**Soil Erosion Mapping of Bagmati Province Nepal using RUSLE Method**

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1. **Introduction**

Soil erosion presents a significant global challenge, with estimates indicating that the average rate of soil loss worldwide ranges between 12 - 15 ta/ha/yr [[1](#one)], meaning that every year the land surface losses are about 0.90 - 0.95 mm of soil [[2](#two)]. In contemporary times, the synergistic effects of climate change and anthropogenic environmental impacts have elevated erosion to a critical environmental concern in numerous regions worldwide [[3](#three)-[4](#four)]. Soil erosion is one of the major factors causing destruction and sustainability of agriculture in the upland is soil erosion [[5](#five)]. Soil erosion by rainfall and surface water flow is generally affected by five factors: Rainfall erosivity, soil erodibility, topography, surface coverage, and support practices [[6](#six)].

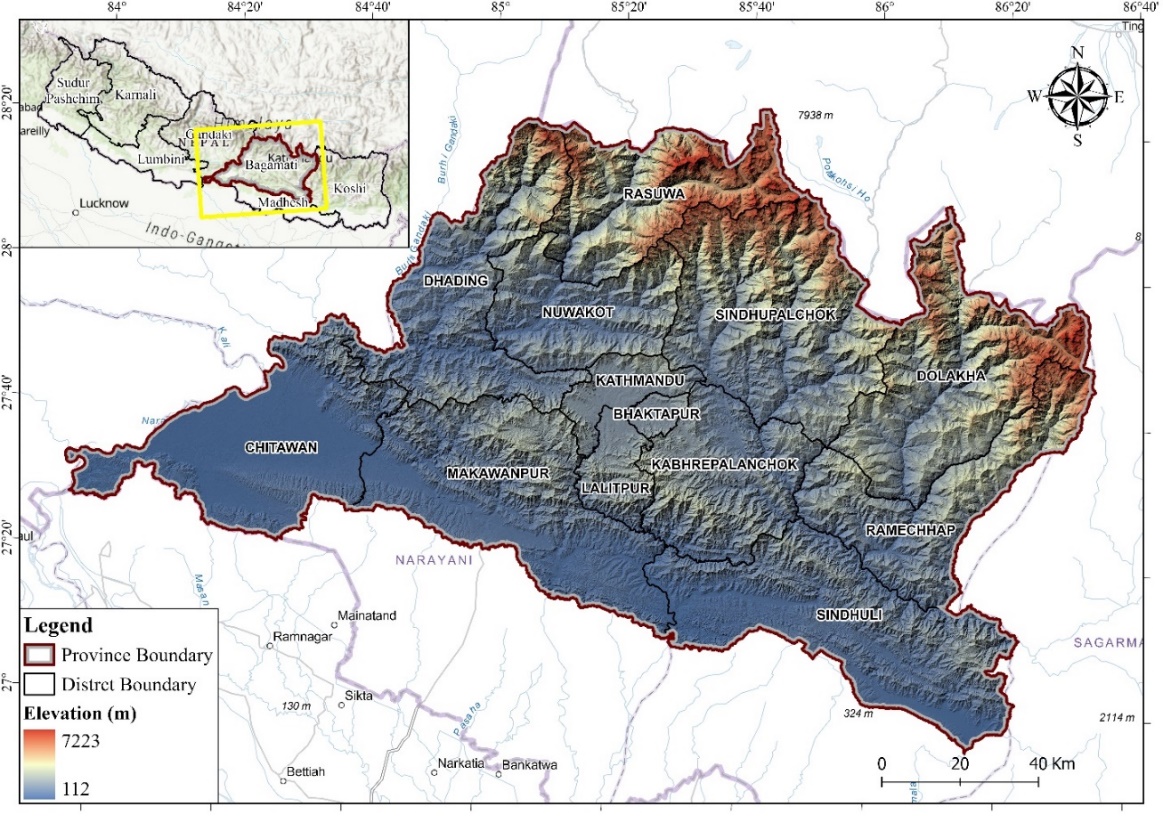
Several models exist to predict the extent of water induced erosion [7]. This study uses the RUSLE model and arcpy, python and GIS to quantify and understand the spatial distribution of soil erosion in Bagmati Province of Nepal.

1. **Objectives**

The primary objective of this project is to develop a soil erosion risk map for Bagmati Province utilizing the Revised Universal Soil Loss Equation (RUSLE) model in conjunction with geospatial technologies. This map will identify regions with elevated erosion risks and highlight districts that are particularly vulnerable to such events.

1. **Materials and Study Area**
   1. **Study Area**

Bagmati Province, located in central Nepal, spans an area of approximately 20,300 square kilometers, making it the fifth largest province in the country. The province shares a northern border with the Tibet Autonomous Region of China and is known for its diverse topography, ranging from the lush, lowland forests of the Terai to the high-altitude mountainous areas in the north. Bagmati Province experiences a humid subtropical climate in the lower areas, while the mountainous regions to the north have an alpine climate, with cooler temperatures and heavier snowfalls. The province’s varied terrain includes the Mahabharat Range and sections of the Himalayan foothills, shaping its distinct ecosystems and supporting rich biodiversity. Economic activities include agriculture, tourism, and service industries, reflecting Bagmati's strategic importance in Nepal.



**Figure 1: Study Area Map Showing Bagmati Province**

* 1. **Data Collection**

The study used various spatial datasets acquired from different sources. The dataset and their respective sources are shown in Table 1.

**Table 1: Datasets Used in RUSLE Model**

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| --- | --- |
| **Datasets** | **Data Sources** |
| DEM | SRTM DEM (30 m)  <https://earthexplorer.usgs.gov/> |
| Soil Data | Digital Soil Map of Nepal  <https://soil.narc.gov.np/getdata> |
| Landcover Map | ESRI Landcover Data 2023  [Esri | Sentinel-2 Land Cover Explorer](https://livingatlas.arcgis.com/landcoverexplorer/#mapCenter=-83.21000%2C34.33200%2C4&mode=step&timeExtent=2017%2C2021&year=2017&downloadMode=true) |
| Rainfall Data | Mean Annual Precipitation from DHM |

* 1. **Methods**

The RUSLE model was used in arcpy environment in this study to prepare soil erosion map. The RUSLE is expressed by the equation

A = [R]\*[K] \*[LS]\*[C]\*[P],

where, A = soil loss (t ha-1yr-1), R = rainfall erosivity factor (MJ mm ha-1h-1yr), K = soil erodibility factor (t h MJ-1 mm-1), LS = slope-length and slope steepness factor (dimensionless), C=land management factor (dimensionless), and P = conservation practice factor (dimensionless).

A diagram of a company

Description automatically generated

**Figure 2: The methodological framework of implementing the RUSLE model for soil erosion estimation**.a

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