

FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



*Presented at the FIG Regional Conference 2024,
14-16 November 2024 in Kathmandu, Nepal*

Application of Web Based Model on Land Pooling (12926)

Er. Ashok Shrestha

Division Chief, Information Technology Division, Kathmandu Metropolitan City

Completed Bachelors Degree in Geomatics Engineering from Tribhuvan University

Currently Pursuing Masters Degree in Geoinformatics.

November 14, 2024, Kathmandu Nepal

ORGANISED BY



PLATINUM SPONSOR





Outlines

- Introduction
- Objectives
- Methodology
- Implementation in web
- Results
- SWOT Analysis
- Conclusions
- Recommendations



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Introduction



ORGANISED BY



PLATINUM SPONSOR





Introduction

- Nepal ranging from 60 m to 8848.86 m height from mean sea level, 65% of the population relies on Agriculture providing 31.7 % of GDP. (Wikipedia)
- However, the landscape poses significant challenges, especially in our hilly regions, where fragmented plots and traditional farming practices hinder productivity and limit access to essential infrastructure like irrigation and roads.
- So, the Innovative approach to tackle these challenges through **Land pooling** is incorporated in this project.





Introduction – Land Pooling

- A method of consolidating small, fragmented plots into larger, well-organized parcels providing all required infrastructures (road, water supply, drainage); subdividing the area and redistributing back to the owners as per agreed terms of land contribution.
- This is more applicable with the use of **Web-based model**.



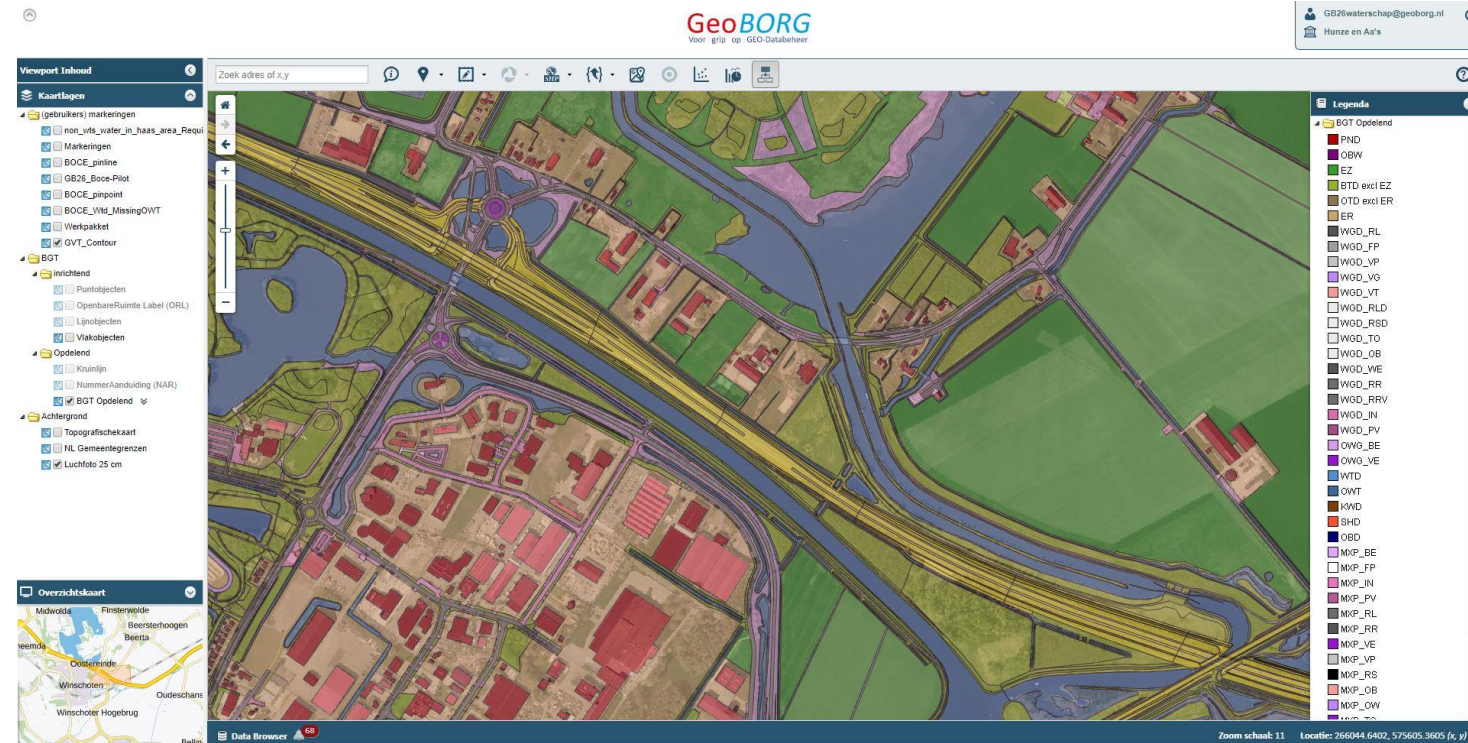
Before: Proposed Road Alignment **After: Arterial Road Acquisition**
 Inefficient and inequitable development **After: With Land Readjustment**
 Opportunity to plan, service, and finance development. All stakeholders benefit.

Source: Mathews et al. 2018. State-Led Alternative Mechanisms to Acquire, Plan and Service Land for Urbanisation in India. World Resources Institute. <http://wriosscities.org/our-work/research>.



Introduction – Web-based model

- It can modernize land pooling, allowing for better planning, visualization, and management of agricultural land.
- This model creates a central platform to help local governments and landowners plan more sustainable and productive land use and directly contact with the buyer.





Objectives

- To prepare an accessible web-based platform to visualize and manage fragmented land plots, focusing on optimizing agricultural land use.
- To promote agricultural and economic growth through the adequate distribution of "agricultural-plots".
- To prepare maps with block designs, master plans for infrastructure such as access roads, irrigation canal on land consolidated sites.



