# Impact-Based Flood Risk Forecasting in the Third Pole Region

A Multi-Criteria Hydrological Approach

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**UN ESCAP**
*IDD Disaster Risk Reduction Section*

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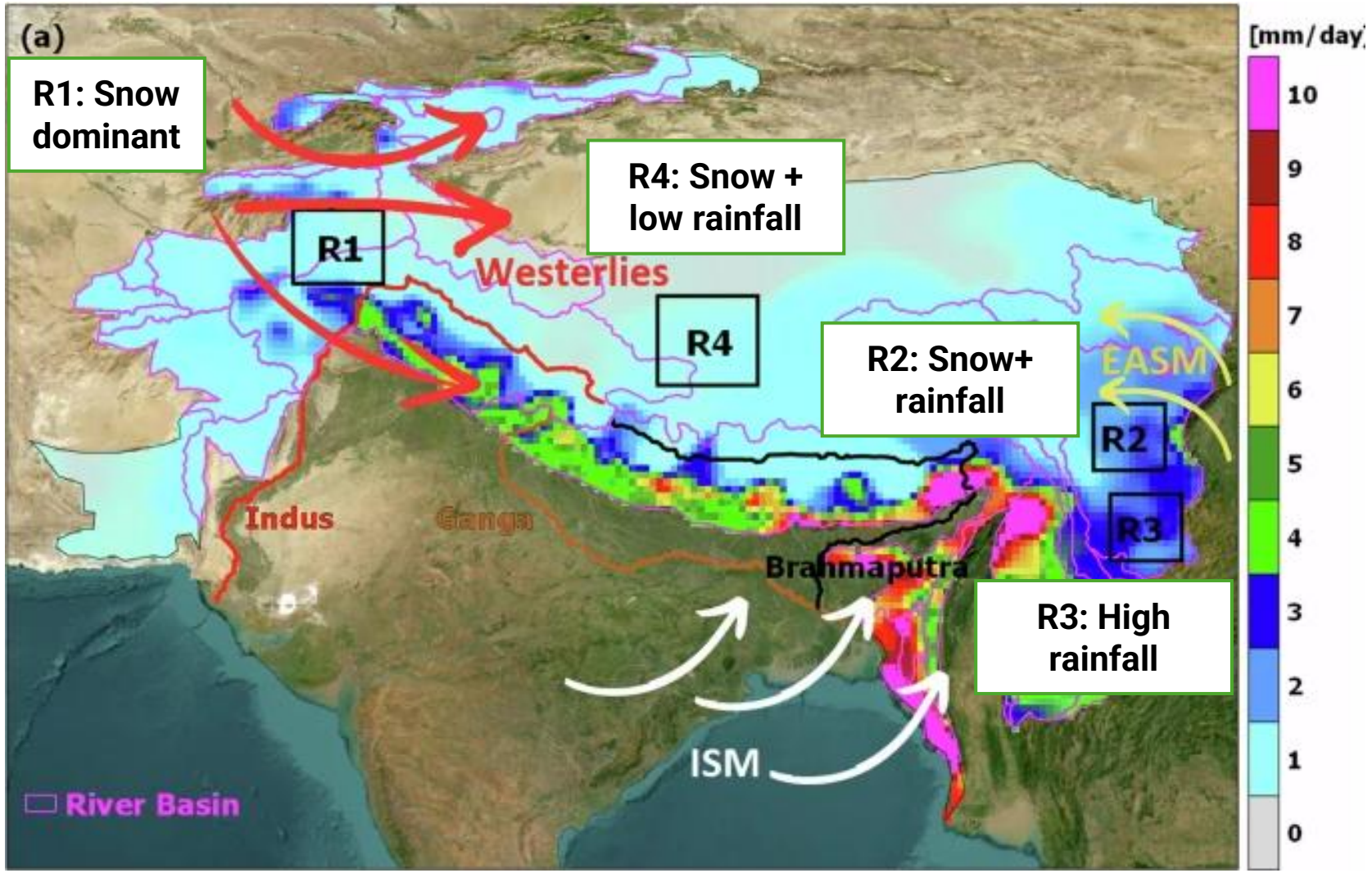
Economic and Social Commission for Asia and the Pacific

