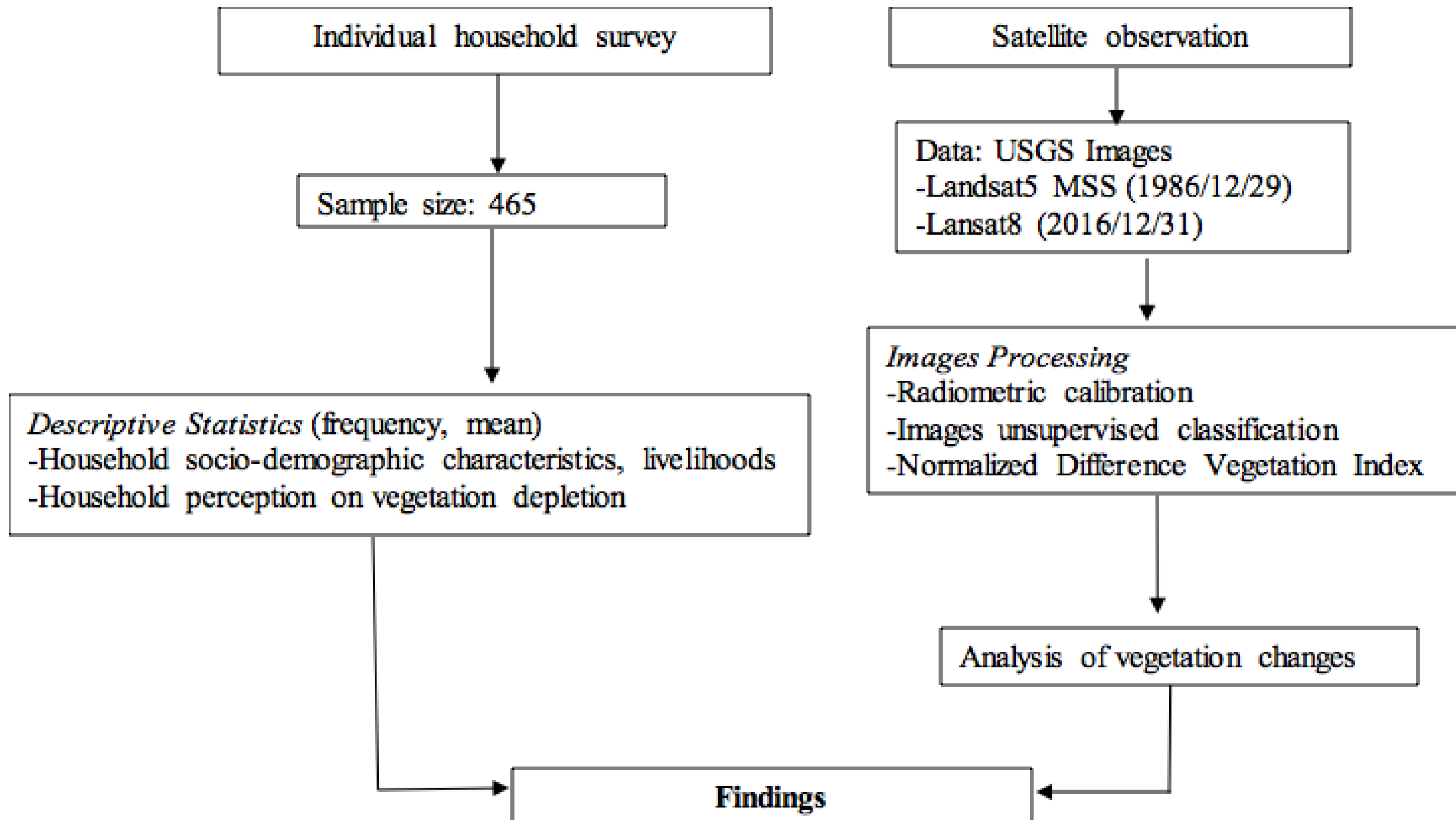
*Landsat8 :2016/12/31*

- Cloud coverage: 0.00%
- Scene path number: 194
- Scene row number: 50
- Size of the scene: 170 km x 185 km