FIG

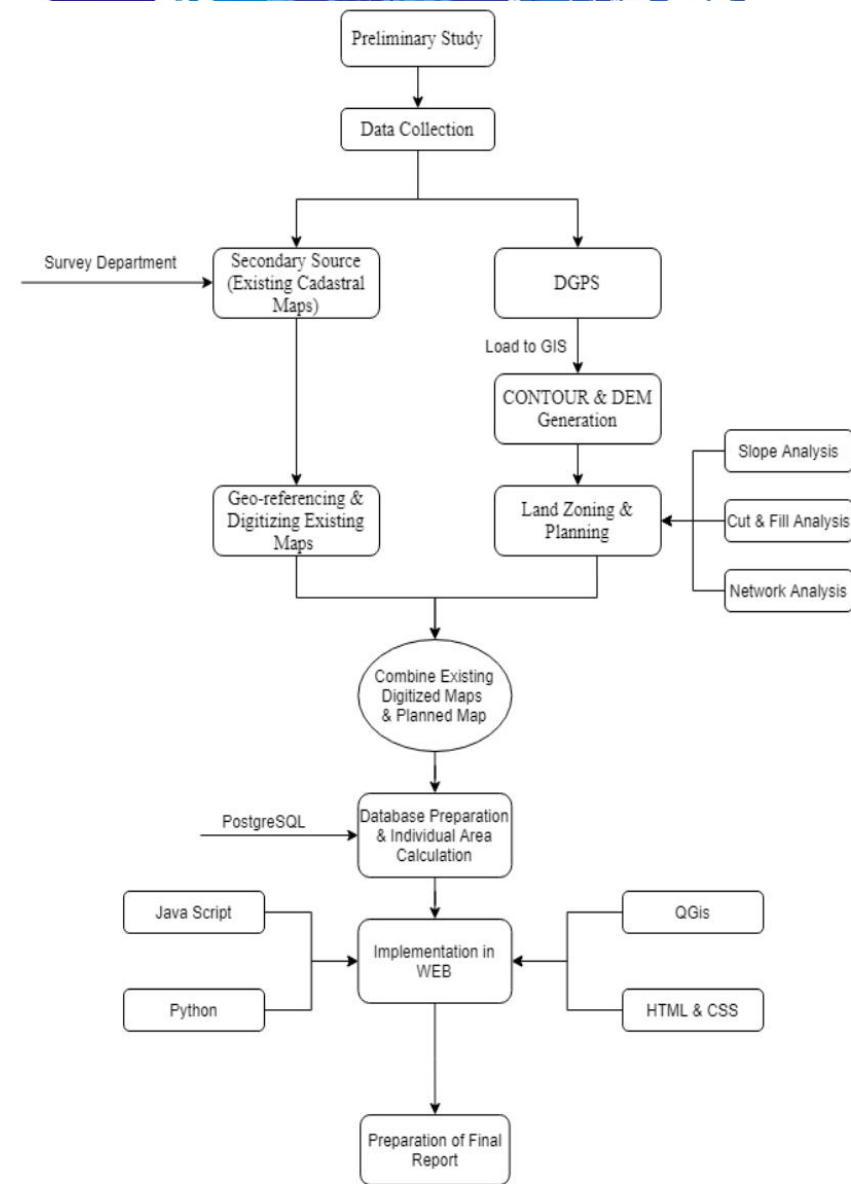
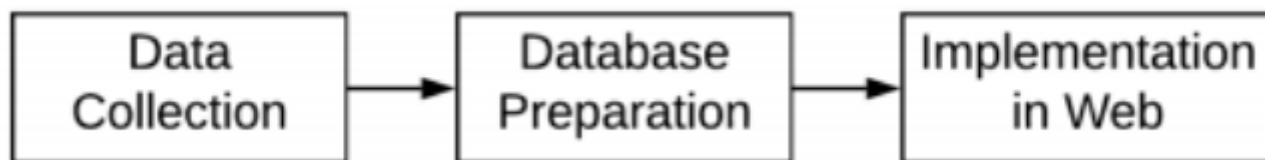
Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Right.