# Third Pole:
# Understanding the teleconnections of impact drivers

## Influence of geophysical drivers on snow melt (SM) and precipitation (P)




- Source: Jayanarayanan K et al (2024), Clim and Atmos J

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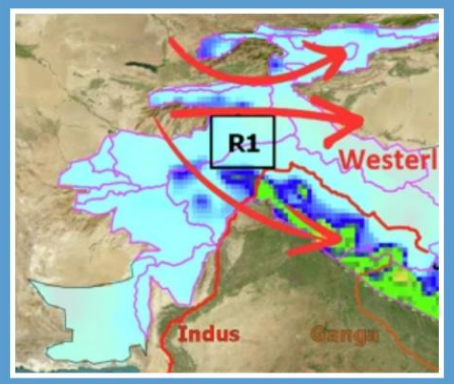


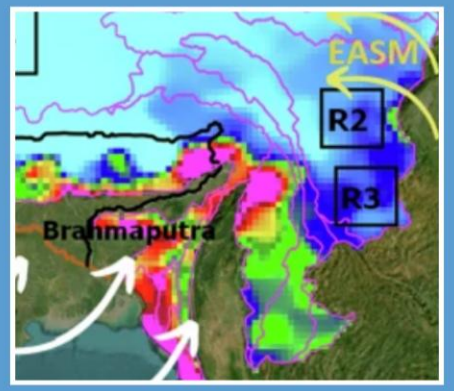


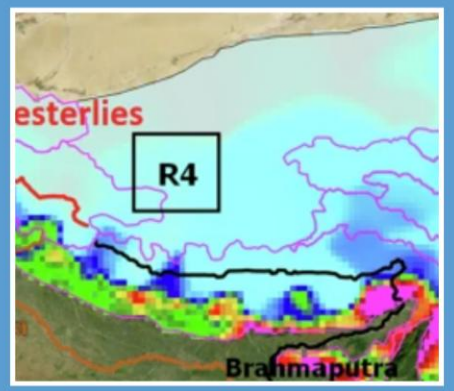


# Risk drivers and impact factors

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## 2 ANNUAL CLIMATOLOGY

Indian Summer Monsoon (ISM), East Asian Monsoon (EASM), Westerlies

## 3 TERRAIN FEATURES

Elevation Topography, glacier locations and snow cover, river basins.

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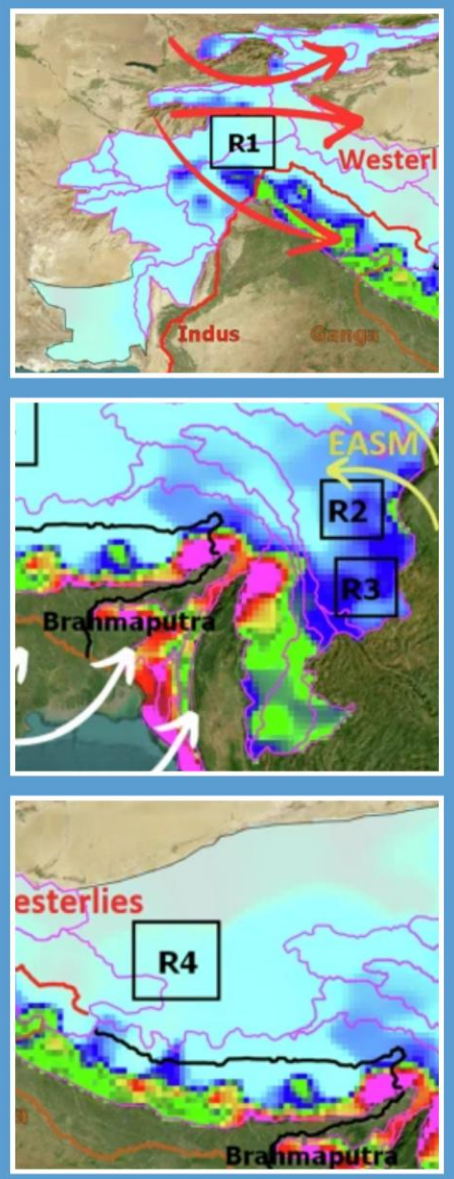


