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Estimation and Monitoring of Above Ground Biomass & Carrying Capacity of Seasonal Rangelands in Awash Basin: Synergistic Use of EO Data & ML

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Outline of the Presentation

I • Introduction: Rationale & Objective

II • Materials and Methods

III • Results

IV • Remarks and the way forward

1. Introduction

- In Ethiopia agriculture (crop production and Livestock raring) contributes:
  - 50% of GDP,
  - creates 85% employment opportunities, and
  - supplies 70% of raw materials for industries for the country.
- The livestock sector supports over 11.3 million households in Ethiopia.
- The quantity and quality of rangelands is low due to:
  - the conversion of this land cover into other land uses;
  - the expansion invasive species;
  - overgrazing;
  - land and ecological degradations, and
  - poor technical efficiency to manage rangelands.

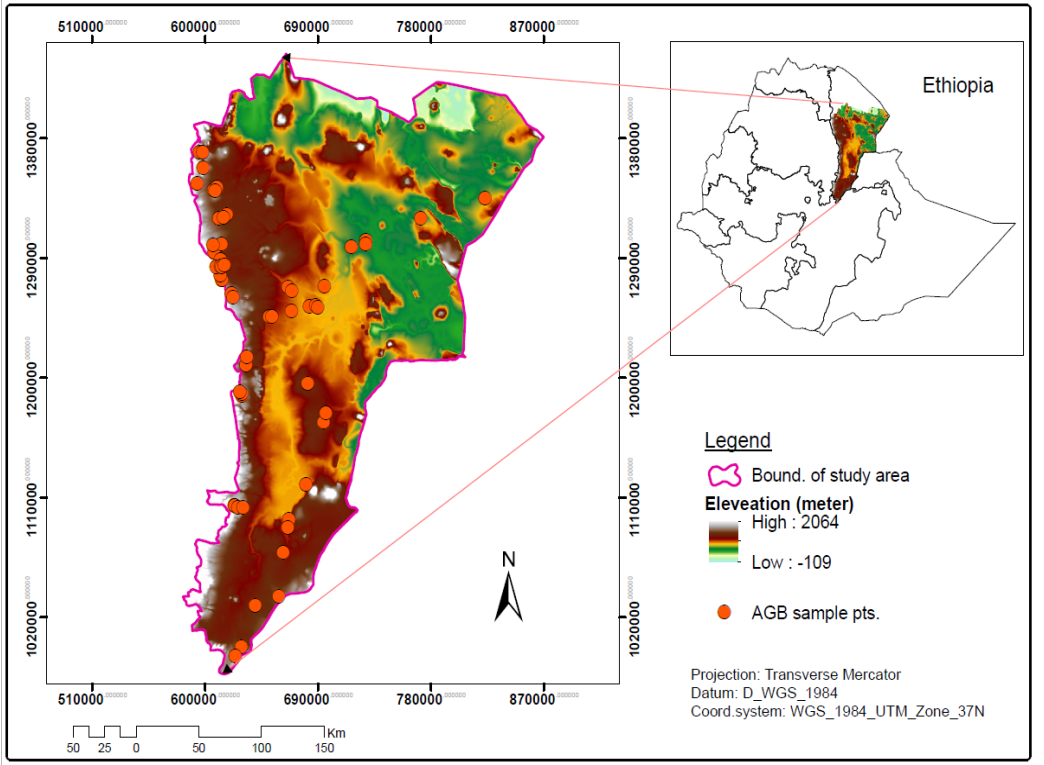
- As a result, failure to meet the production targets could potentially lead to **chronic food insecurity**.
- The conditions of rangelands are not **fully studied, characterised, monitored, understood and mapped**.
- **Integrated solutions** such as EO and in-situ datasets and ML techniques could narrow these gaps to improve the sustainable managements of rangeland ecosystems in Ethiopia.

2. Materials and Methods

- **EO data & ML techniques** can help a lot to:
  - monitor, map & detect changes and
  - characterize AGB, NPP & CCs of rangelands.