**Figure 2. Display of the Landsat TM5 MSS and Landsat 8 Imageries Acquired in Month of December over the study area**

Source: USGS

# Methodology (4/4)



# Results and Discussion (1/12)

## Socio-Demographic Characteristics

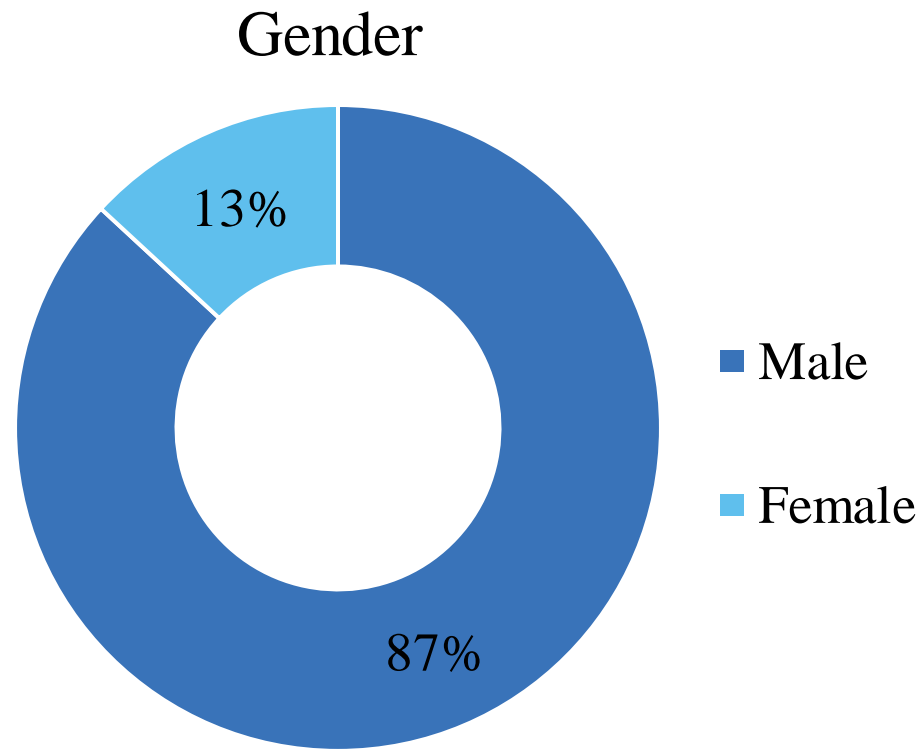


Figure 4. Gender of Respondents

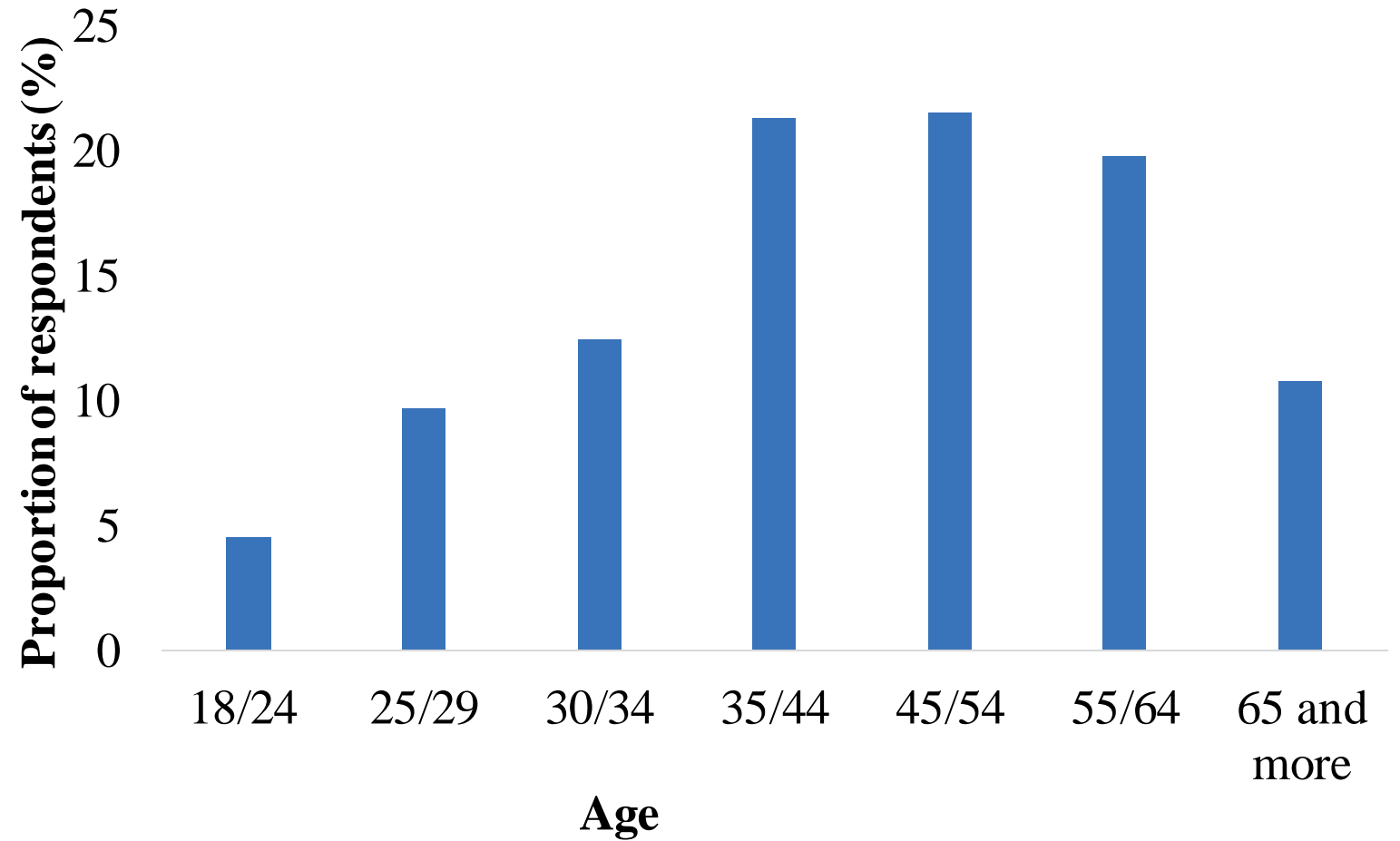


Figure 5. Age of Respondents