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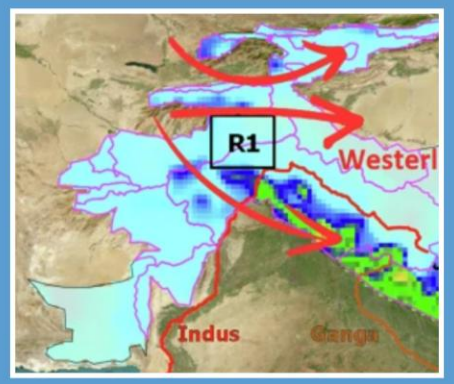


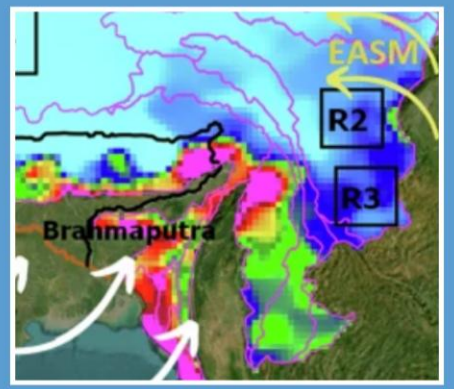


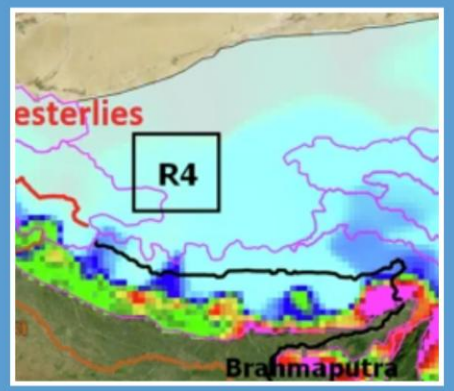


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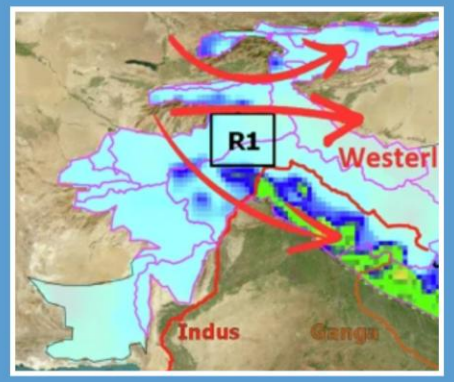