Objectives:

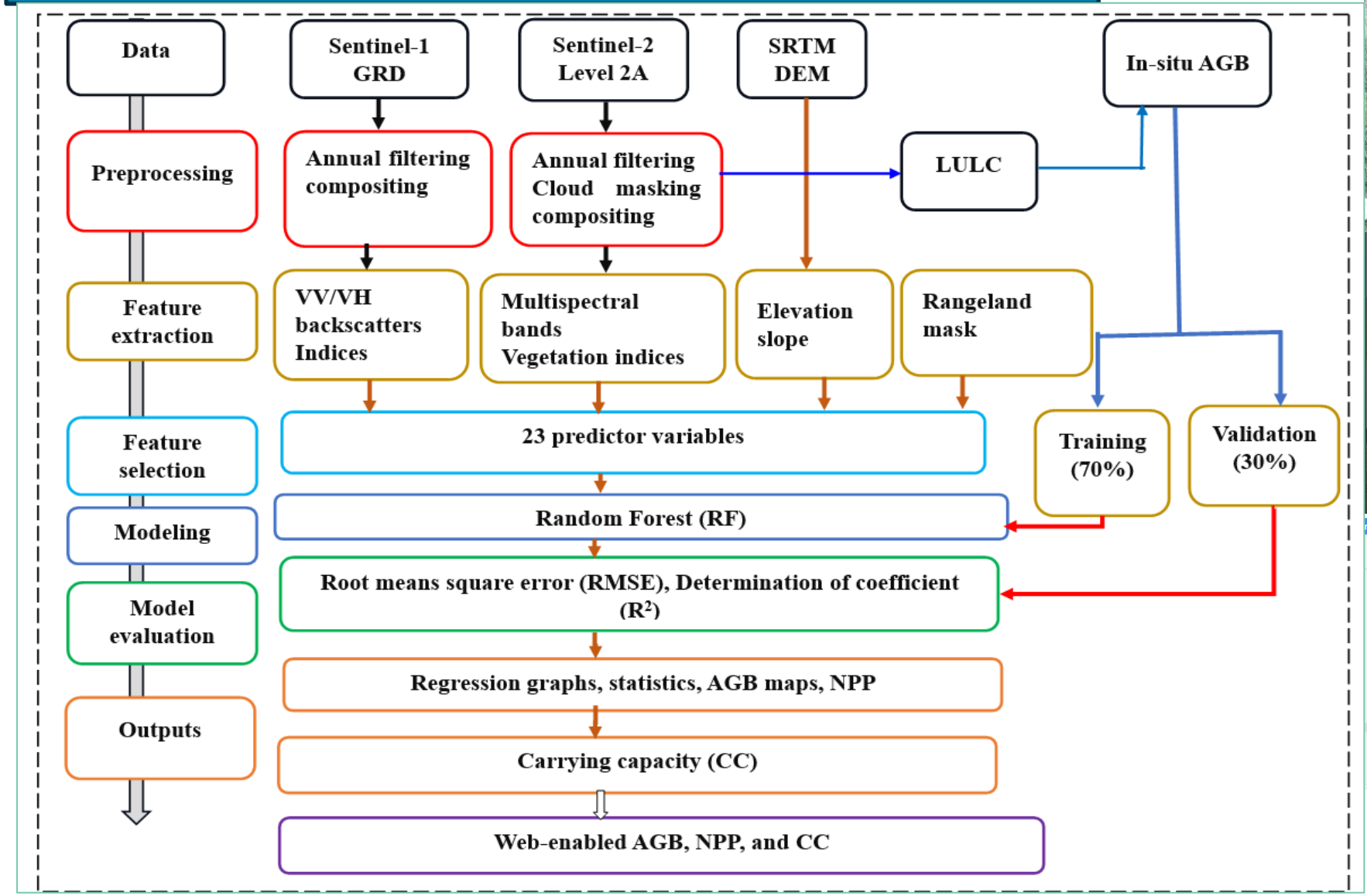
- to estimate seasonal AGB using different covariates derived from optical, SAR and biophysical datasets for cattle population;
- to evaluate the Net Primary productivity,
- to compute CCs of the rangelands;
- to develop web-enabled map to avail information for policy option and informed decision.