# Results and Discussion (2/12)

## Socio-Demographic Characteristics

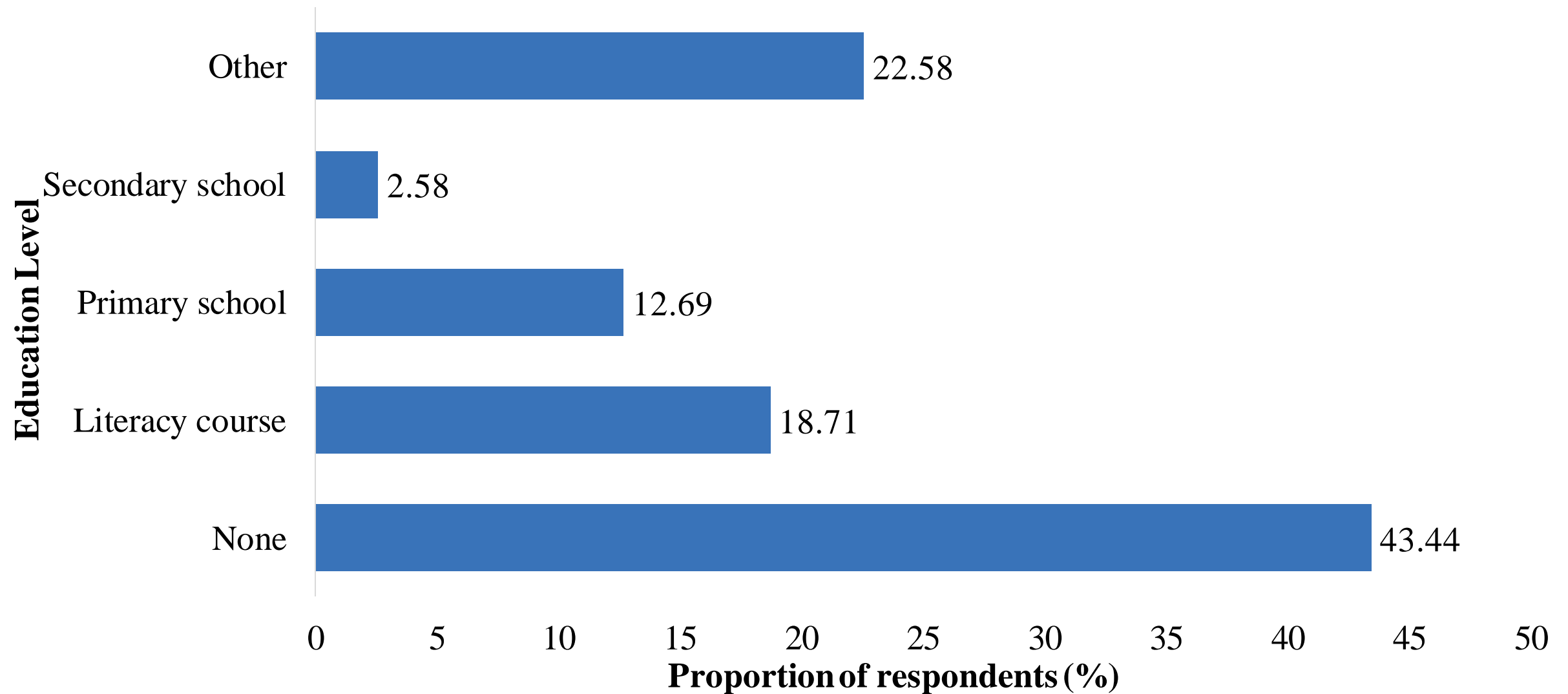


Figure 6. Education Level of Respondents

# Results and Discussion (3/12)

## *Smallholder Occupation*

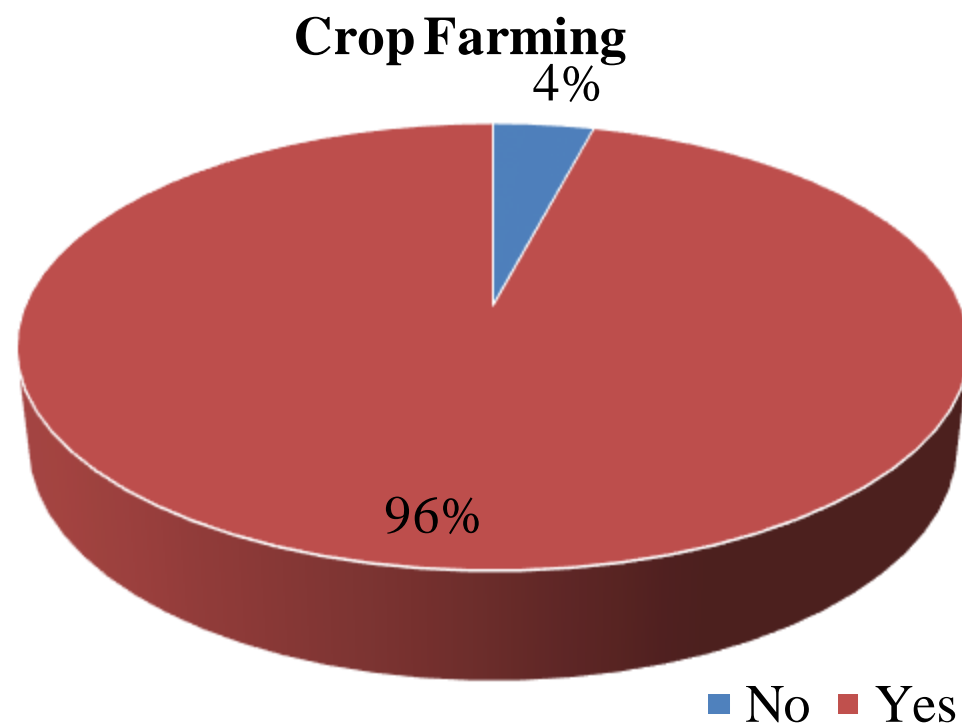


Figure 7. Occupation of Respondents

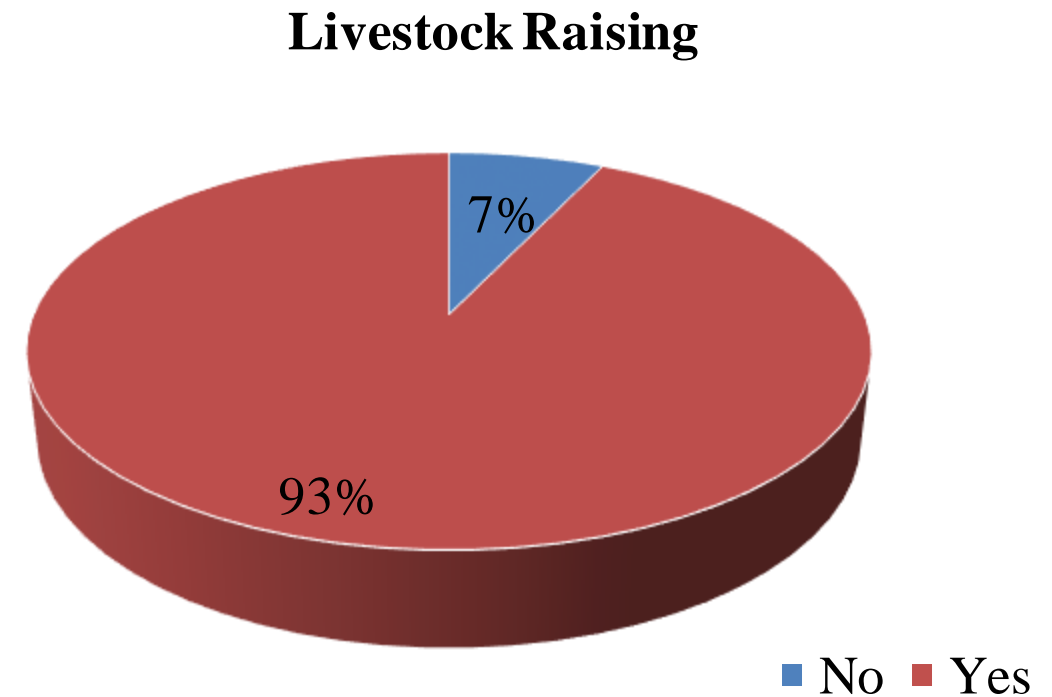


Figure 8. Occupation of Respondents