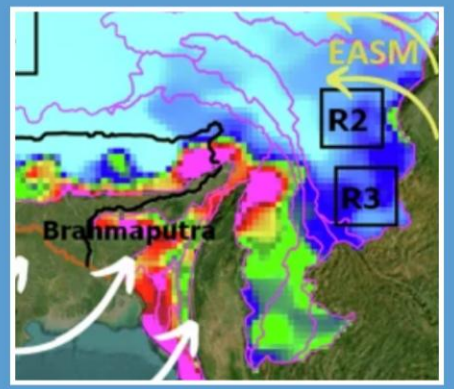


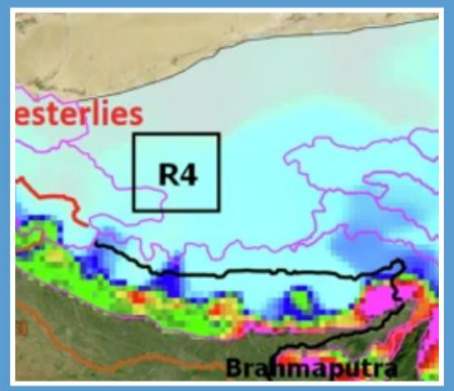


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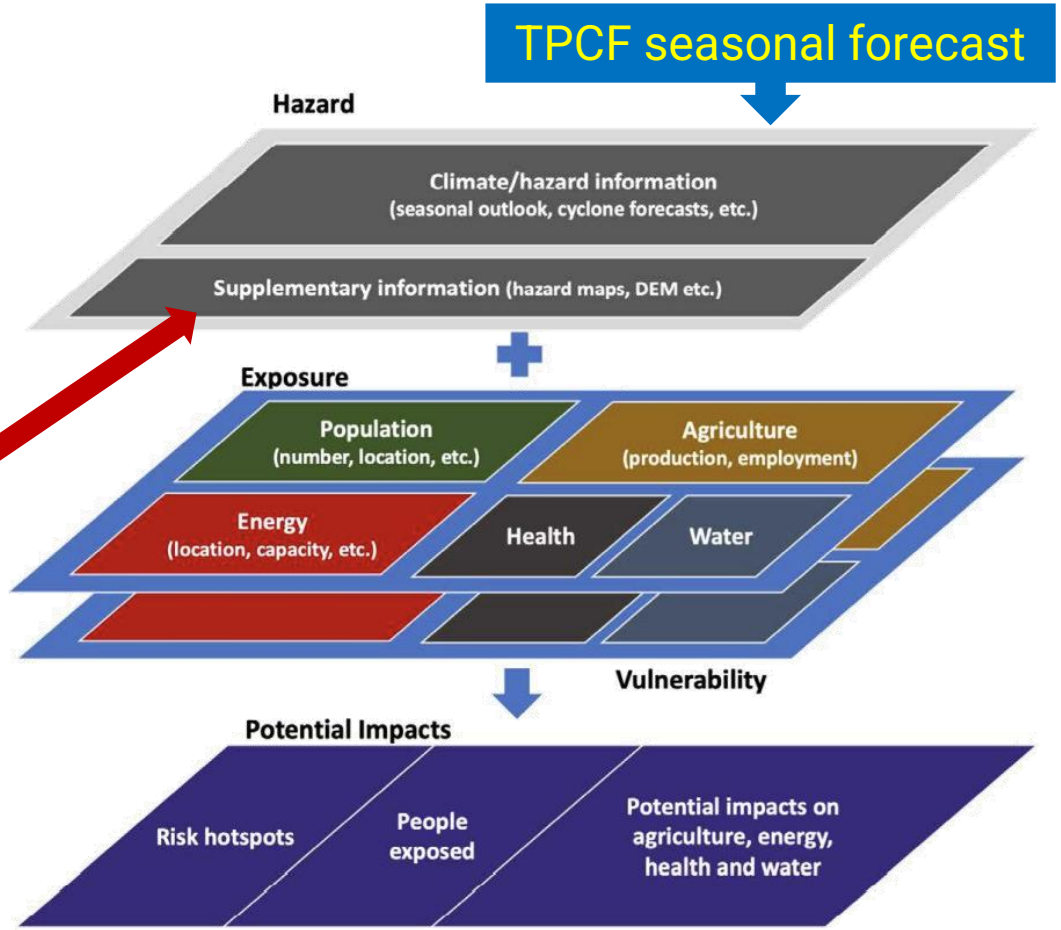
We are also using Land use/ Land Cover to cover anthropogenic factors

# #3. Translating TPCF into impact scenarios

- Slope/Elevation
- Precipitation
- Land use/land cover
- **Hydrologic analysis**
  - DEM enabled flow direction, accumulation and distance from stream

