The Use of Satellite Data for Identifying the Risk of JE Disease in District Gorakhpur, Uttar Pradesh, India

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Presented By

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INTRODUCTION

- Vector-borne diseases represents one of the greatest global public health challenges of the 21st century.
- Changes in public health including lack of effective vector control, deterioration of public health infrastructure to deal with vector-borne diseases, disease surveillance and prevention programs and possible climate change.
- In the absence of effective control, these diseases have a major impact on public health and socio-economic development.

- The tropical environment is highly conducive to the propagation of vector borne disease all over world.

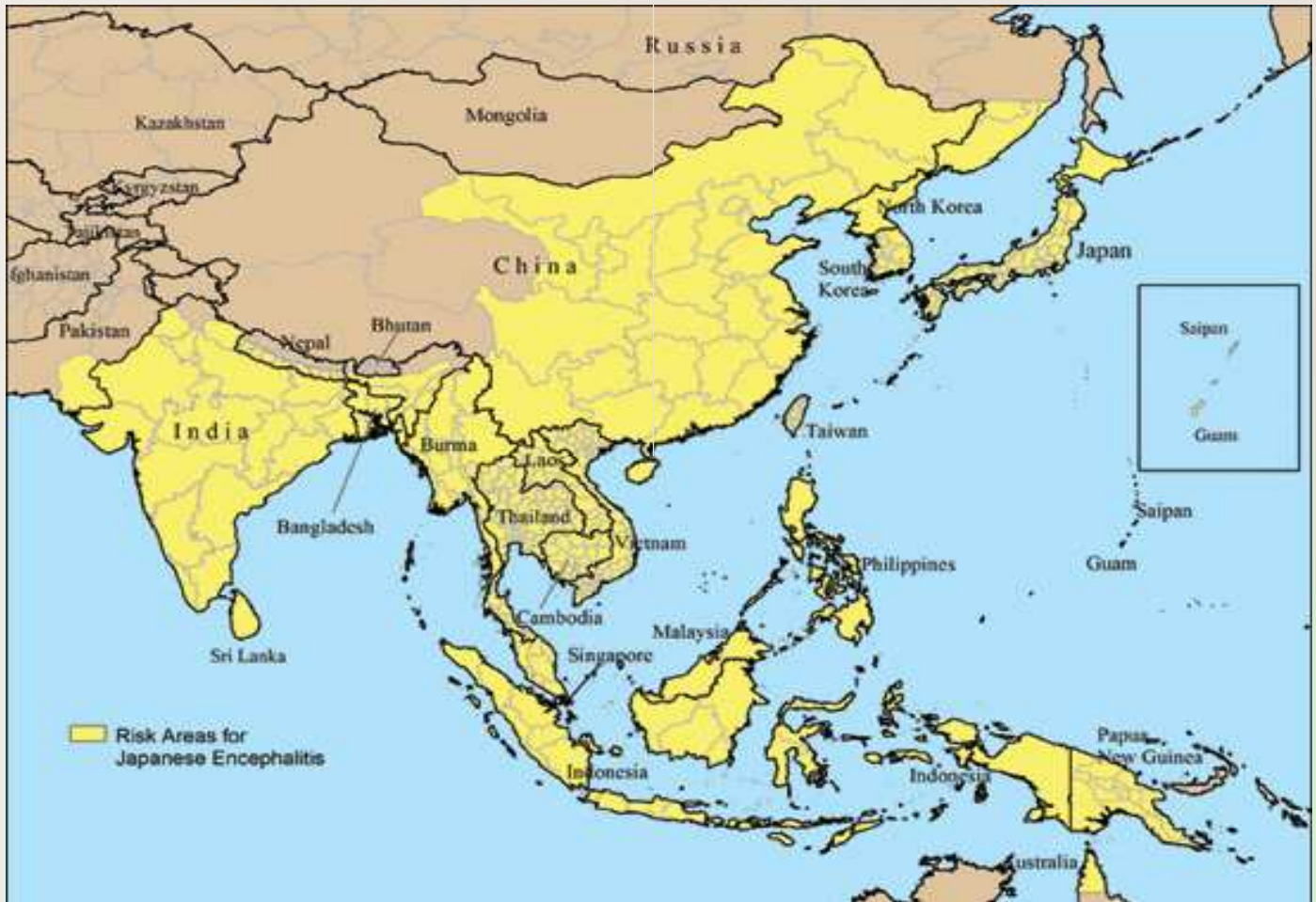
- Such as dengue, plague, lymphatic filariasis, malaria and Japanese encephalitis (JE) have long been cause of severe problem. In whole world a new trend of vector disease i.e. JE is the more killer of human beings in the northern states of India.

- Over the past 60 years JE estimated that it has infected approximately 10 million children globally, killing 3 million and causing long-term disability in 4 million.

Japanese Encephalitis (JE)

- Japanese encephalitis is a major cause of encephalitis in Asia (Erlanger *et al*., 2009 Singh *et al*., 2004).

- An estimated 50,000 cases occur in largely rural areas of the south and east Asian region resulting in significant morbidity and mortality (Gupta *et al*., 2008).



- JE is caused by a zoonotic flavivirus which is one of the common causes of AES.

- It is difficult to eradicate JE because it is transmitted from natural reservoirs like pigs, waddling birds which are important amplifying hosts and man is involved as an accidental host (Khinchi *et al.*, 2010, Fischer *et al.*, 2010).

- Among 175 districts among 80 districts classified as endemic 54(68%) are from Uttar Pradesh state alone (Sabenson, 2008, Saxena *et al.*, 2008).

- The scourge of the disease is most severe in Gorakhpur District (Singh. 2007).

ROLE OF GIS AND REMOTE SENSING

- GIS has proved extremely useful for supporting the extent of various infections in the world.
- A simplified GIS supported database management tool facilitates the collection, storage, retrieval and analysis of data for public health purposes (Berquist., 2001).
- By utilizing a GIS, various departments can share information through databases on computer generated maps in one location.
- Disease mapping is used to understand the geographical distribution and spread of disease in the past or present.