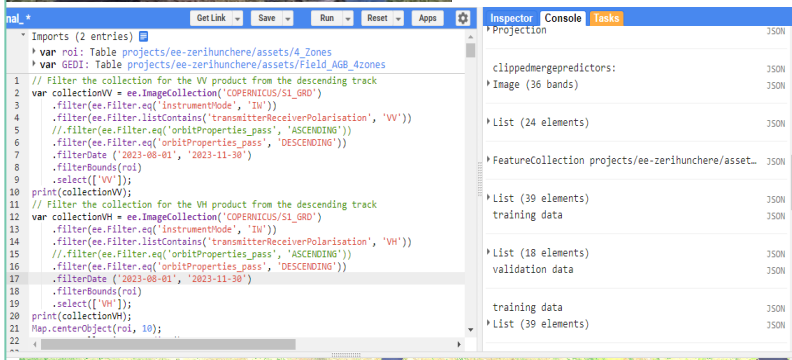


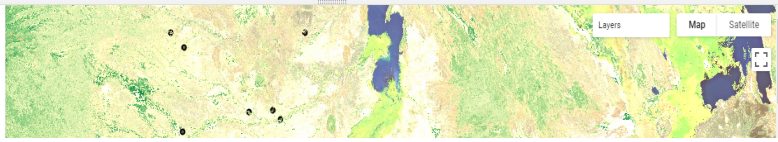
Study area

- Found in the north-eastern Ethiopia
- Six administrative zones
- Bimodal RF9 (150 - 500 mm) and T^0: 20-48°C
- Area: 9,720, 470 ha

Data Sources, Types & Methods







3. Major Findings

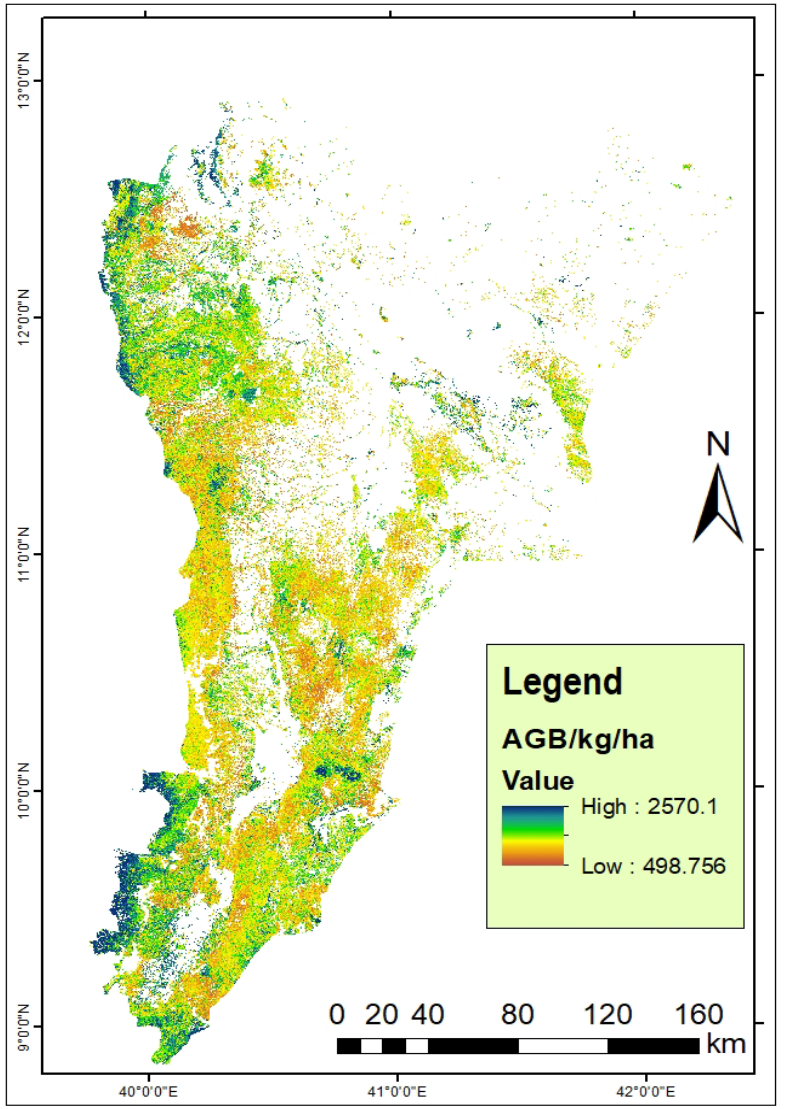
1. LULC

- We developed LULC and classification with an overall accuracy and kappa coefficient of 86.6% and 83.7%, respectively.
- **We achieved** 87.87% UA and 89.69% PA **for the Rangeland** map.