# Results and Discussion (4/12)

## *Farmers' Perceptions in the Change of Rainfall over Last 20 years*

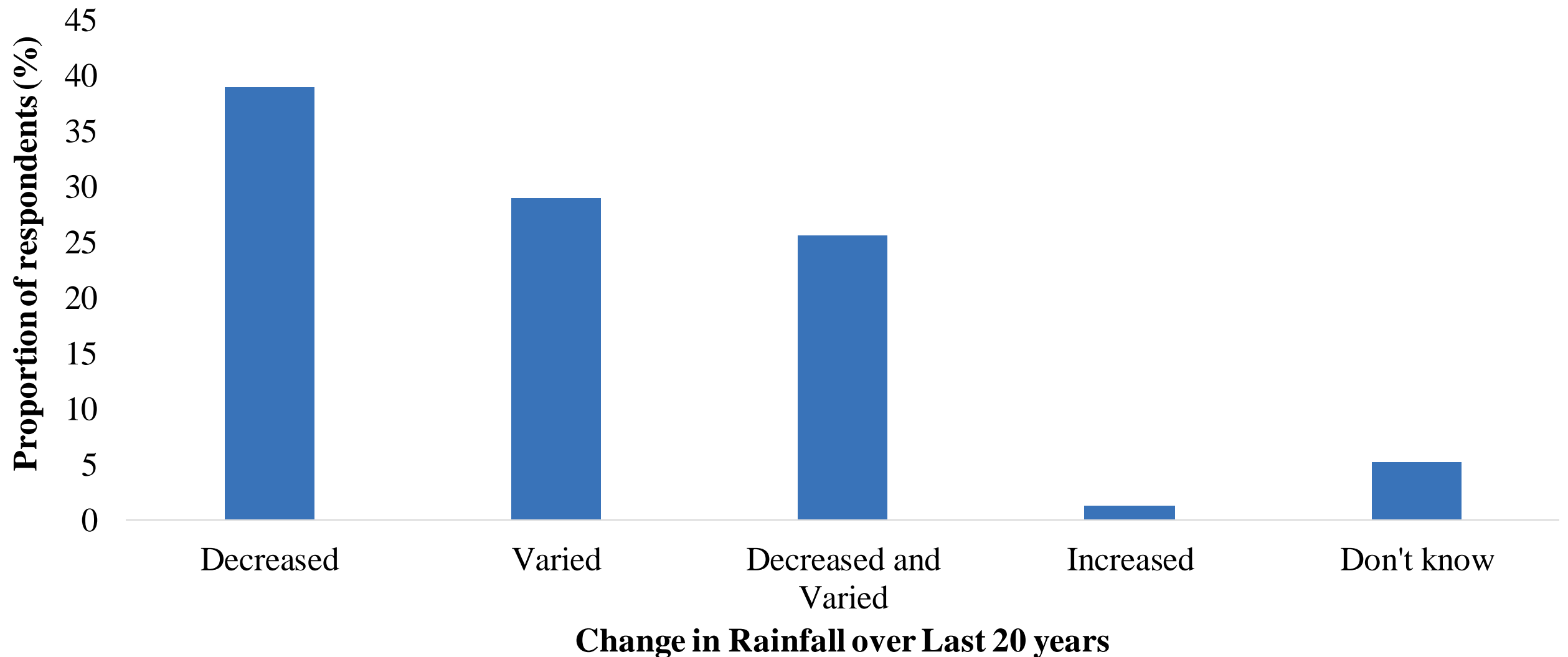


Figure 9. Smallholder Farmers' Perception in the Change of Rainfall over Last 20 years

# Results and Discussion (5/12)

## *Impact of Climate Disturbance*

### Pasture Depletion over Last 20 Years

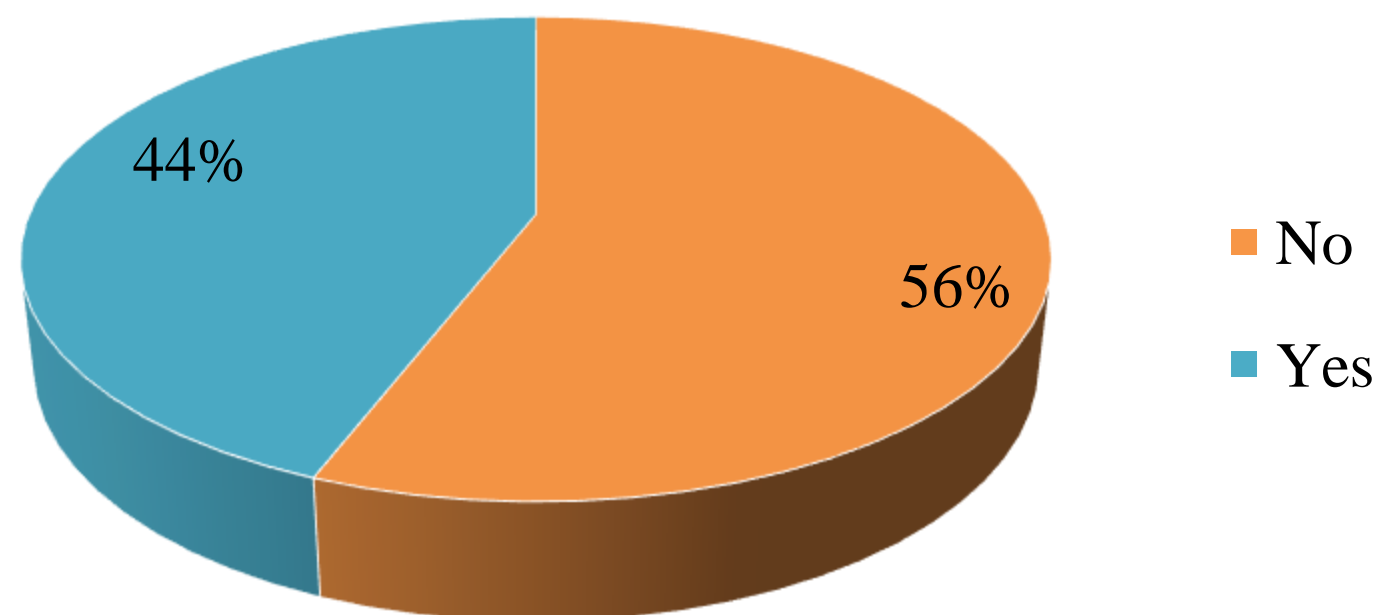
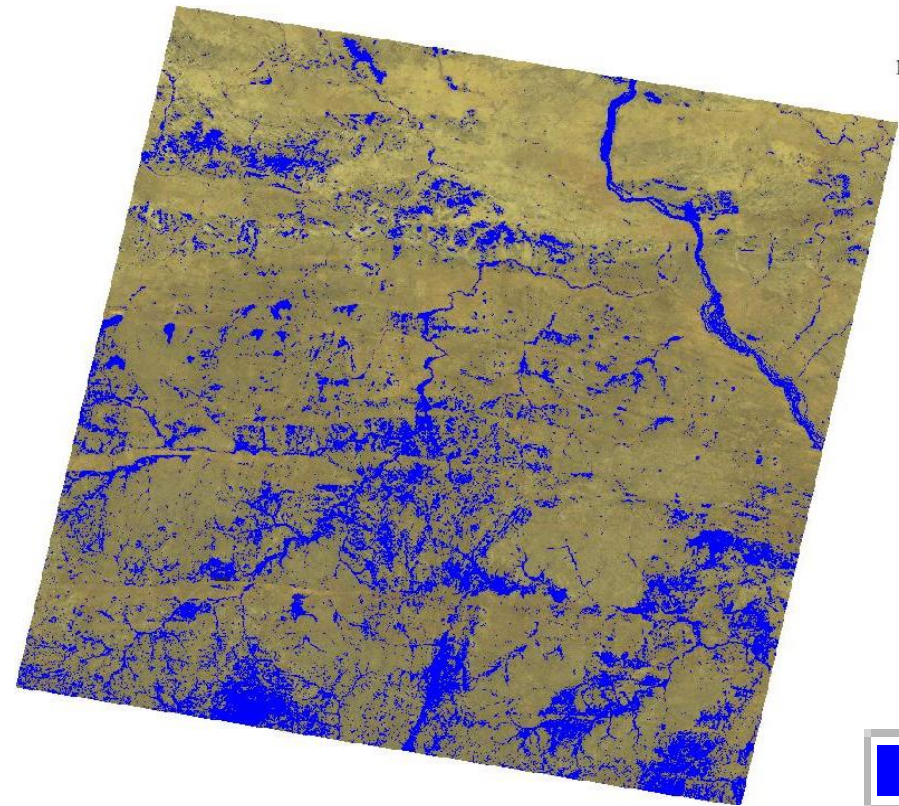