- Remote sensing (RS) by earth-observing satellites has become increasingly important for the analysis and integration of various data.

- The heterogeneity of climates and landscapes determines the distribution of vector-borne diseases.

- The new technologies through their propensity for powerful data collection and data handling are particularly well suited to pinpointing constraining factors.

- The disease information obtained by remote sensing technique on classified image, vegetation properties (NDVI, NDWI) canopy and surface temperature and soil moisture over large areas.

- Satellite-derived information considered useful in understanding these diseases include patterns of vegetation (crop type, deforestation, rate of green-up), habitat type (forest patches, ecotones), fresh water sources (permanent water, wetlands, flooding, soil moisture, canals), housing (human settlements, urban features) and ocean conditions (ocean color, sea surface temperature, sea surface height) (Kallouri *et al*., 2007; Stoops *et al*., 2008).

- Remote Sensing and GIS enhance the understanding of the relationship between vegetation and vector-borne disease and prepare health professionals for changes in the distribution of important infectious pathogens (Chaung *et al*., 2012).

- An important step in understanding their ecology for the purposes of intervention is to determine the environmental causes of the spatial and temporal variation in the disease (Beck *et al*., 2000).

Factors affecting Japanese Encephalitis

- Change in land use pattern - from dry land crops to wet land crops (rice)
- Change in agriculture practices - increasing the frequency of rice cultivation (Paulo, 1991)
- Change in socioeconomic status & animal husbandry – promotion of pig breeding as a food source - promotion of duck farming (Badari, 1995)
- Climate and environmental conditions like spatial factors
- Temperature
- Rainfall
- Soil moisture
- Vegetation

Objective Of The Present Work

- The objective of present work included using remote sensing and GIS for monitoring environmental conditions and mapping the disease risk.

- Using 2010 Landsat ETM data were initially classified into spectrally distinct water and vegetation classes, GIS has been used in turn to identify suitable presence and proximity to habitat sites.

- **Gorakhpur** is a city in the eastern part of the state of Uttar Pradesh in India, near the border with Nepal.

- Gorakhpur division is mainly a paddy growing area, with clay soil and a very high water table. It has seven districts including Gorakhpur district.

- The district of Gorakhpur lies between Lat. 26º 13' N and 27º 29' N and Long. 83º 05' E and 83º 56' E.

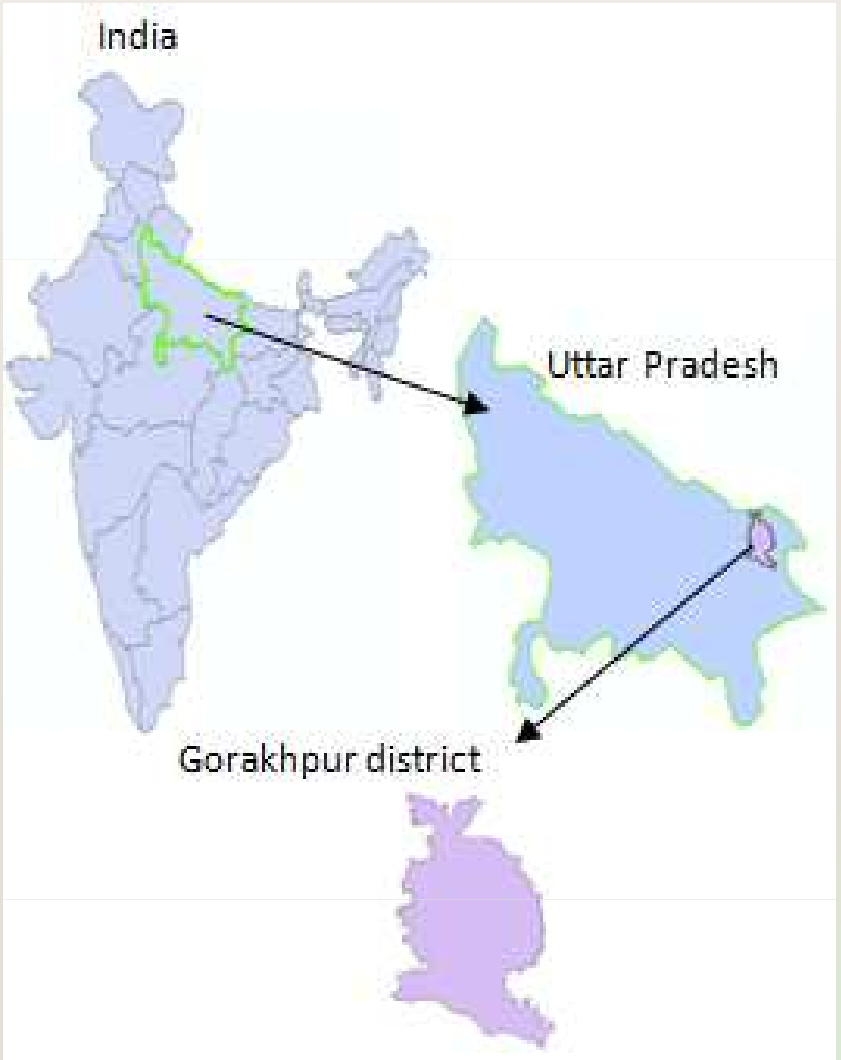
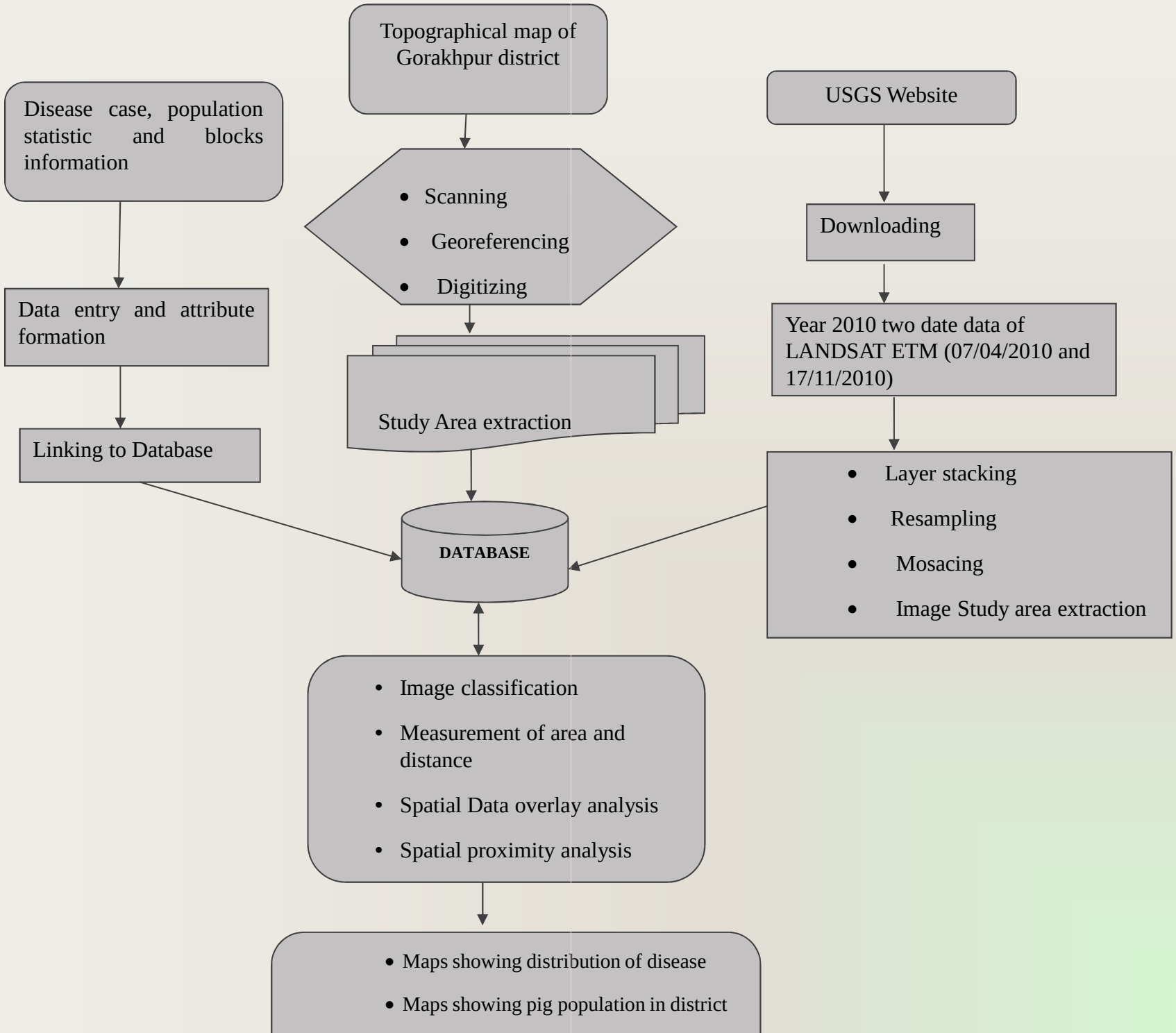