2. Above ground biomass (AGB)

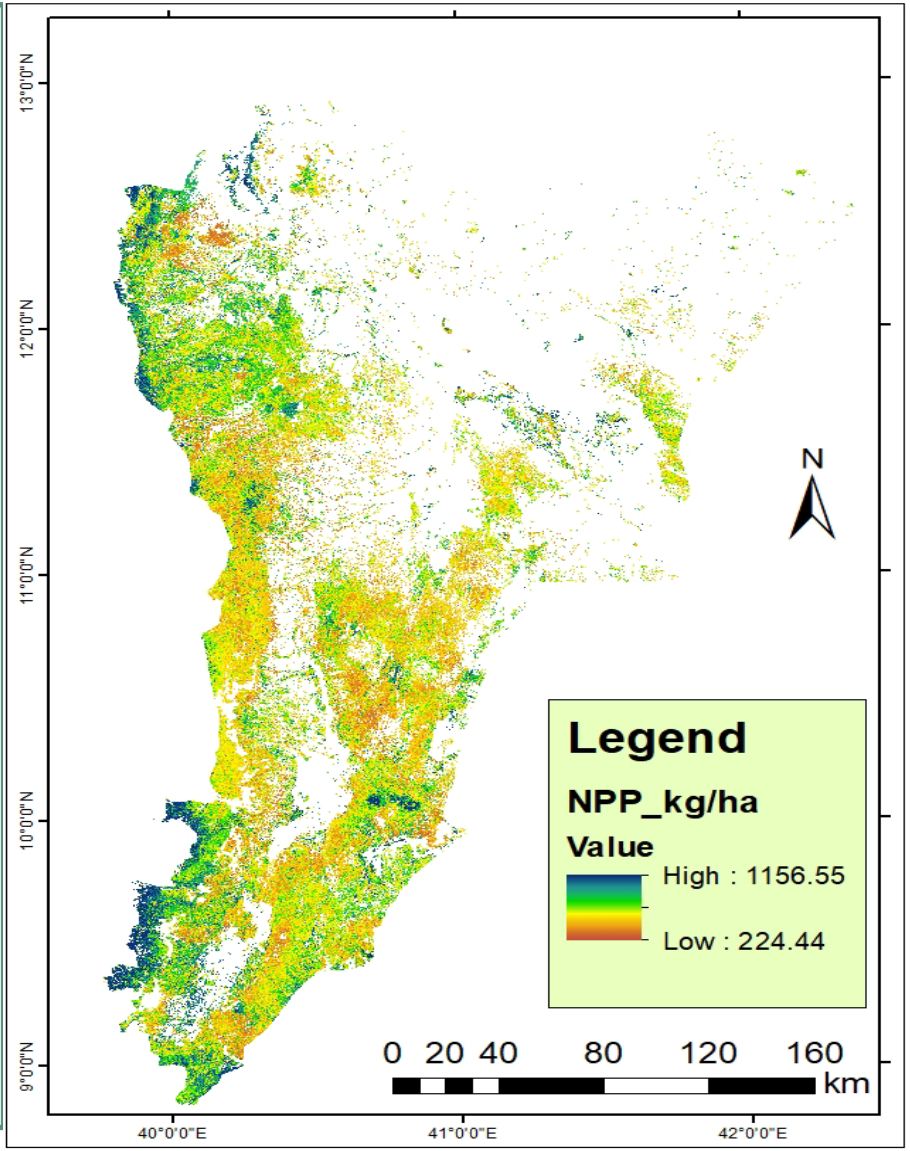
Spatial Patterns of AGBs (from July to September)

- The predicted AGB values ranged from **2570.1 kg/ha to 498.76 kg/ha, with mean value of 1130.9 kg/ha**.
- The spatial distribution of AGB exhibited heterogeneity in the study area.
- parts of **southwestern** and **northwestern part of the area reveled high AGB**.
- this study's findings on AGB are largely consistent with existing findings like(Fenetahun et al., 2022, Meshesha et al., 2020, Schucknecht et al., 2015, Jin et al., 2014).