Methodology



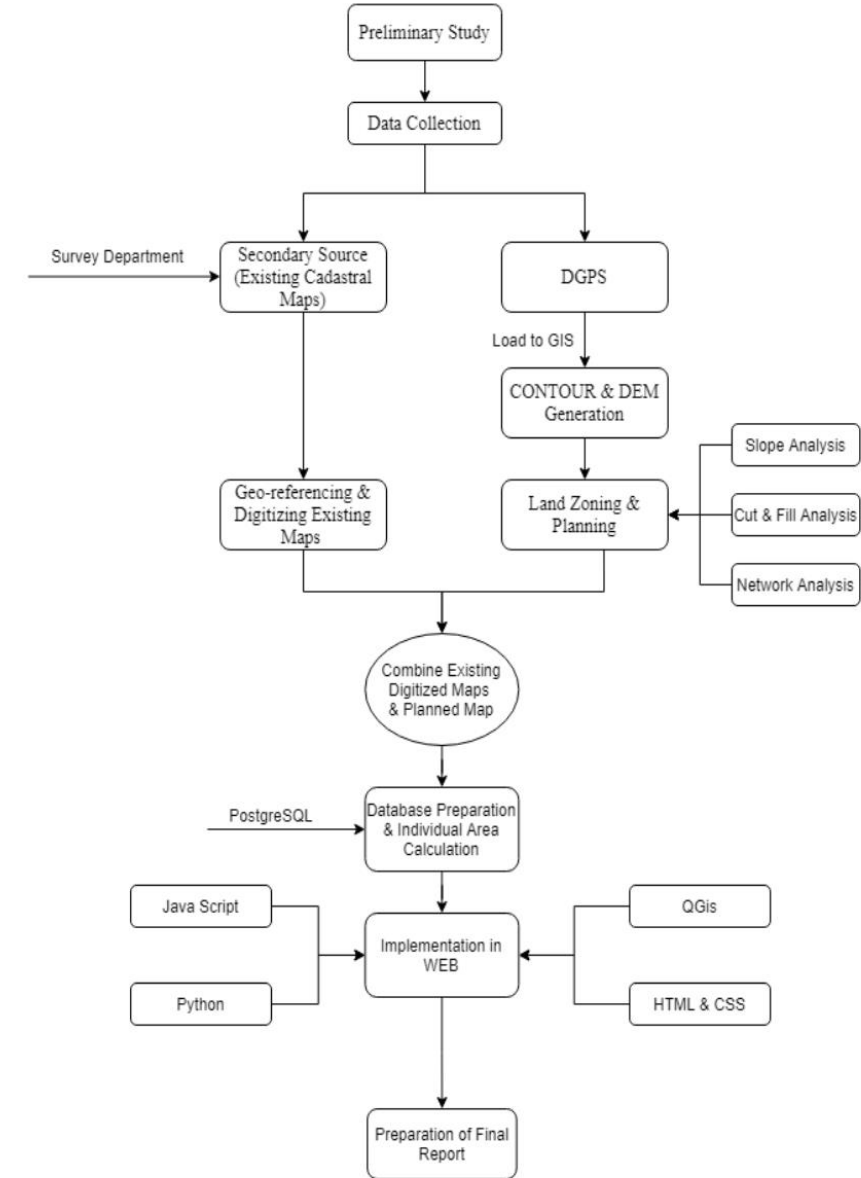
ORGANISED BY





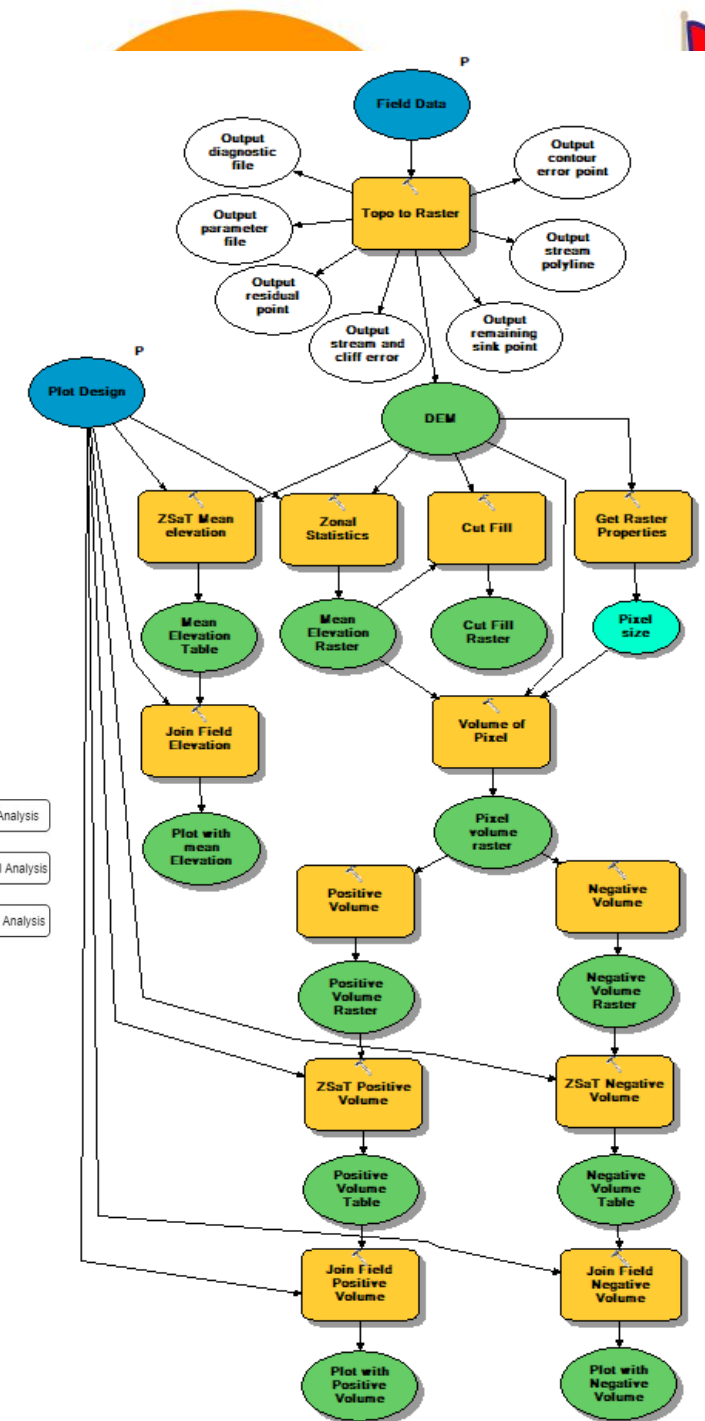
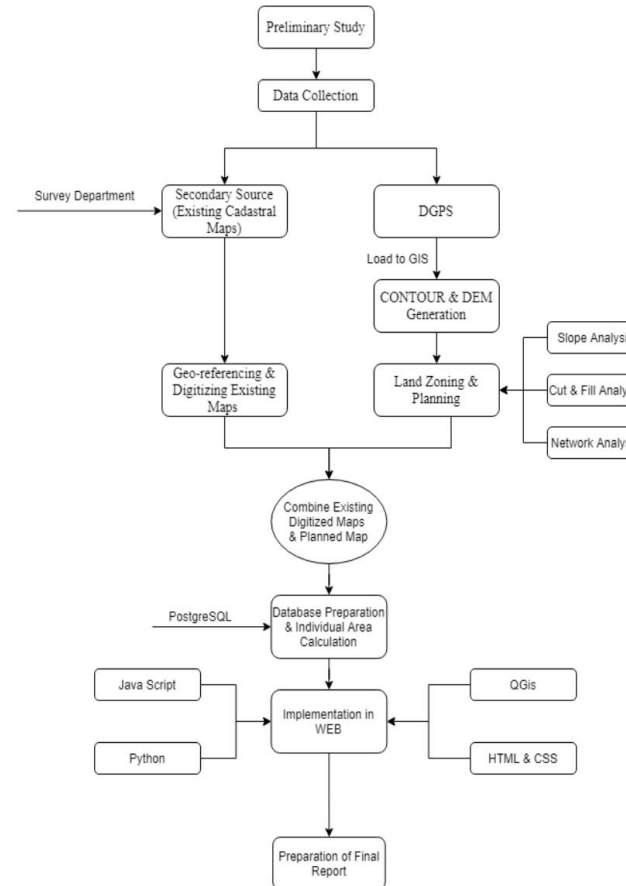
Methodology

1. Preliminary Study
2. Data Collection
 1. Primary data collection
 2. Secondary data collection
3. Data Processing and analysis
 1. DEM Creation and Contour Generation
 2. Land Plot Designing
 3. Calculating Zonal Statistics
 4. Cut Fill Analysis
4. Database Preparation and Area Calculation
5. **Implementation in Web**



Methodology

1. Preliminary Study
2. Data Collection
 1. Primary data collection
 2. Secondary data collection
3. Data Processing and analysis
 1. DEM Creation and Contour Generation
 2. Land Plot Designing
 3. Calculating Zonal Statistics
 4. Cut Fill Analysis
4. Database Preparation and Area Calculation
5. **Implementation in Web**





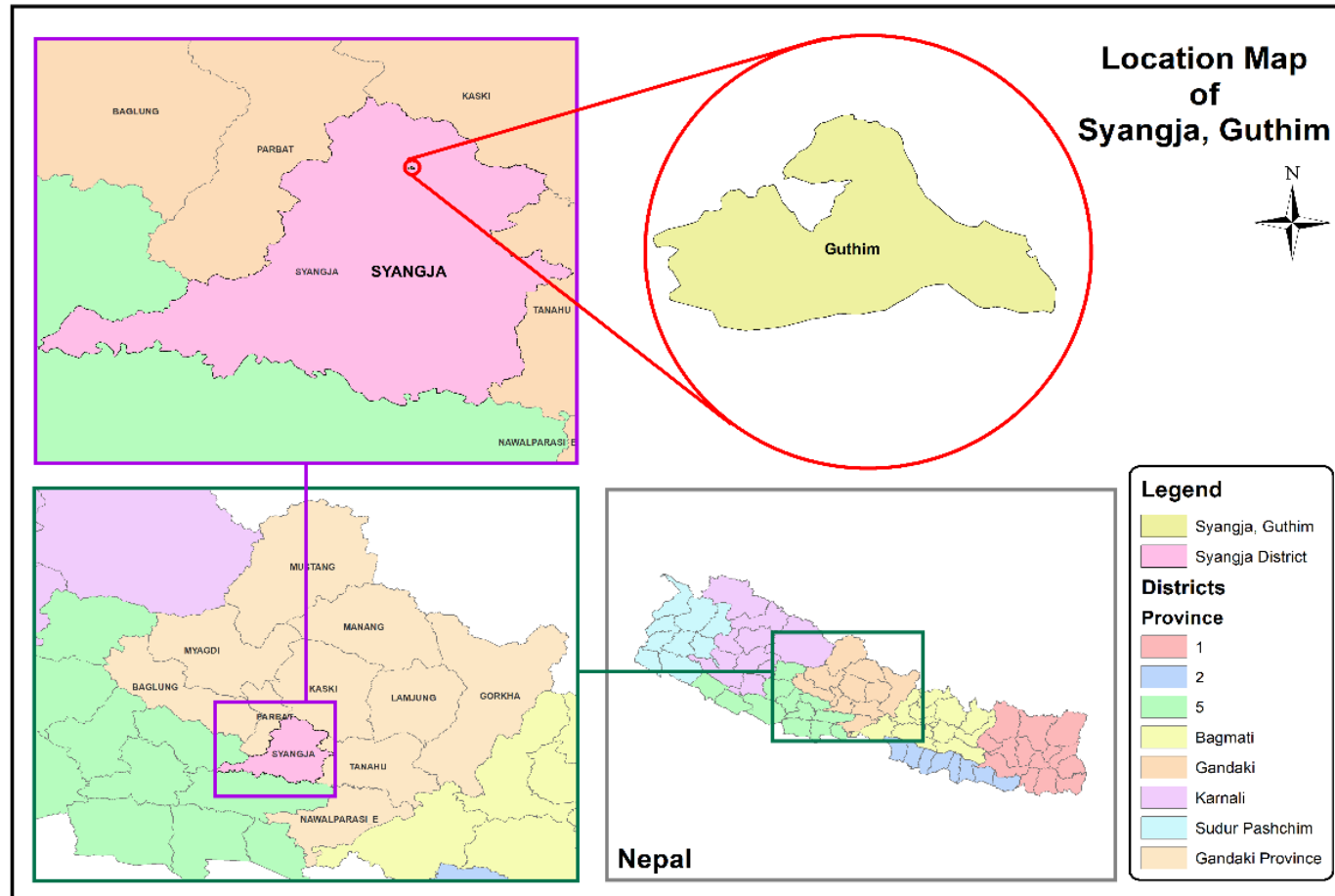
Implementation in Web

- The web-based land pooling model was developed to streamline the visualization, management, and access of land data.
- This platform combines geographic and parcel-specific data to create an interactive, user-friendly interface where users can view and manage land information efficiently.
- Different frontend and backend technology is used along with some interactive elements for the better user experience.