**IBF methodology for the mountainous region**



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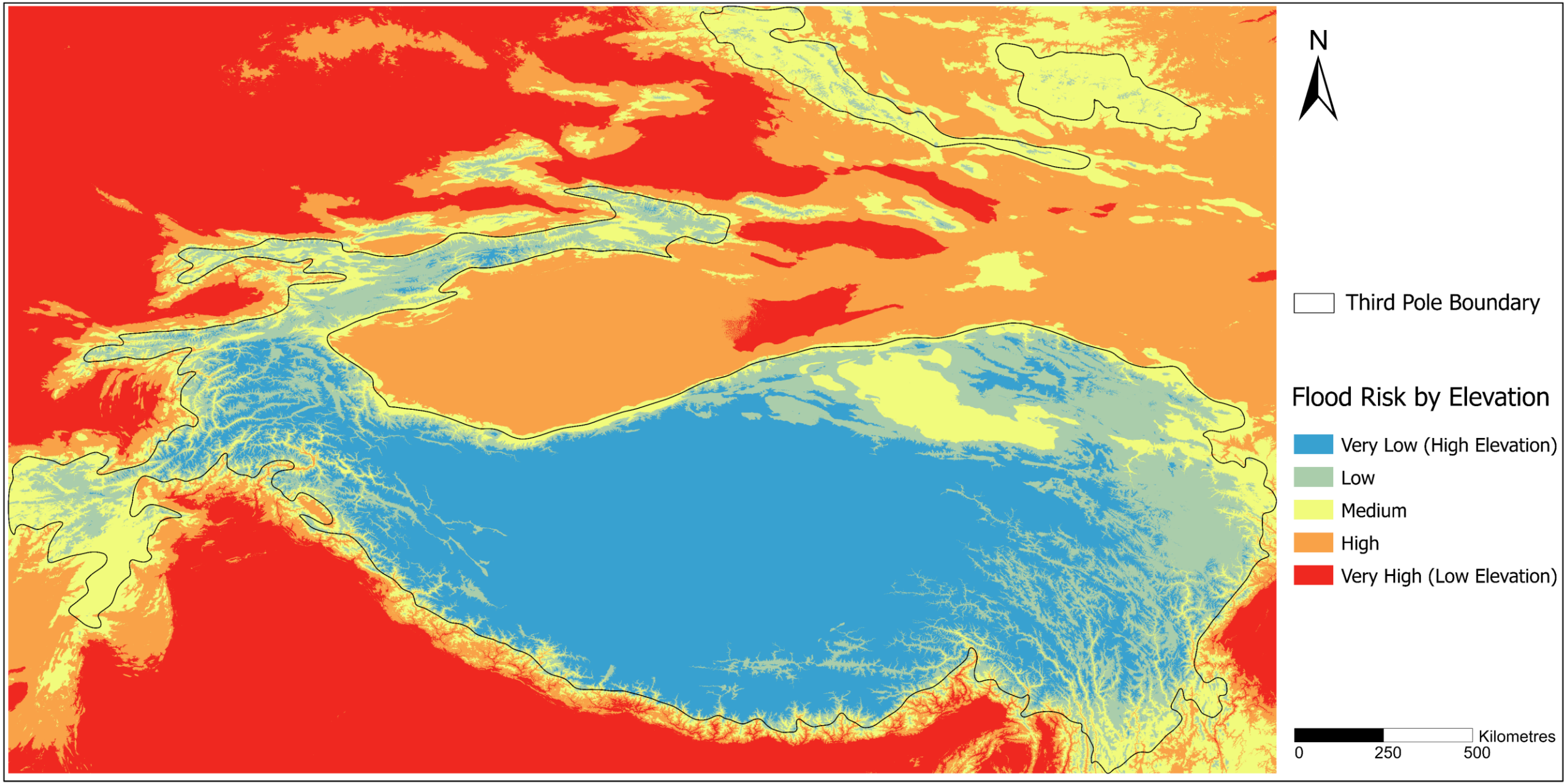
# Flood Susceptibility by Elevation (Topographic Lowlands as High Risk)