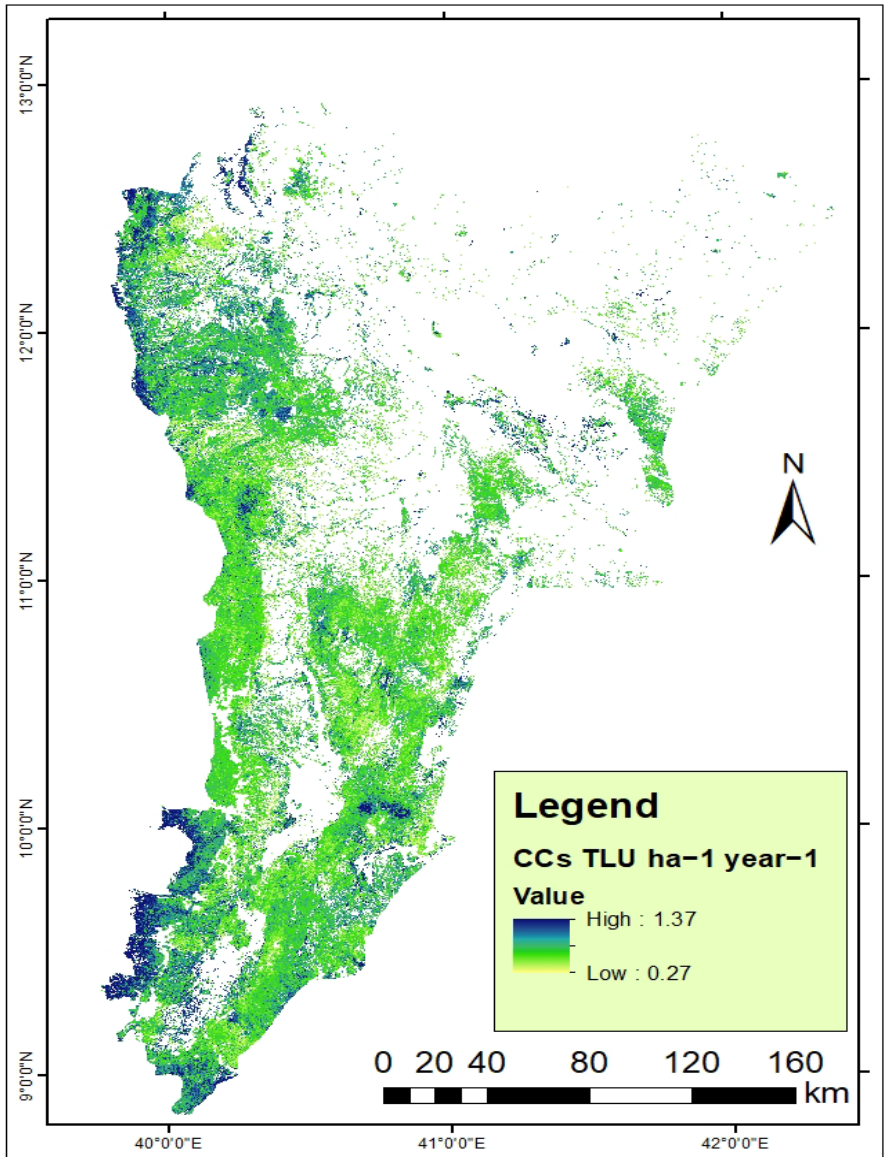
3. Net Primary Production (NPP)

- There is significant variation in **average annual NPP** across the study area.
- NPP varies from **224.44 kg/ha to 1156.55 kg/ha with** estimated average values of **508.9 kg/ha**.
- The predicted NPP values are lower in the central and northern parts of the study area.
- the value of NPP is high in the **northwestern, southwestern & southeastern** parts of the area.