Results (Case Study of Ganeshpur Village, Syangja, Nepal)



FIG

Kathmandu, Nepal 14–16 November

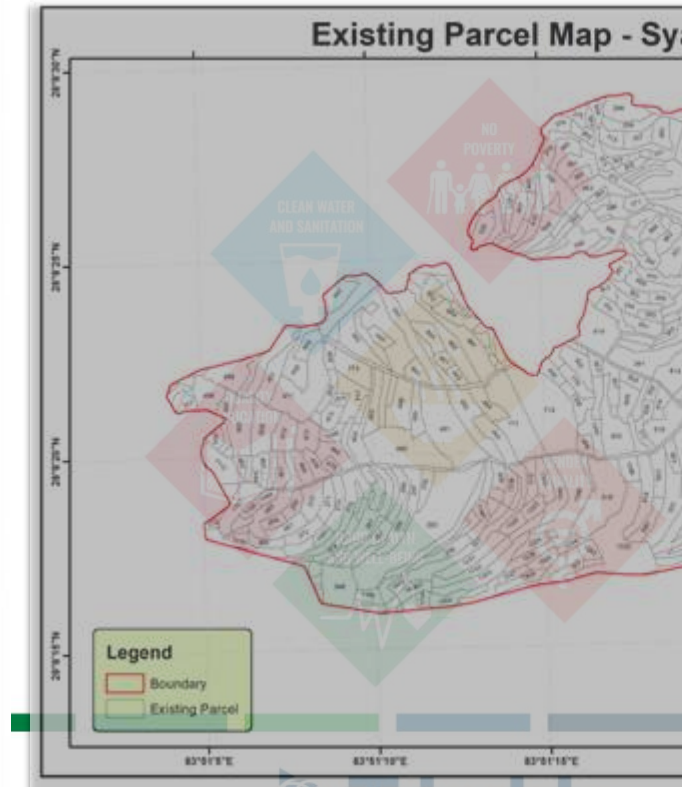
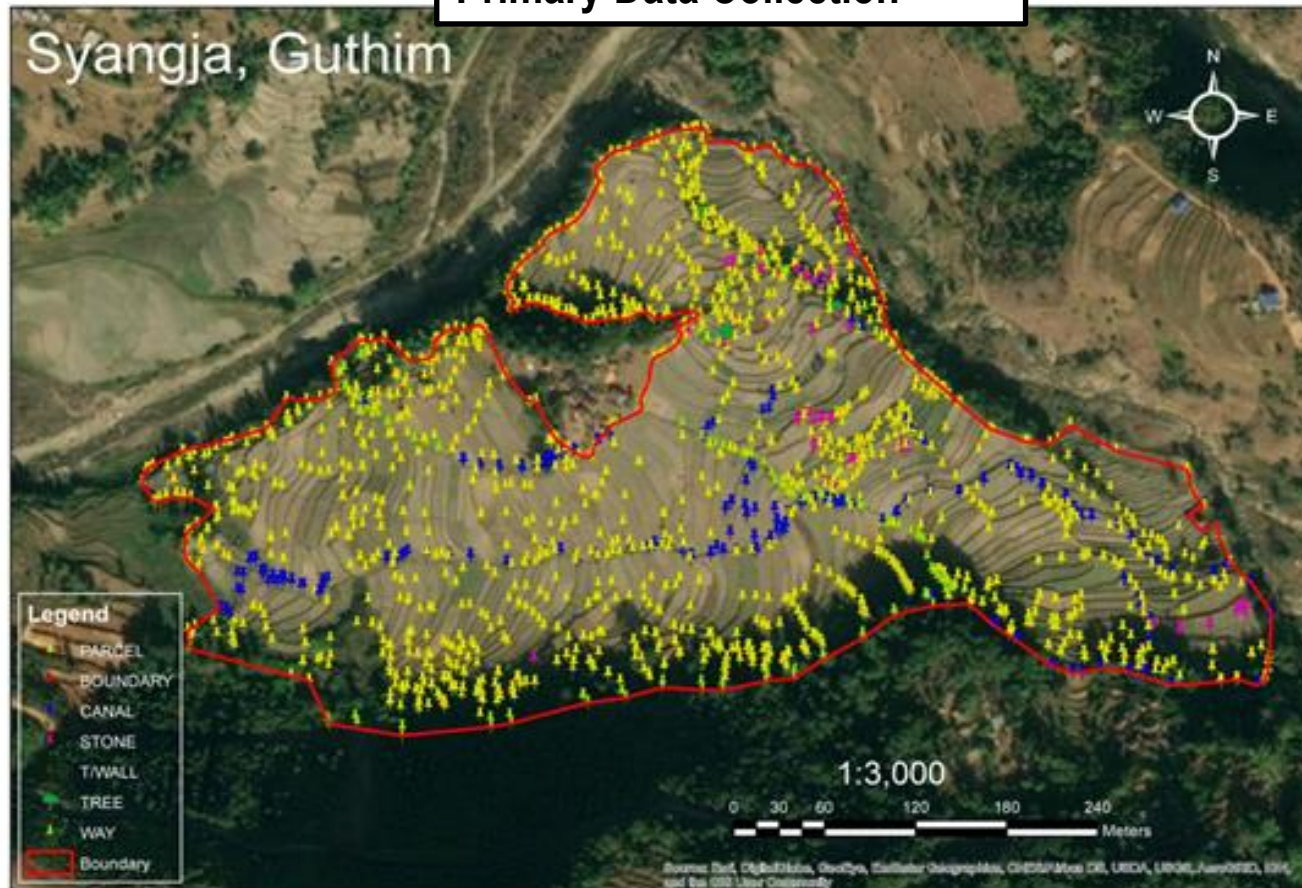
REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Primary Data Collection