Figure 10. Household Heads Perception of Pastures Depletion over last 20 Years



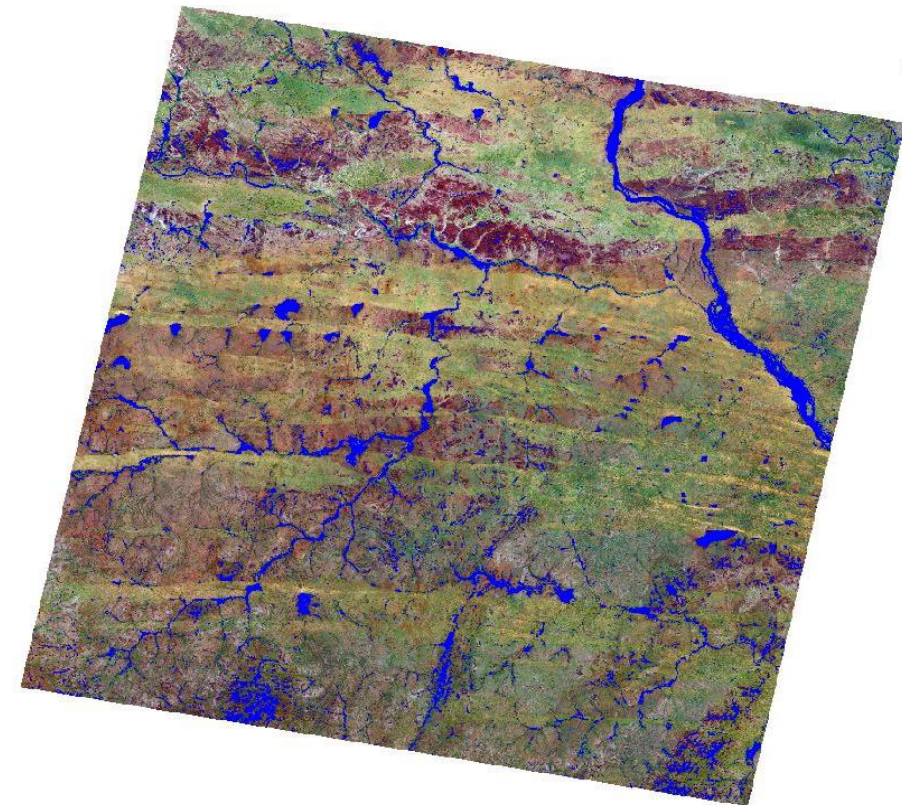
# Results and Discussion (6/12)