Fig 1: Location Map of Study Area

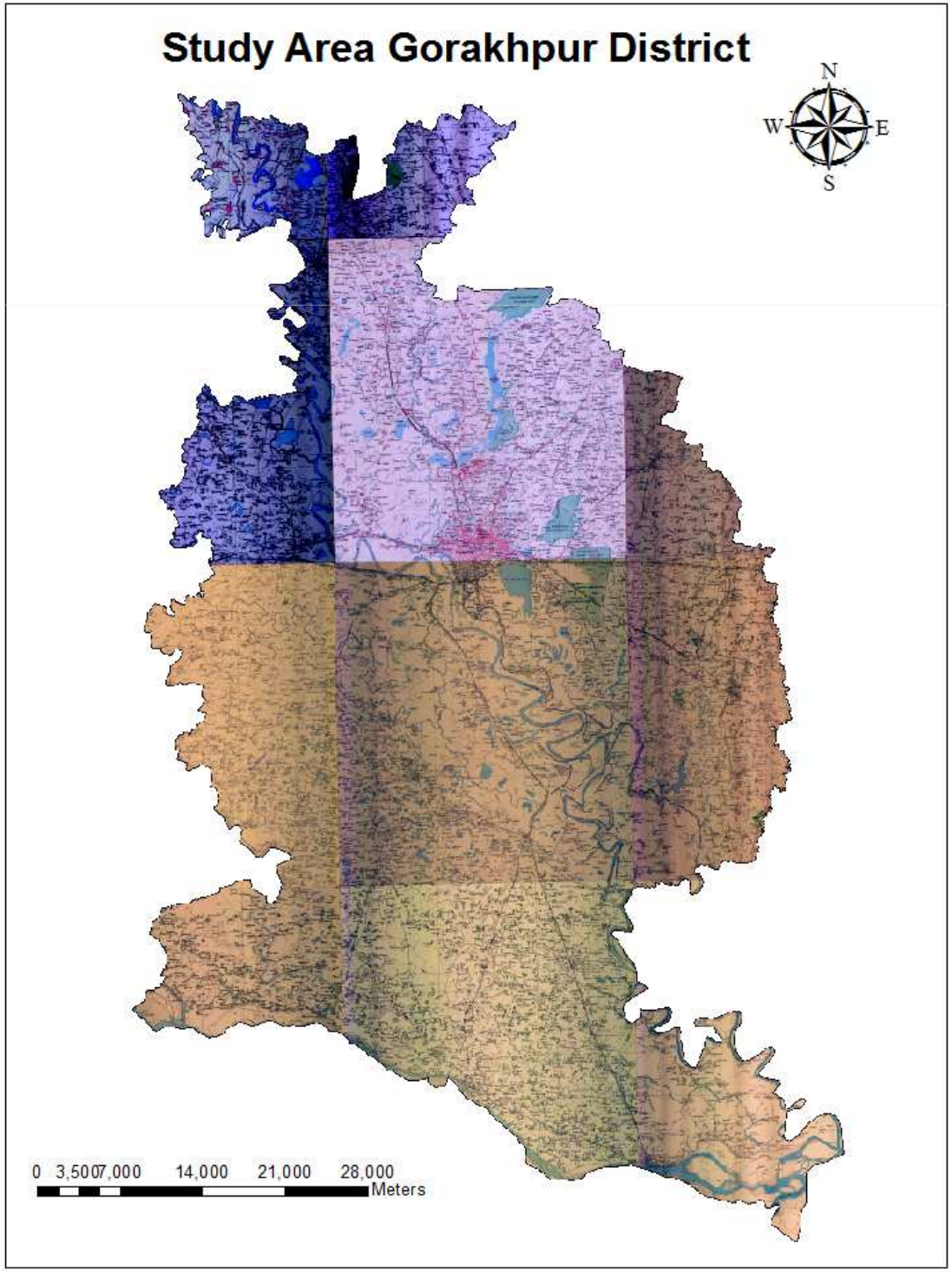
Collection of Health data

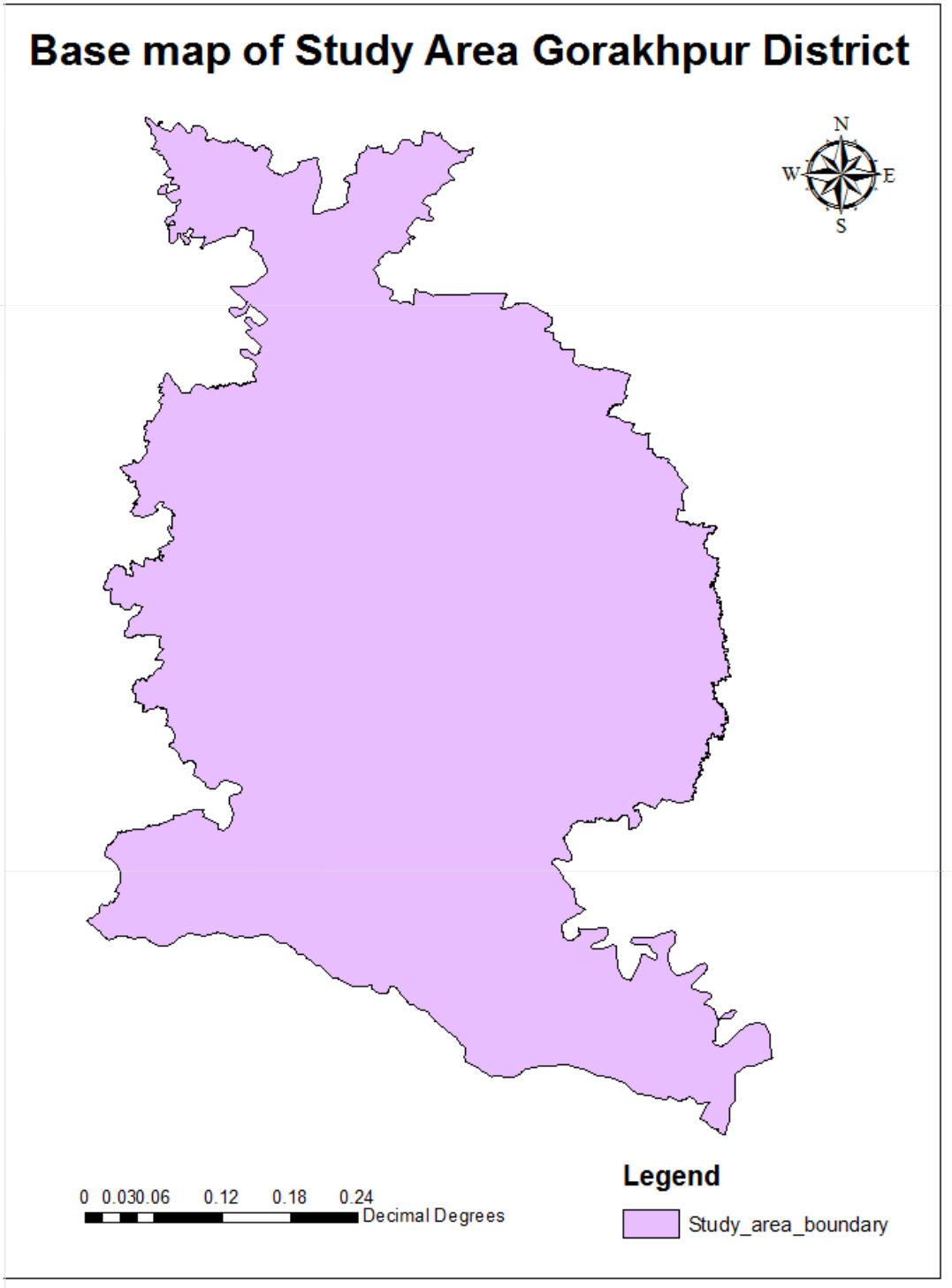
- The health data is collected from district hospital Gorakhpur, Vikas Bhawan and NIC center Gorakhpur.
- The topographical maps were collected from Survey of India (Dehradun).
- Landsat ETM data was downloaded free of cost from USGS.
- The Landsat ETM images used from year 2010 of months April and November.