ORGANISED BY



PLATINUM SPONSOR



FIG

Kathmandu, Nepal 14–16 November

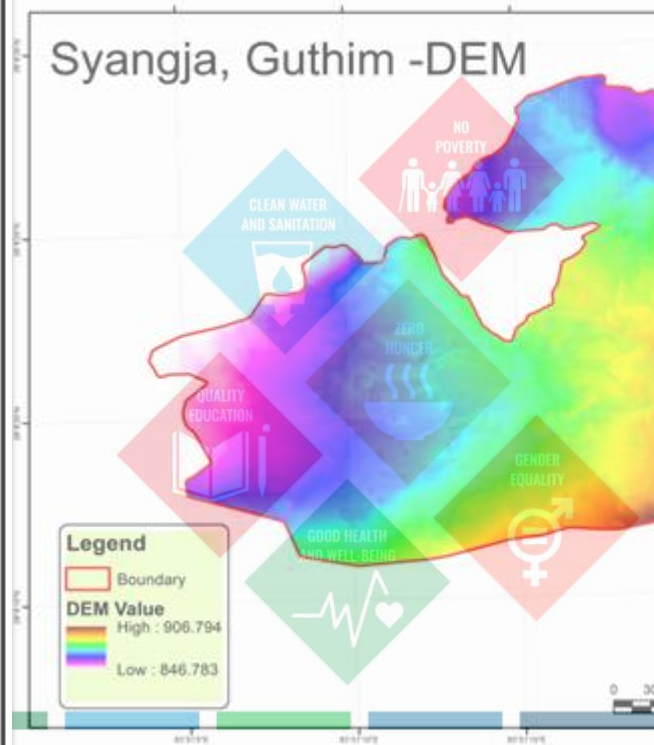
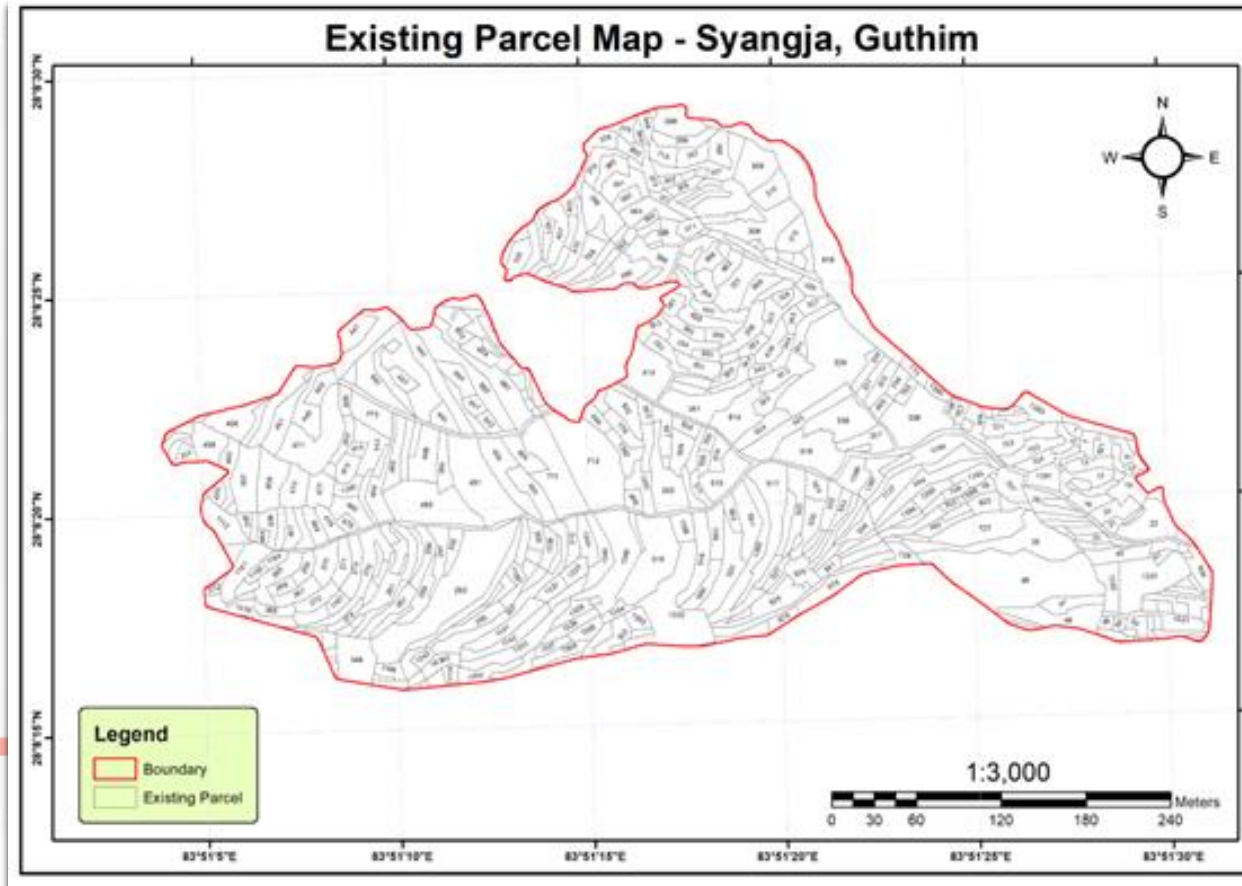
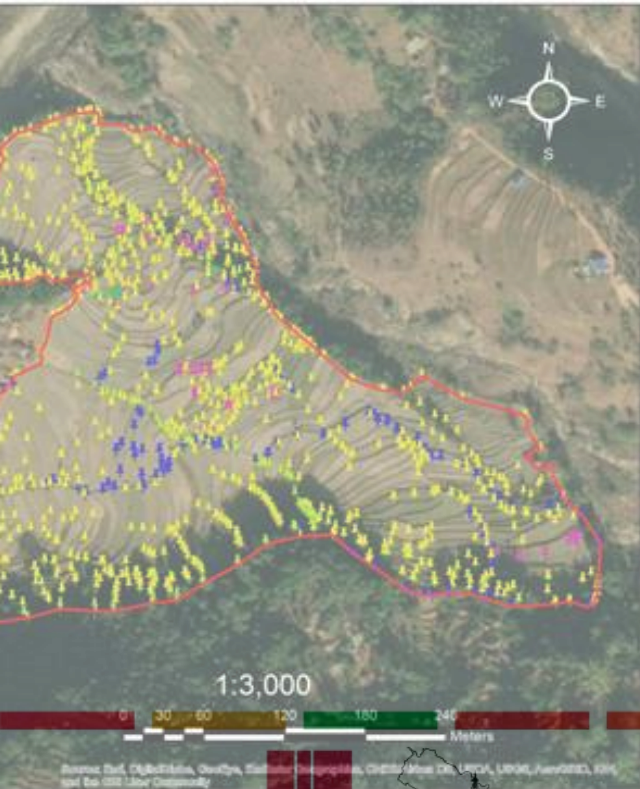
REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Secondary Data Collection