## *Landsat Satellite Imageries Observation*



*TM5 MSS: December 29, 1986*

 Water



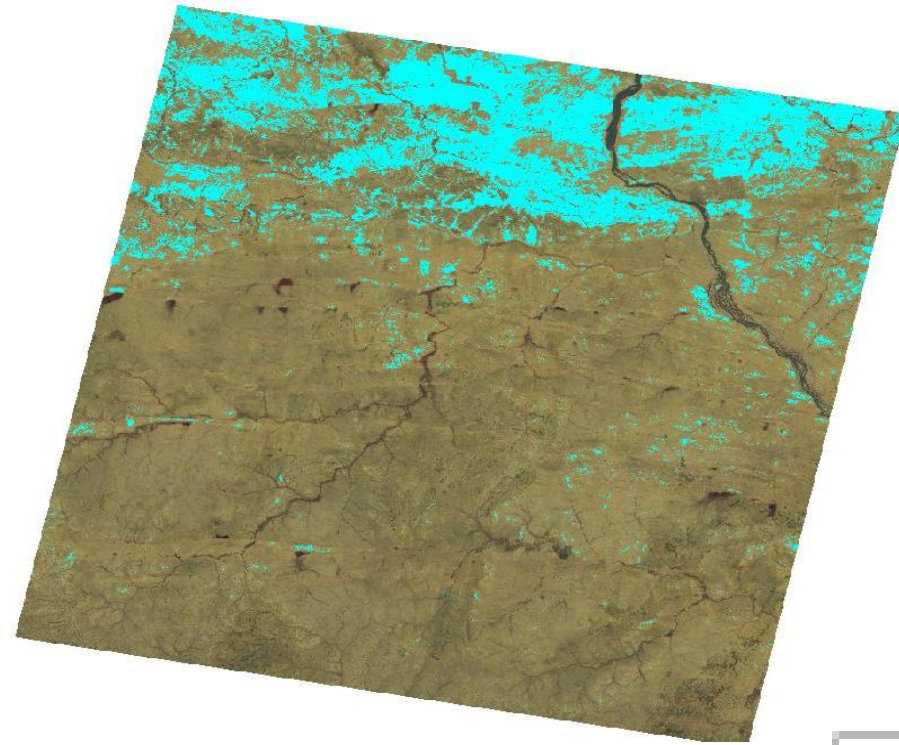
*Landsat 8: December 31, 2016*

**Figure 11. Comparison of the Landsat Imagery overtime with the Unsupervised Classification Analysis Showing a Decrease in the Water Area for the Last 30 years (1986 - 2016)**

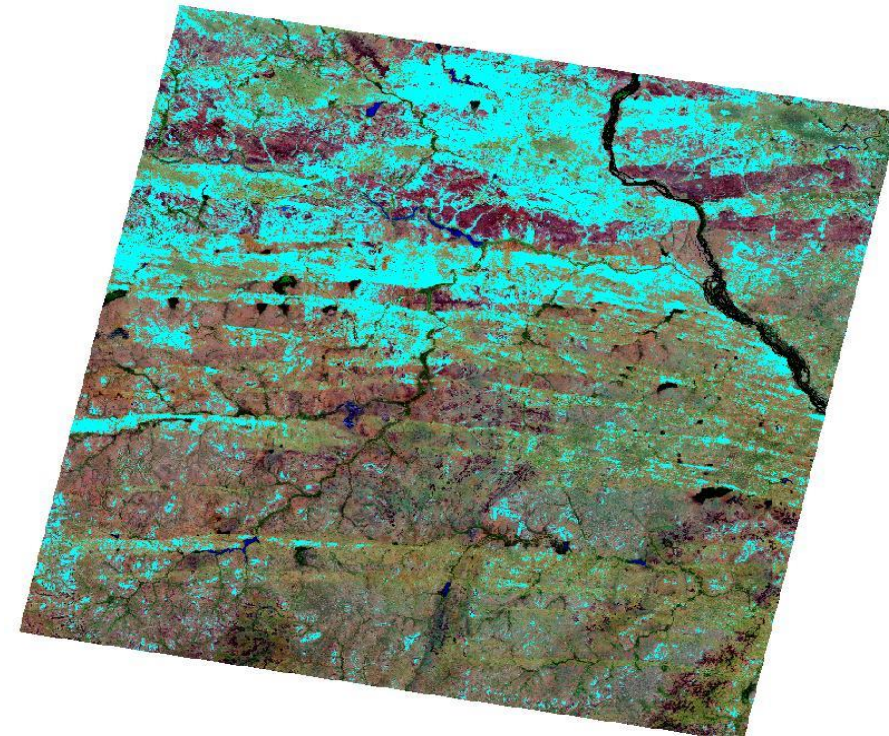


# Results and Discussion (7/12)

## *Landsat Satellite Imageries Observation*



*TM5 MSS: December 29, 1986*



*Landsat 8: December 31, 2016*

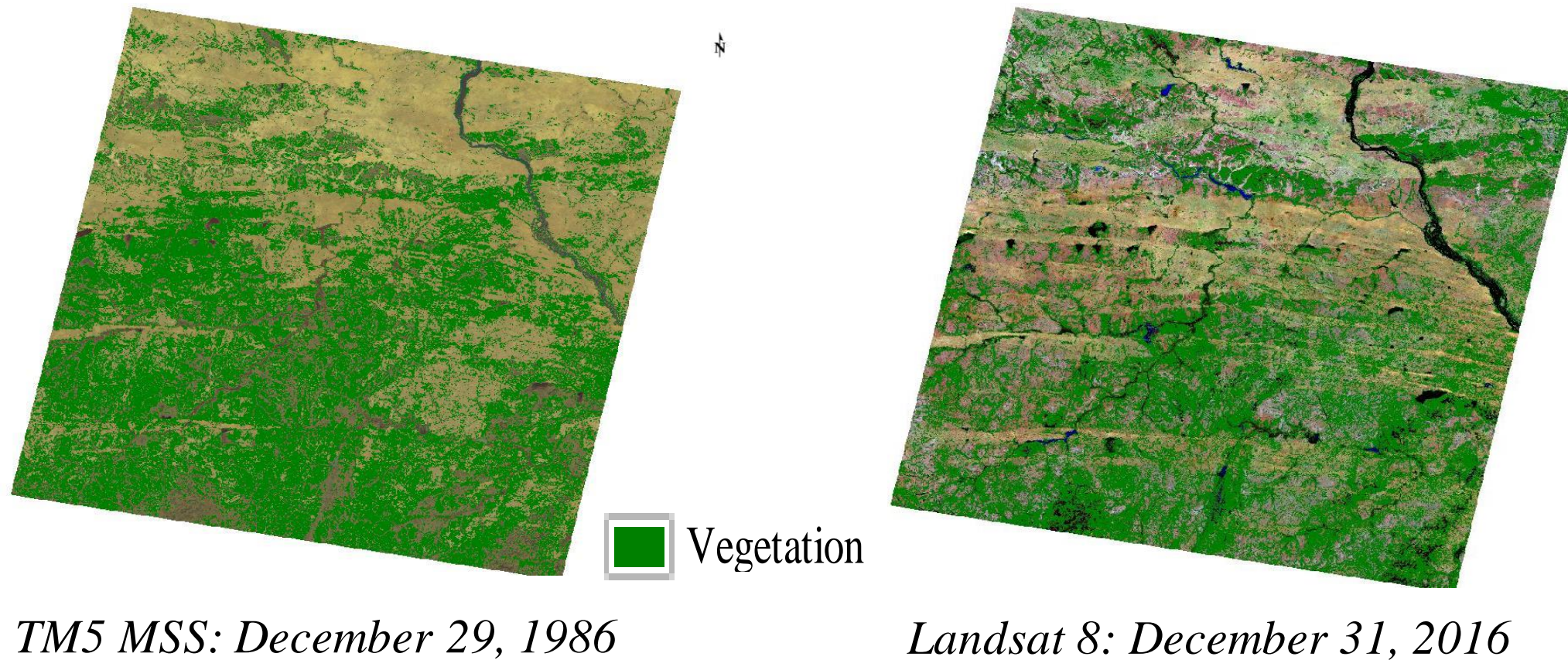
 Sandy bar soil

**Figure 12. Comparison of the Landsat Imagery overtime with the Unsupervised Classification Analysis Showing an Increase of the Sandy Bar Soil Surface for the Last 30 Years (1986 - 2016)**