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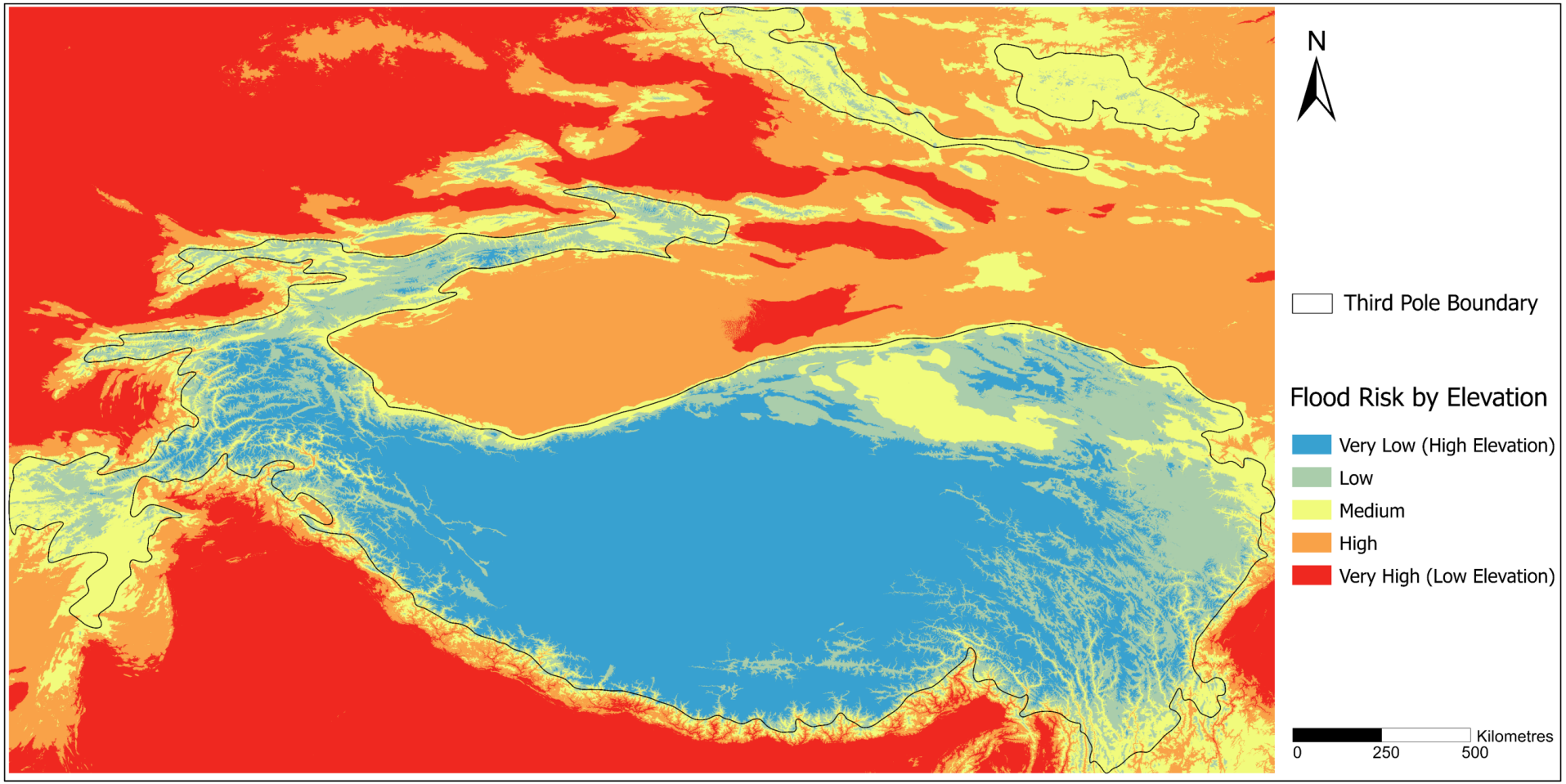


- This map shows flood risk derived from elevation.
- Lower-lying areas are more prone to flooding and thus marked in red as 'Very High Risk.'
- Conversely, high-altitude zones are marked in blue and represent 'Very Low Risk.'
- As expected, valleys and foothill regions stand out as particularly vulnerable due to their low-lying topography.