ORGANISED BY



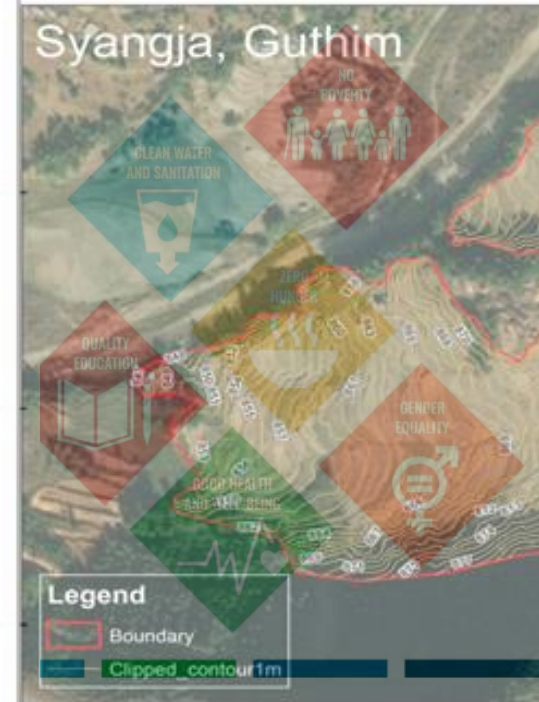
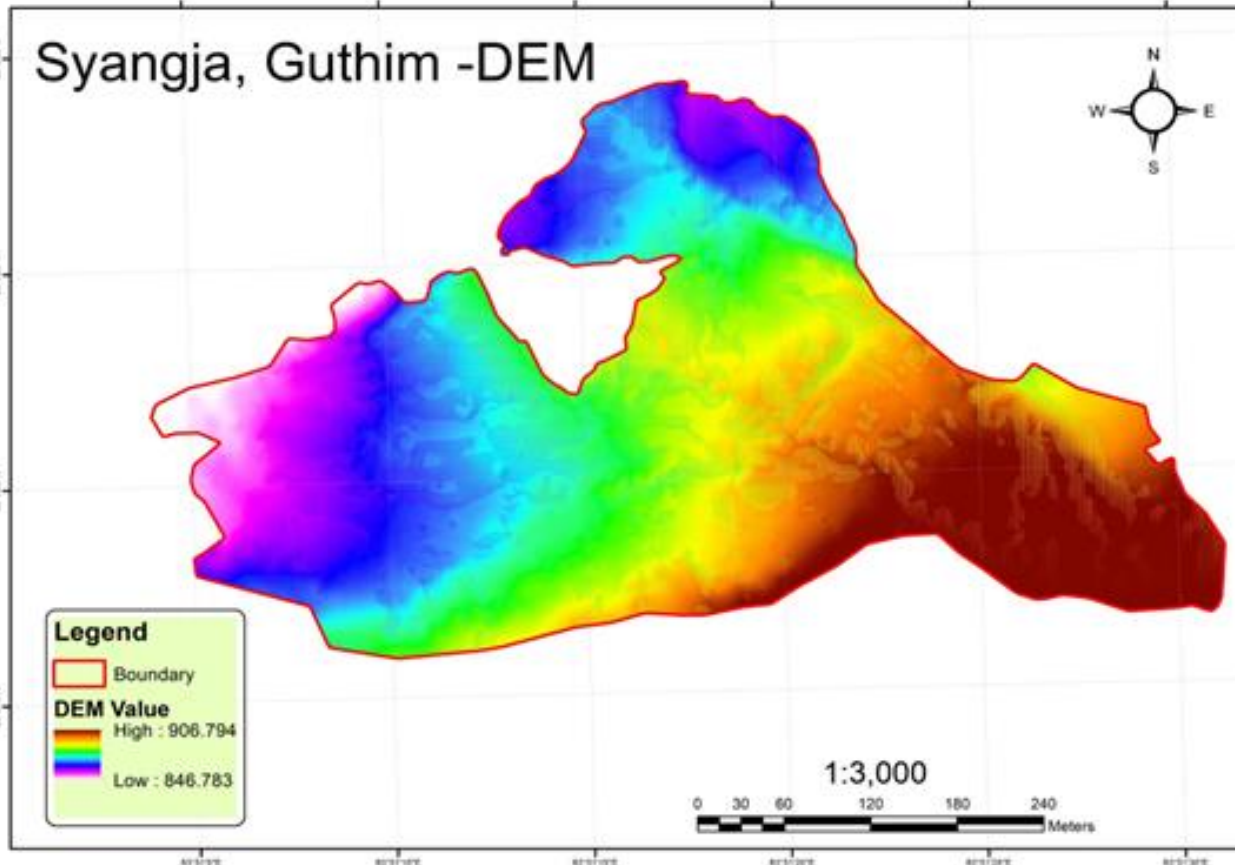
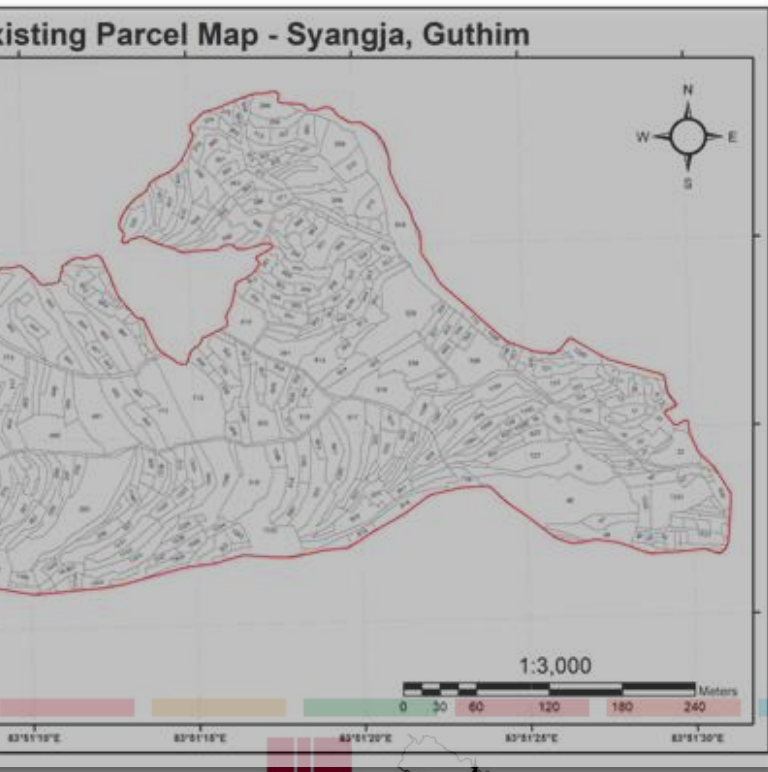
PLATINUM SPONSOR





Results (Case Study of Ganeshpur Village, Syangja, Nepal)