# Results and Discussion (8/12)

## *Landsat Satellite Imageries Observation*

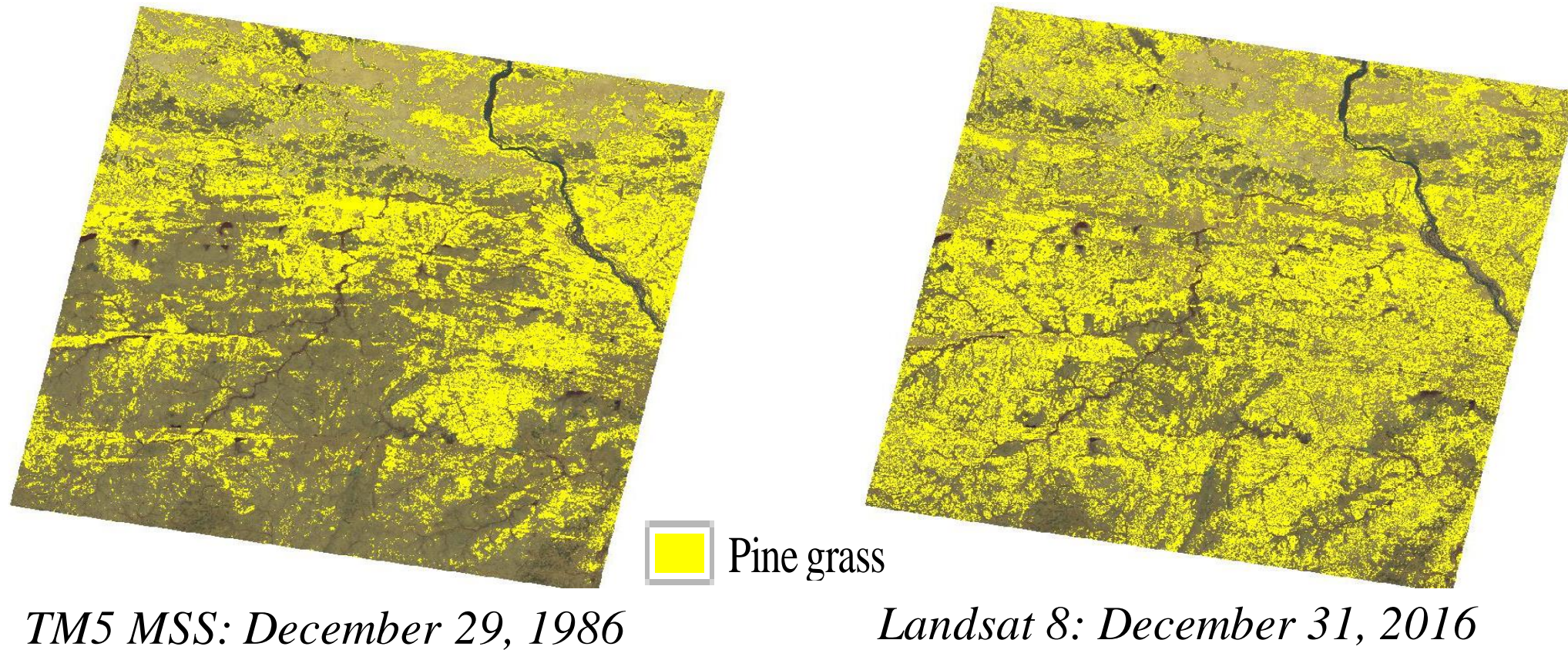


**Figure 13. Comparison of the Change of the Vegetation Cover Spotted by Landsat Spacecraft for Last 30 Years (1986 - 2016)**