Adopted Methodology



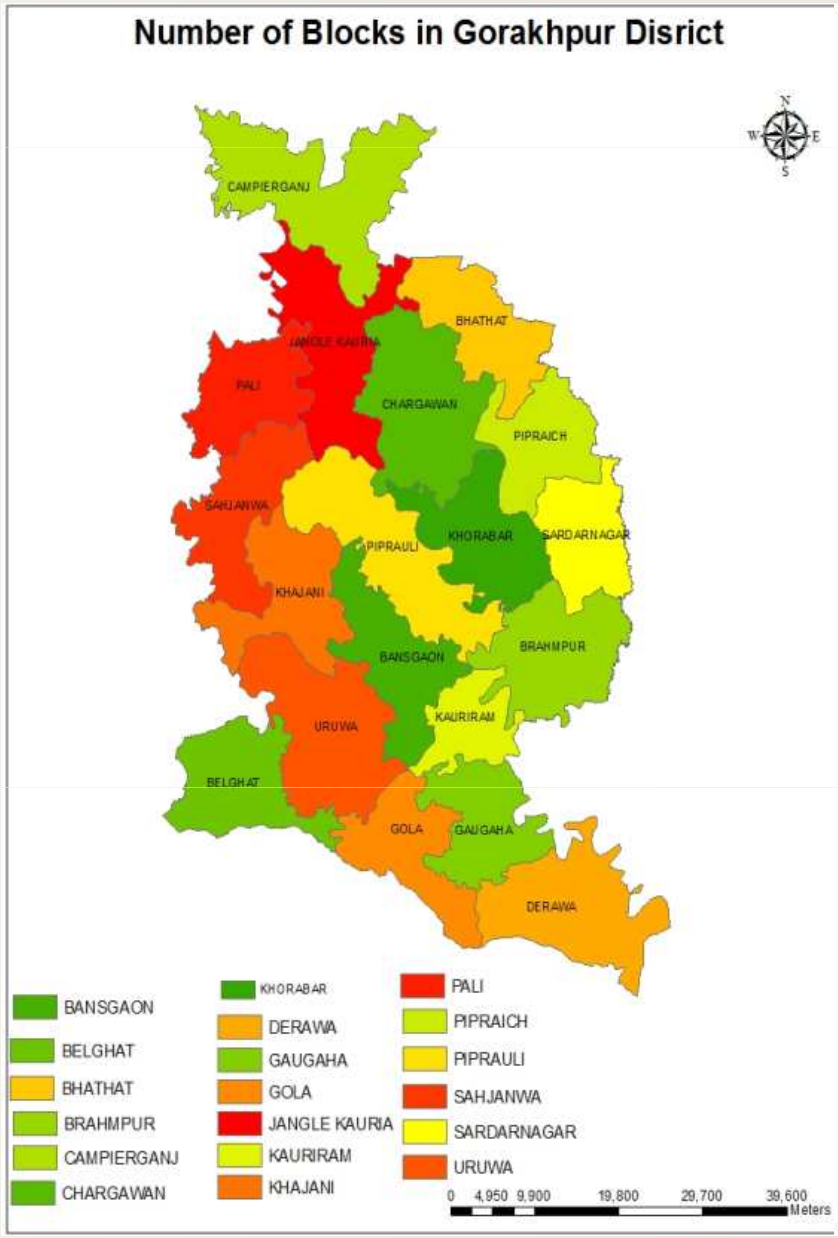
Extract the Study area boundary

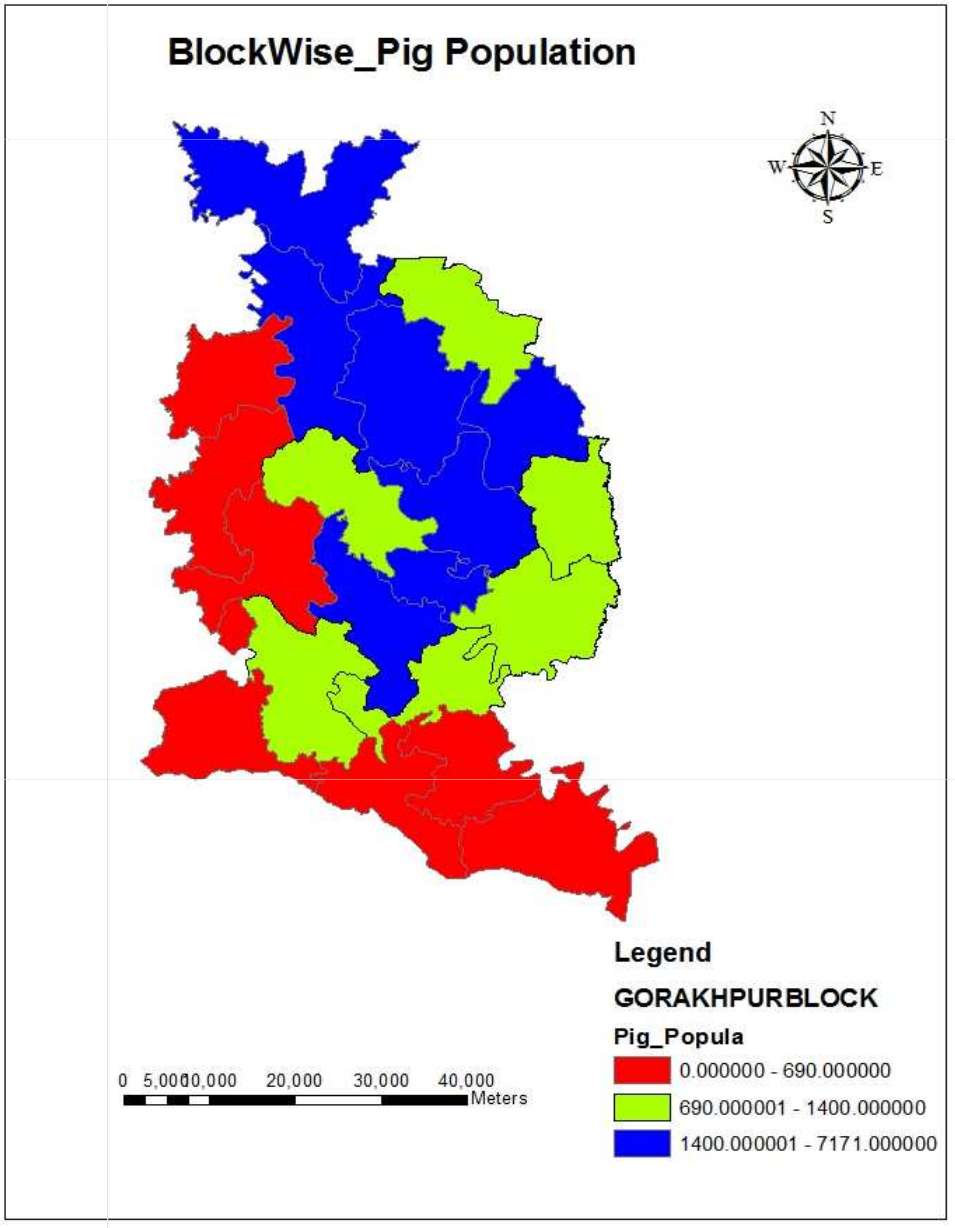