DEM Preparation



FIG

Kathmandu, Nepal 14–16 November

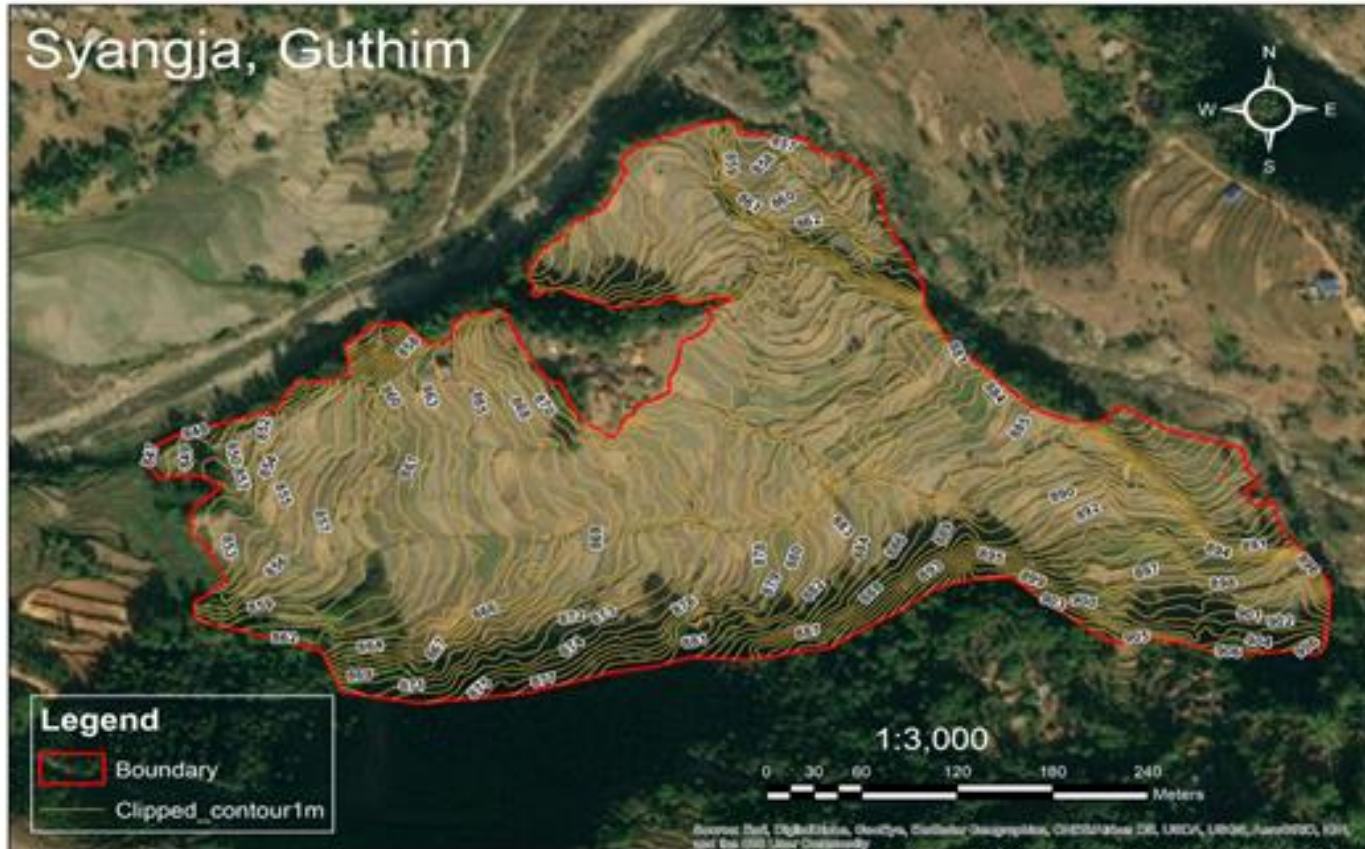
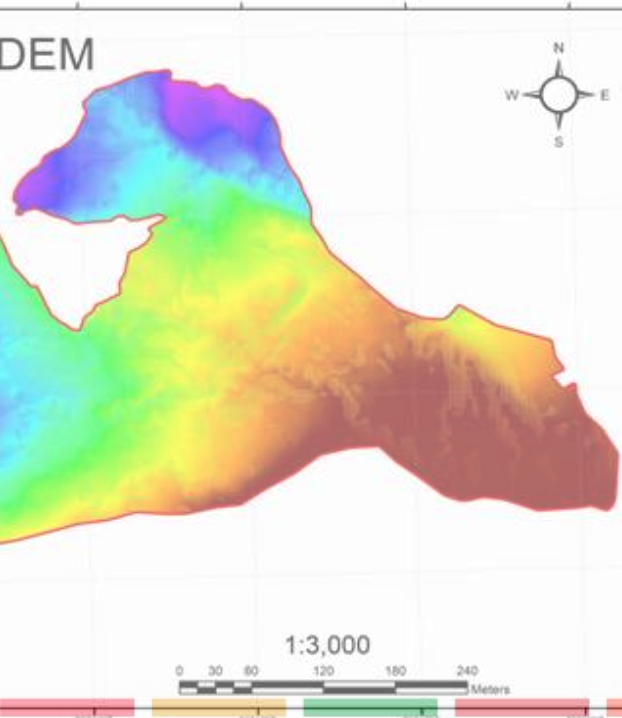
REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Contour Generation



ORGANISED BY



NSOR



FIG

Kathmandu, Nepal 14–16 November REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Readjusted Plot in Web based model



Information about the feature

Latitude: 28.17028179511287
Longitude: 83.83063886642817

Plot

Properties	Value
ID	51
Plot No.	23
Plot Perimeter	217.425203774
Plot area(m2)	5676.34907912
Plot area(arpad)	11.5547
Owner name	LAKSHMAN SHRESTHA
Existing area(m2)	7188.05176339
Existing area(arpad)	14.1213
Category	private



ORGANISED BY

FIG

Trimble

FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Readjusted Plot with Road Network in Web based model

Properties	Value
Point ID	5

NO POVERTY

HUNGER

GOOD HEALTH AND WELL-BEING

GENDER EQUALITY

ORGANISED BY





Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Readjusted Plot with Road and Irrigation Network in Web based model

The screenshot displays a web-based GIS application interface. The main map area shows a satellite view of a village with a readjusted plot outlined in red and purple. A road and an irrigation network are overlaid on the plot. The interface includes a sidebar on the left with 'Irrigation' information, a 'Basic Layers' panel on the right, and a 'Trimble' logo at the bottom right.

Properties	Value
Point ID	41

Basic Layers

- NO POVERTY
- HUNGER
- GENDER EQUALITY
- GOOD HEALTH AND WELL-BEING

ORGANISED BY FIG

Trimble



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Clusters of points in Web based model

Base Layers

Choose Your Layers...

- Satellite Map
- Open Street Map
- Water Color Map
- Mapbox

Opacity

Add Default Base Layer Remove All Base Layers

Shapefiles

- New Plot
- Old Parcel
- Road Network
- Irrigation Canal
- Point of Interest

Opacity

Add Default Layers Remove All Layers

Rasterfiles

- Digital Elevation Model
- Cut and Fill
- Zonal Statistics

100 m
300 ft

Coordinates: Lat: 28.140003617781804, Long: 83.849400809662

NO POVERTY

GOOD HEALTH AND WELL-BEING

GENDER EQUALITY

Trimble



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Zonal Statistics in Web based model



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Cut Fill Analysis in Web based model

Opacity: [Slider]

- Open Street Map
- Water Color Map
- Mapbox

Add Default Base Layer **Remove All Base Layers**

Shapefiles

- New Plot
- Old Parcel
- Road Network
- Irrigation Canal
- Point of Interest

Add Default Layers **Remove All Layers**

Rasterfiles

- Digital Elevation Model
- Cut and Fill
- Zonal Statistics

Opacity: [Slider]

Remove All Raster Layers

Options

NO

Go back to Options

WE PRESENT YOU THE WEB-BASED APPLICATION FOR THE LAND POOLING SYSTEM

HOW TO USE

Base Layers

Choose Your Layers...

- Satellite Map
- Open Street Map
- Water Color Map
- Mapbox

Add Default Base Layer **Remove All Base Layers**

HEALTHY WELL-BEING

Shapefiles

- New Plot
- Old Parcel

Opacity: [Slider]

100 m

300 ft

Coordinates: Lat: 28.14039615842774, Long: 83.8904817473795

Trimble

ORGANISED BY

FIG

N



Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Crop Production Form in Web based model

The screenshot displays a web-based application for land pooling. The main interface features a satellite map with a grid overlay. A modal window titled "Product Form" is open, containing the following fields:

- Your First Name
- Your Last Name
- Input your product header
- Enter plot number
- Your product in detail
- Submit your product

The "Options" sidebar on the left includes:

- Go back to Options
- HOW TO USE
- Base Layers: Satellite Map (selected), Open Street Map, Water Color Map, Mapbox
- Shapefiles: New Plot, Old Parcel

At the bottom, the coordinates are displayed as: Lat : 28.138413200567804, Long: 83.85099291801454. A scale bar shows 100 m and 300 ft.