# Results and Discussion (9/12)

*Landsat satellite imageries observation*

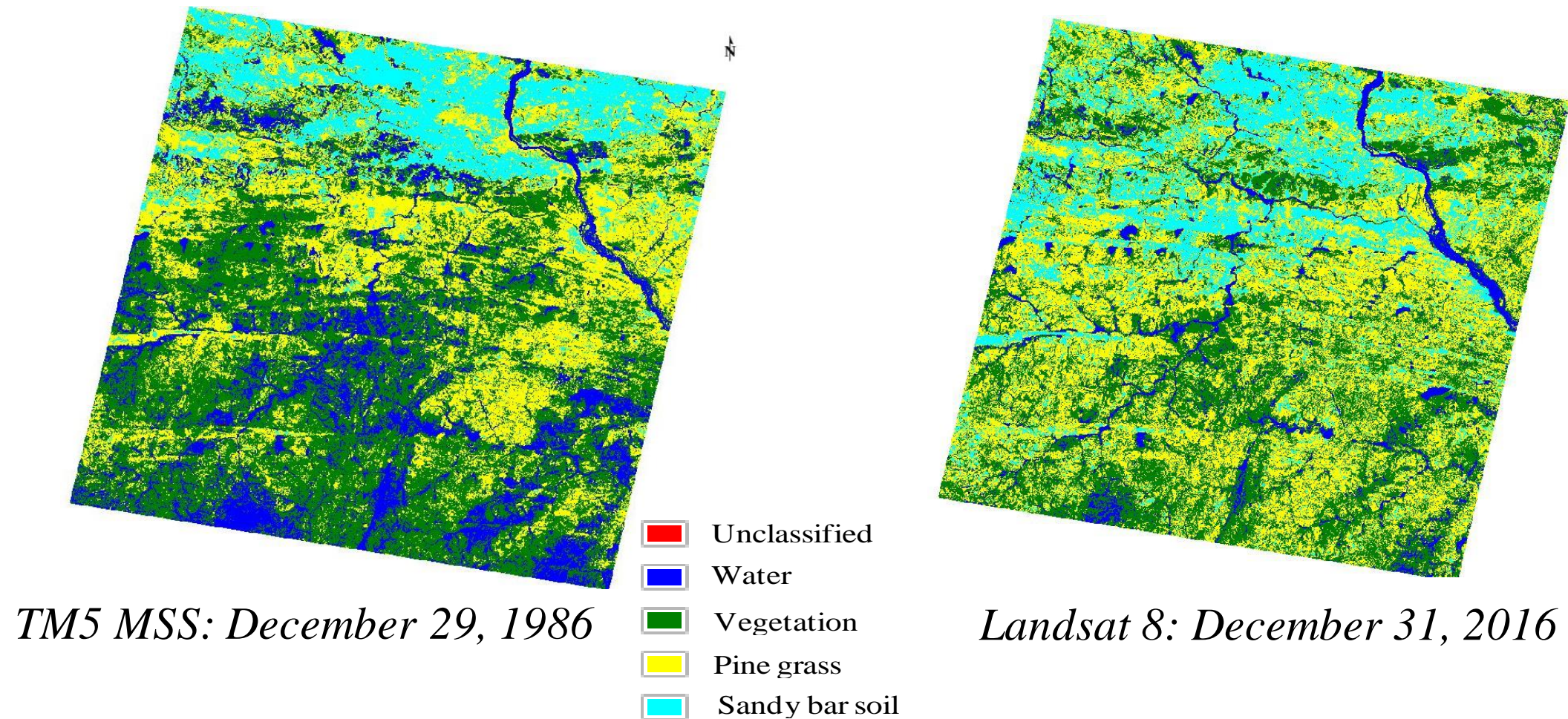


**Figure 14. Comparison of the Change of the Pine Grass by Landsat Spacecraft for Last 30 Years (1986 - 2016)**



# Results and Discussion (10/12)

## *Landsat Satellite Imageries Observation*

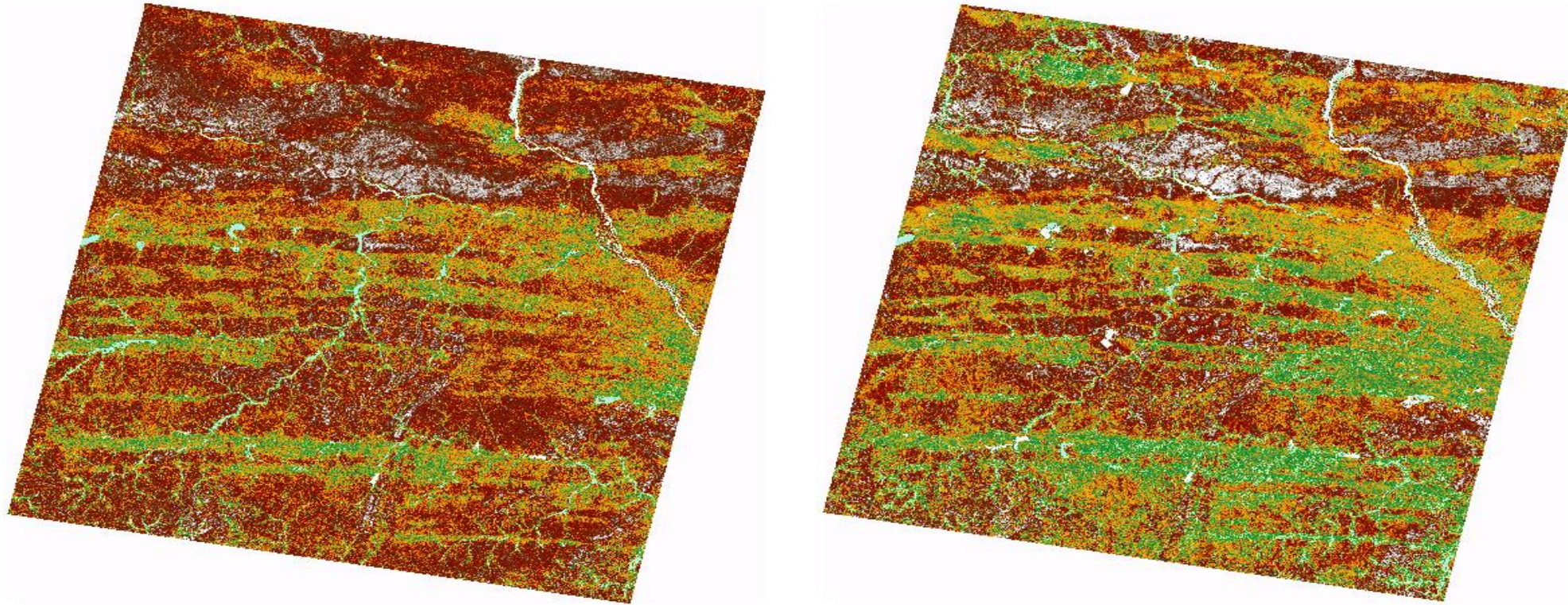


**Figure 15. Unsupervised classification of the Landsat TM5 MSS and Landsat 8 Imagery over the Study Area for Last 30 Years (1986 - 2016)**



# Results and Discussion (11/12)

*Landsat satellite imageries observation*



**Figure 16. Comparative map of the Normalized Difference Vegetation Index (NDVI) overtime between December 1986 and 2016.**

# Results and Discussion (12/12)

## Landsat satellite imageries observation

**Table 2. Unsupervised classification statistics**

TM5 MSS December 29, 1986		
Class	Pixel Count	Percent (%)
Unclassified	13281349	27.52
Water	5314433	11.01
Vegetation	14844797	30.76
pine grasses	10341724	21.43
Sand/bare soil	4473102	9.27

**Table 2. Unsupervised classification statistics (Cont.)**

Landsat 8 December 31, 2016		
Class	Pixel Count	Percent (%)
Unclassified	13276971	27.51
Water	2042523	4.23
Vegetation	11945135	24.75
pine grasses	14631809	30.32
Sand/bare soil	6358967	13.18

# Conclusions

- Combining the field survey and satellite imagery information is an effective way to assess climate disturbance impact on vegetation.
- 44% of the respondents reported depletion of the pasture as one of the impacts of climate disturbance over the past 20 years.
- The area covered by water and vegetation have decreased while sandy bar soil and pines grasses surfaces have increased between December 1986 and 2016.

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# Thank you!