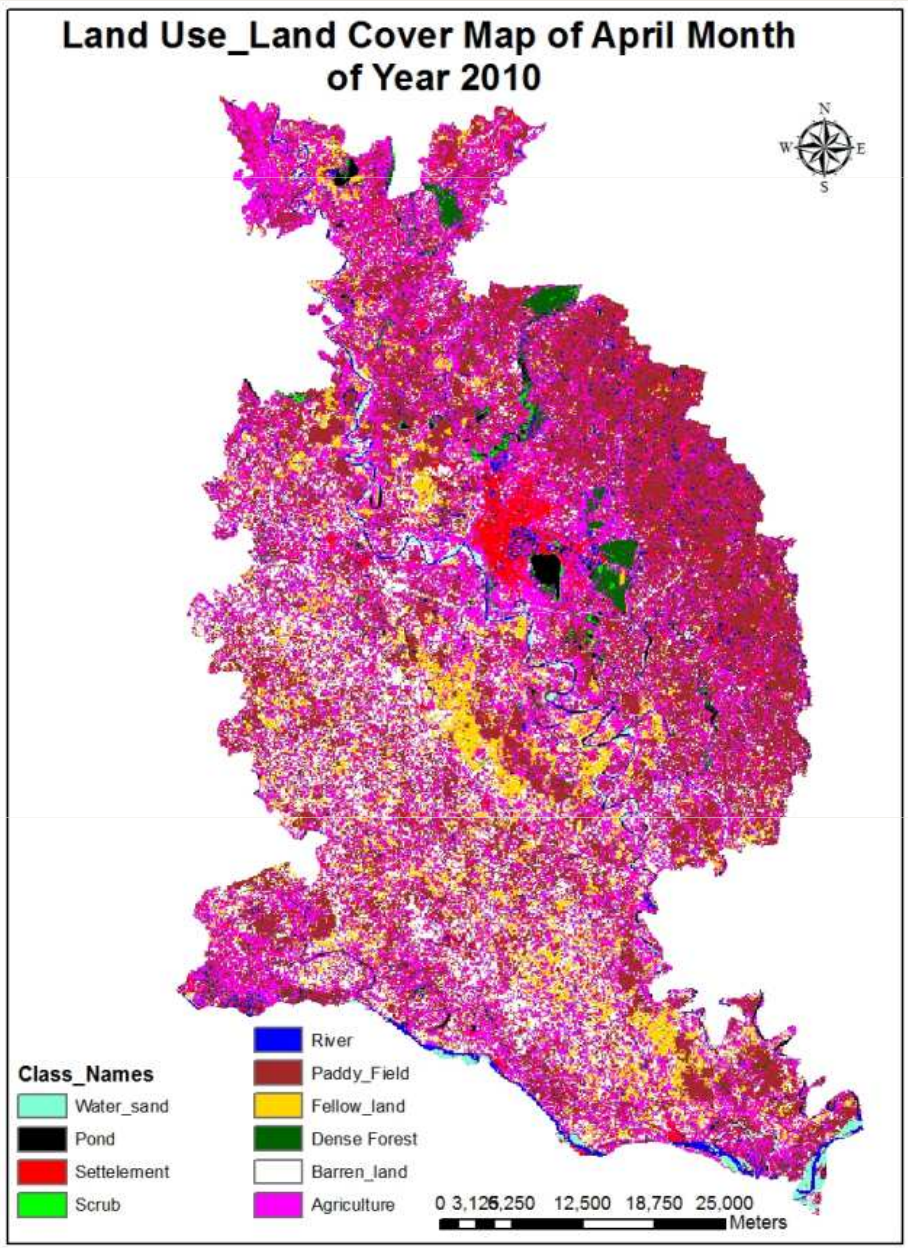
Details of Maps Created

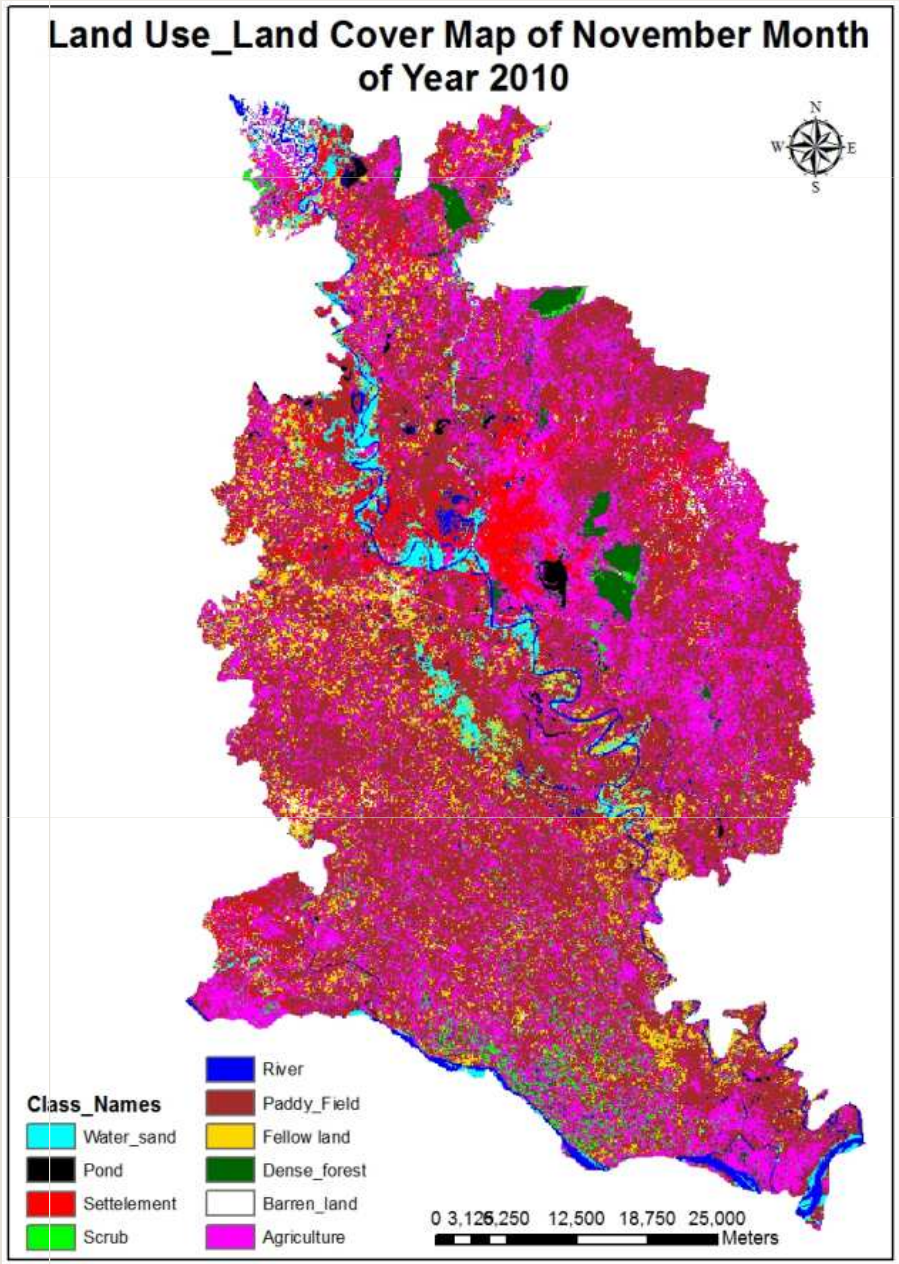
1. Number of blocks and pig population in Gorakhpur district