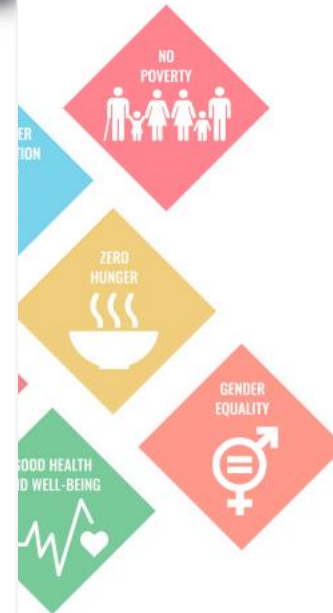




Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Fetching Crop based Information in Web based model

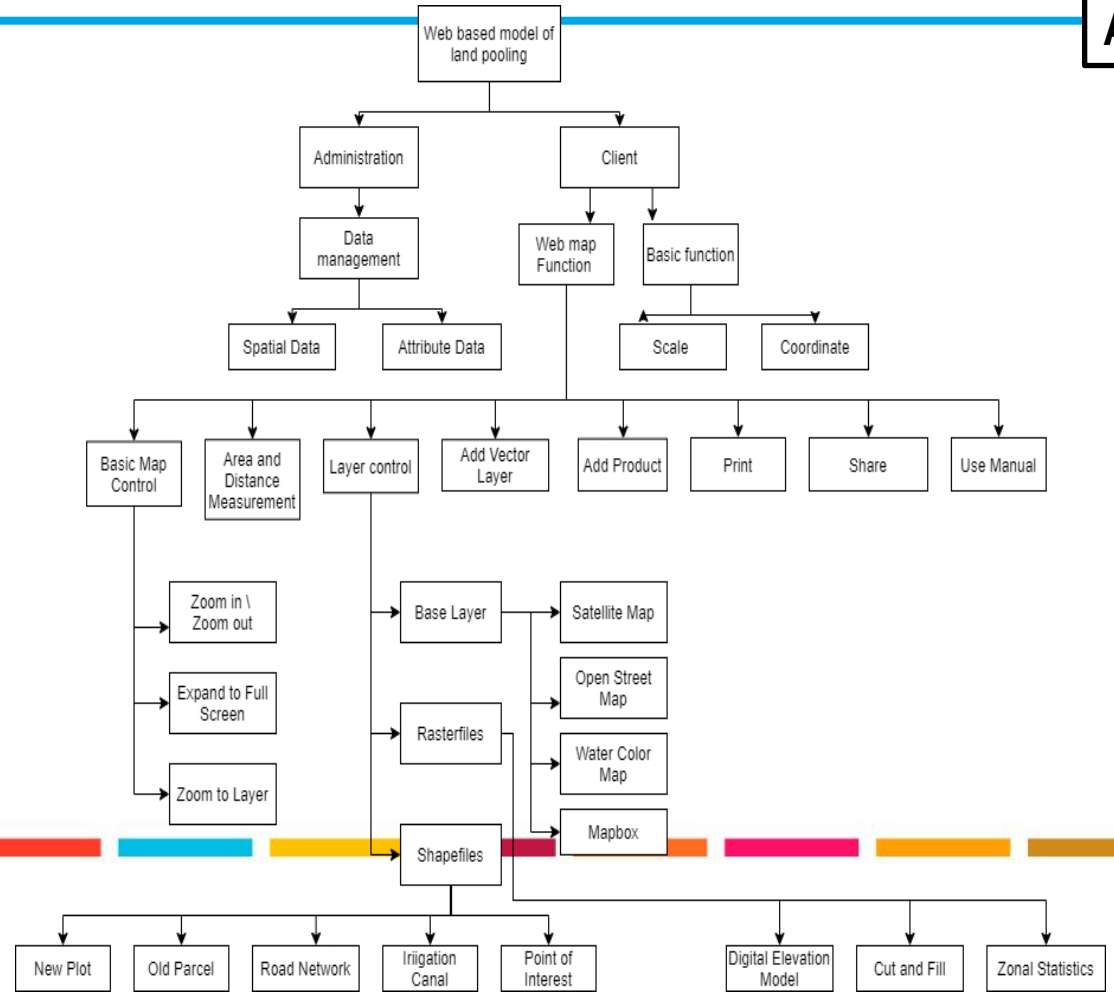
The screenshot shows a web application interface for land management. At the top, there is a navigation bar with links for "Land Pooling", "Home", "About", and "Product", along with "View Web-Map" and "Log In" buttons. The main content area is titled "PRODUCTS" and includes the text "All products listed out by farmers:". Below this, there is a prompt to "Click on the marker to see the full detail. For Full map:" followed by a "Goto Web-map" button. A map is displayed with several green markers. A pop-up window for a "Banana" plot is visible, showing "Plot No: 10", "Listed by: Radhika", and "Listed date: July 19, 2021, 12:28 a.m.". To the right of the map, a box titled "Top most products" lists: "Vegetables", "Fruits", "Herbs", "Wheats", and "Maize".





Results (Case Study of Ganeshpur Village, Syangja, Nepal)

Architecture of Web based land pooling





SWOT Analysis

Strengths	Weakness
<ul style="list-style-type: none"> Unified database consolidates spatial and non-spatial cadastral data in a single platform. Easy data access and management, improving efficiency for landowners and officials. 	<ul style="list-style-type: none"> Errors may occur if control points are inaccurate, affecting survey results. System performance may slow down when processing large volumes of data.
Opportunities	Threats
<ul style="list-style-type: none"> Can be expanded to other municipalities or areas needing land pooling and better infrastructure. Can support government policies for sustainable land use and climate resilience. 	<ul style="list-style-type: none"> Potential land disputes may slow down project implementation. Dependence on digital infrastructure poses risks if technical issues arise.



Conclusions

- Through this model, local governments can enhance land consolidation processes, which are essential for promoting sustainable urban development while safeguarding land rights.
- The integration of Geographic Information Systems (GIS) and web-based technologies allows for real-time data access, precise mapping, and improved decision-making processes, enabling a more efficient allocation of land for infrastructure development and disaster preparedness.
- Further research and pilot projects will be crucial to refining the model and scaling it for broader implementation, ensuring that it addresses both current and future challenges in land management.





Recommendations

- Governments and urban planners should consider integrating web-based land pooling models into their national and local land governance frameworks.
- Government should prepare the policy ensuring that land pooling processes integrate climate adaptation strategies and green space preservation.
- The system can be implemented in the coordination of the Survey Department and Land Revenue Office of Nepal as there have not been any development works in the web GIS sector of land pooling. This can play a vital role in the decision-making process.



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



References

- Aratyn, T. (2018). *Building Django 2.0 Web Applications*. Birmingham: Packt>.
- Chang, K.-t. (2016). *Introduction to Geographic Information Systems*. New York: McGraw-Hill Education.
- Shrestha, S. (n.d.). *Land Pooling Projects in Nepal: A Consolidated Documentation*. Tribhuvan University, Institute of Engineering, South Asia Urban Knowledge Hub. Nepal.
- Thoen, B. (October 1995). *Interactive Mapping and GIS Thrive on the Web*. GIS World.



ORGANISED BY



PLATINUM SPONSOR



FIG

Kathmandu, Nepal 14–16 November REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



ORGANISED BY



PLATINUM SPONSOR