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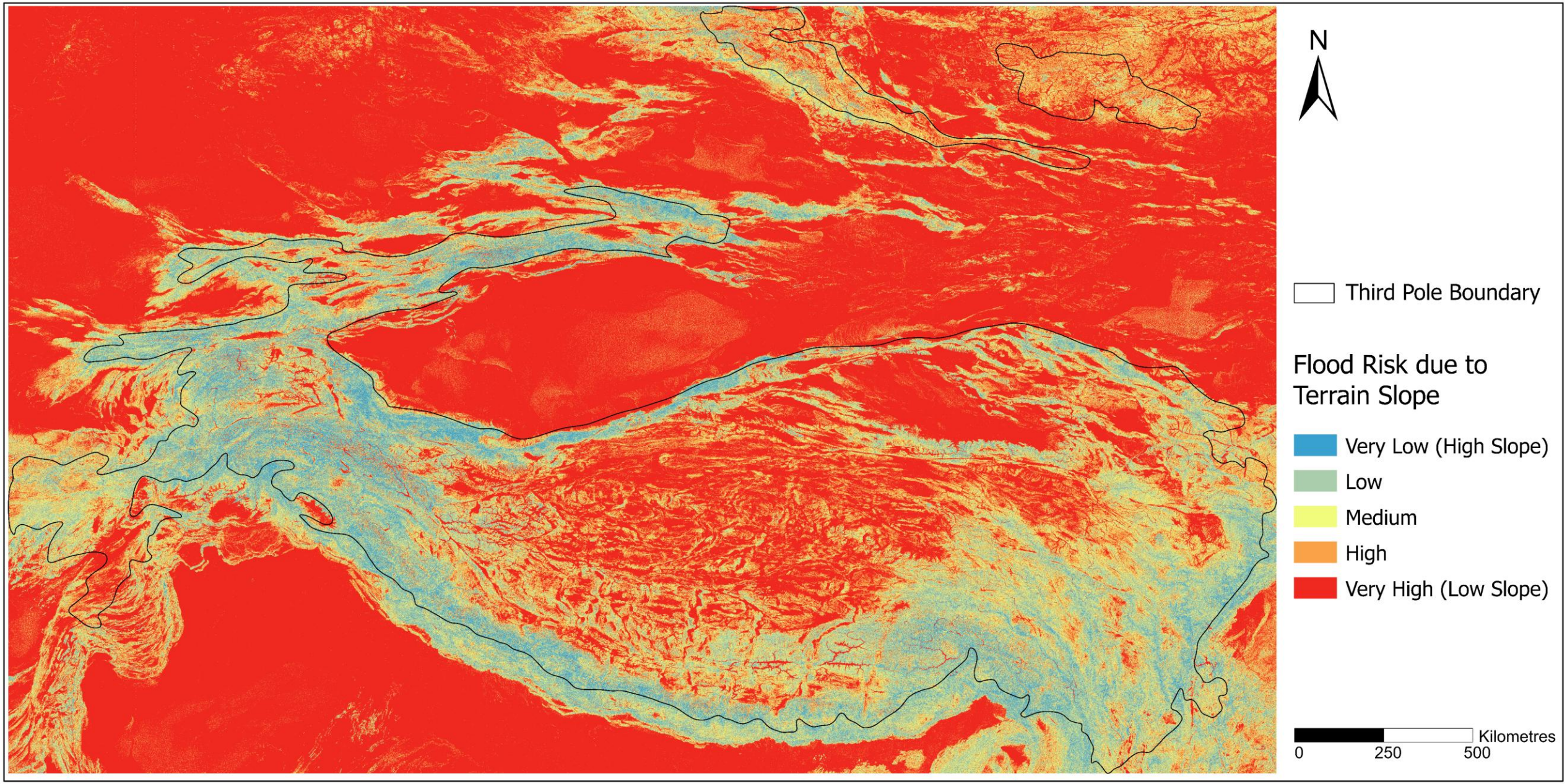
# Flood Susceptibility by Terrain Slope (Flat Areas as High Risk)