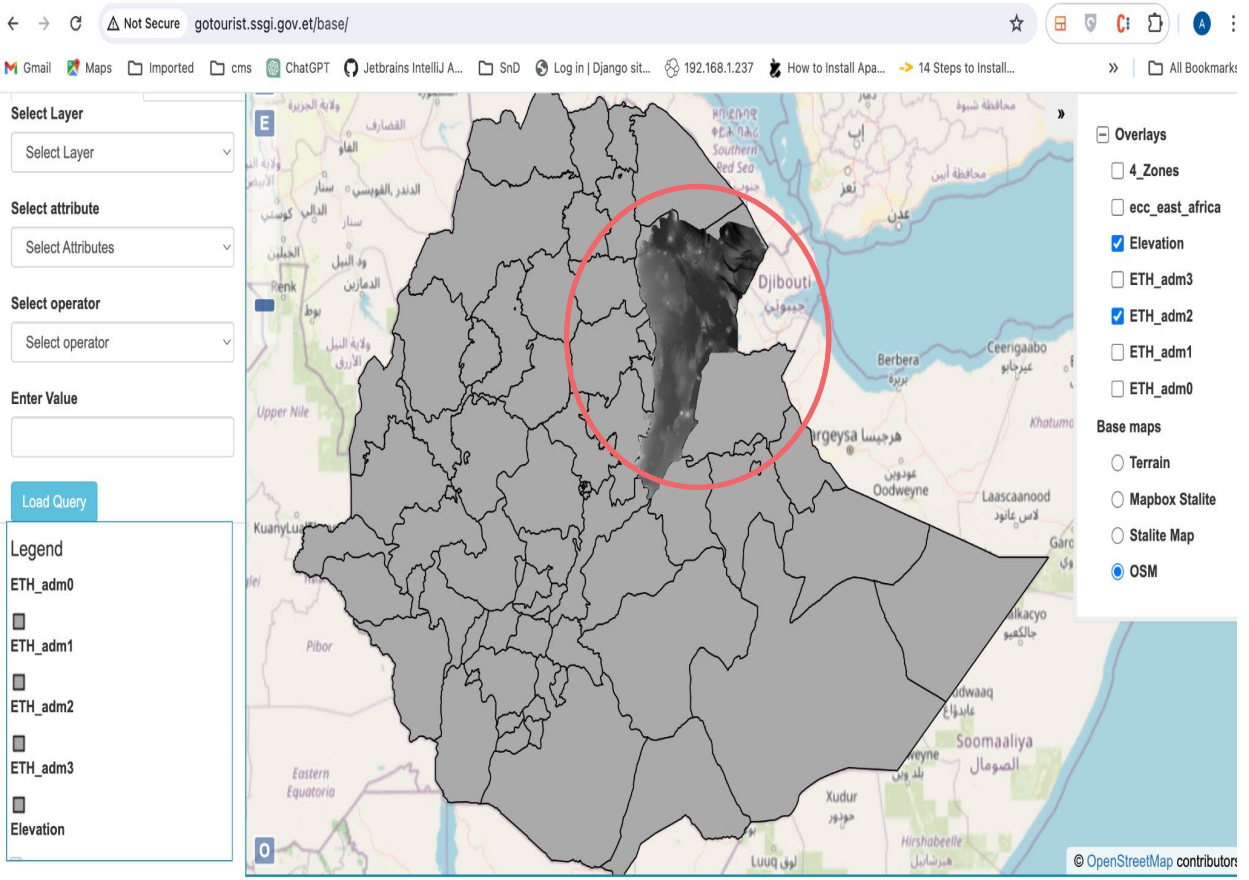
4. Carrying capacity (CCs) of Cattle

- The computed CCs value for the study area ranges between **0.26 and 1.37 TLU ha^{-1} year^{-1}** with average value of **0.6 TLU ha^{-1} year^{-1}**.
- Our result well agree with 0.57 TLU/ha for Borena rangeland (Habte et al., 2021).
- However, the mean CC was relatively higher than:
  - **0.3 TLU/ha/yr** for rangelands in Somali (Meshesha et al. (2019) ,
  - **0.23 TLU/ha/year** in mid
  - 0.21 TLU ha/year (Ayele et al., 2022);
  - 0.32 TLU/ha/year (Abdulahi, 2023).



4. Web-based Visualization

- We have developed **an interactive web system** to provide users with useable AGB, NPP & CCs spatial information.
- The system has three-tier layers:
  - User interface
  - Web GIS application, and
  - Back-end GIS database
- The web-based platform provides:
  - visualization of maps
  - graphs
  - downloadable data and
  - reports for informed decision .



•http://Awashrangelands.ssgi.gov.et/base/ (The map will be corrected)

4. Conclusions & the way forward

- The integration of EO and ML models offers powerful tools for optimizing:
  - ❖ rangeland conservation, management and better decision-making outcomes.
- the methodologies developed can be **scalable and applicable to national level and other African regions** supporting broader continental efforts to enhance livestock farming practice resilience and sustainability.
- The findings also serve as the base for policy brief formulation for rangeland resource informed decisions.

- Thank for your Attention!
- Comments or Questions…