2. Land use map of Two Months Data



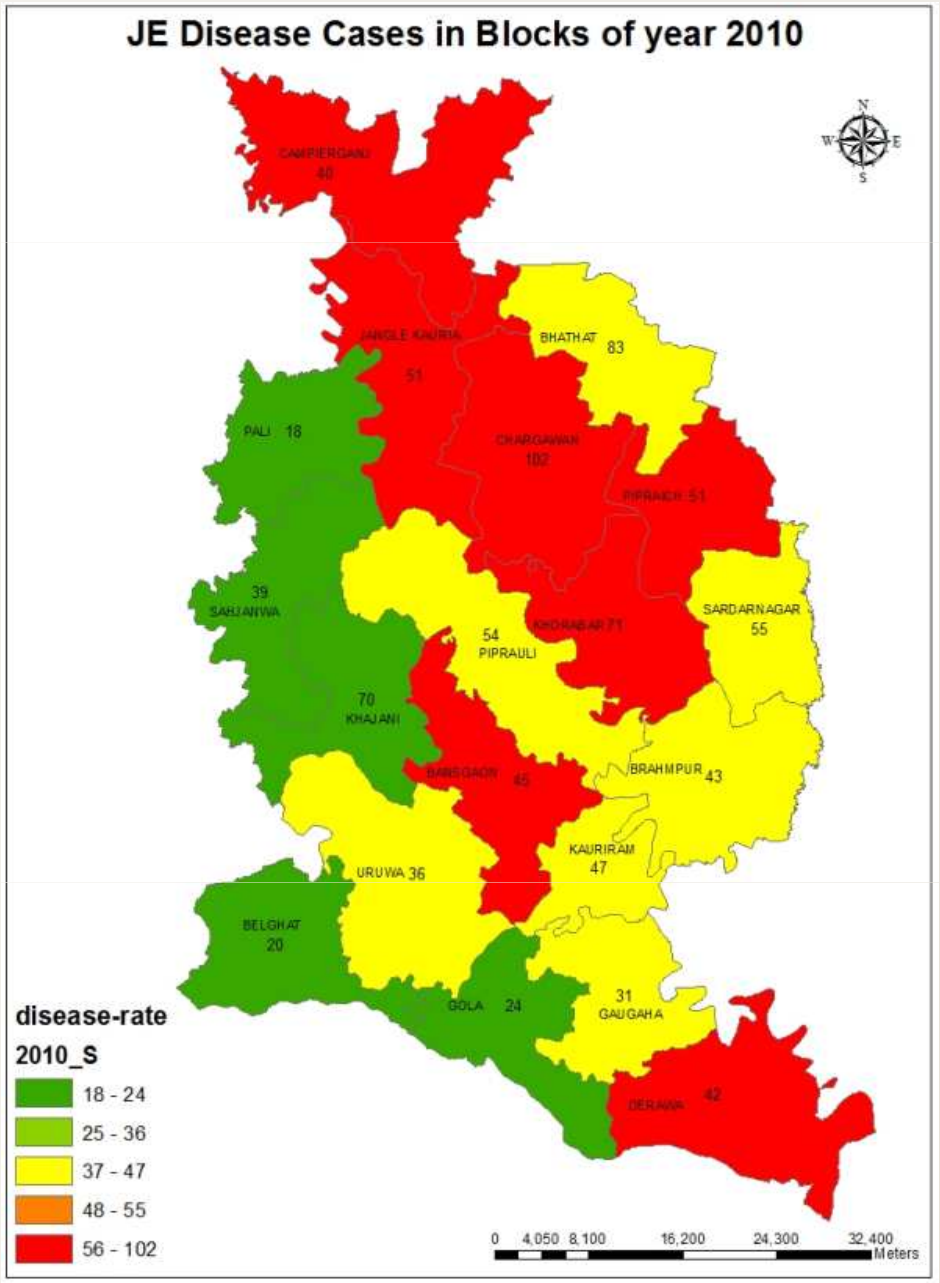


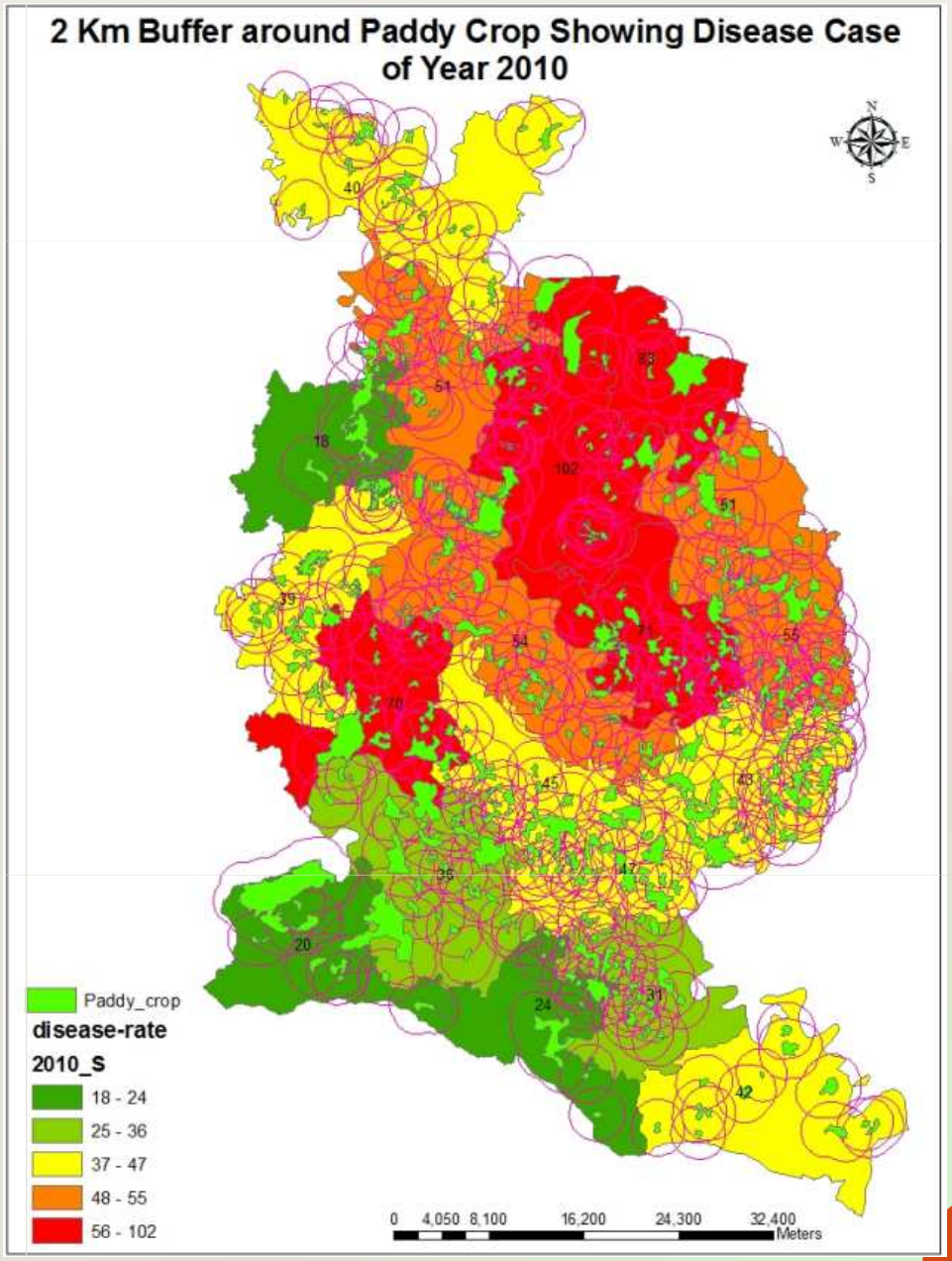
➢ The total area covered by each land use type of month April and November Year 2010

Class Name	April - 2010		November - 2010		Suitability for disease
	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)	
Pond	44.50	1.32	39.58	0.74	Not - Suitable
Scrub	12.11	0.361807	85.14	2.46	Very Suitable
Dense Forest	71.50	2.135868	71.06	2.06	Not Suitable
Agriculture	1007.65	30.09983	884.87	25.66	Very Suitable
River	91.92	2.745924	94.23	2.73	Not Suitable
Water_sand	24.34	0.727163	49.95	1.44	Not Suitable
Settelement	292.20	8.728518	292.71	8.48	Suitable
Paddy_Field	986.36	29.46402	1531.52	44.41	Very Suitable
Fellow_land	324.85	9.703697	266.88	7.74	Not Suitable
Barren_land	492.23	14.70362	145.92	4.23	Not Suitable
Total	3347.69	100	3347.69	100	

3. JE disease cases in blocks

2 Km buffer around paddy field in more susceptible Blocks





CONCLUDING REMARKS

- The study by using GIS and remote sensing helped to extract the update information and prepare the data for disease control and management strategies.
- For the tarai region near to district are tending to high increase rice cultivation seasonally. This land would be favorable to habitation of piggistic population which is host of JE vector.
- The digital data processing using satellite data has given prospects results on spatial distribution of disease.
- The study area constitutes 19 blocks. Comparing the gradual increase of pig habitation in blocks.
- There was generally slight increase the pig population habitats in blocks in range above 1400 (Campierganj, Jungle Kauria, Khorabar, Chargaon, Piparaich, Bansgaon, Derwa).

- This study demonstrates the methodology of using LANDSAT ETM images for identification of land cover variables that may be associated with disease-carrying mosquito breeding.

- The use of software demonstrated the importance of classification for LANDSAT data, which allows for quantification of surface patterns that are not adequately done with per-pixel approaches.

- The proximity approach to find out the area which is located around paddy field area and most sensitive to disperse the disease.

- The two season data and timely data have given main advantages of the data for disease monitoring applications.

- Additionally the role of this technology remains to be explored for supporting the implementation of endemic surveillance activities.

THANK YOU