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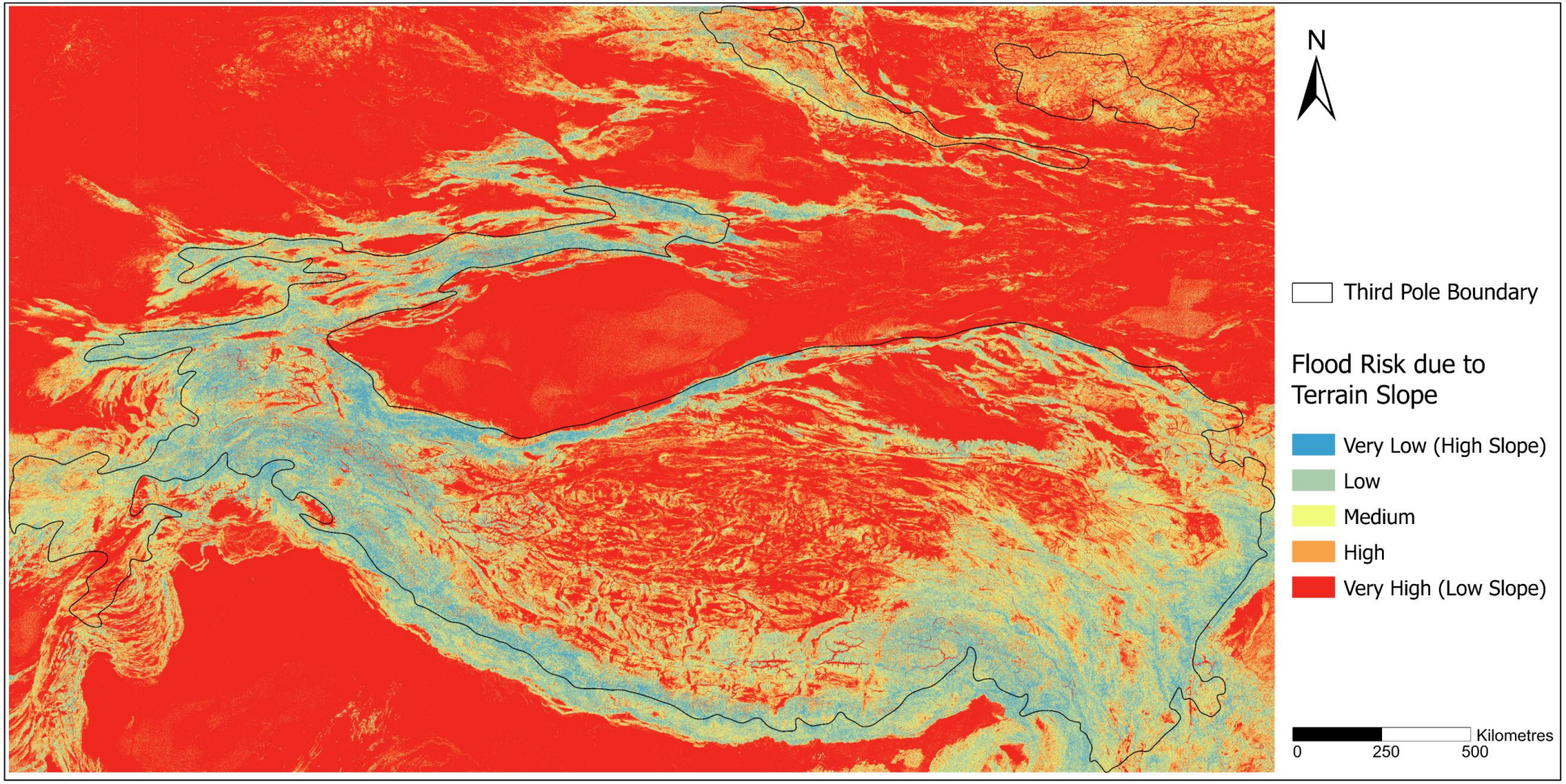
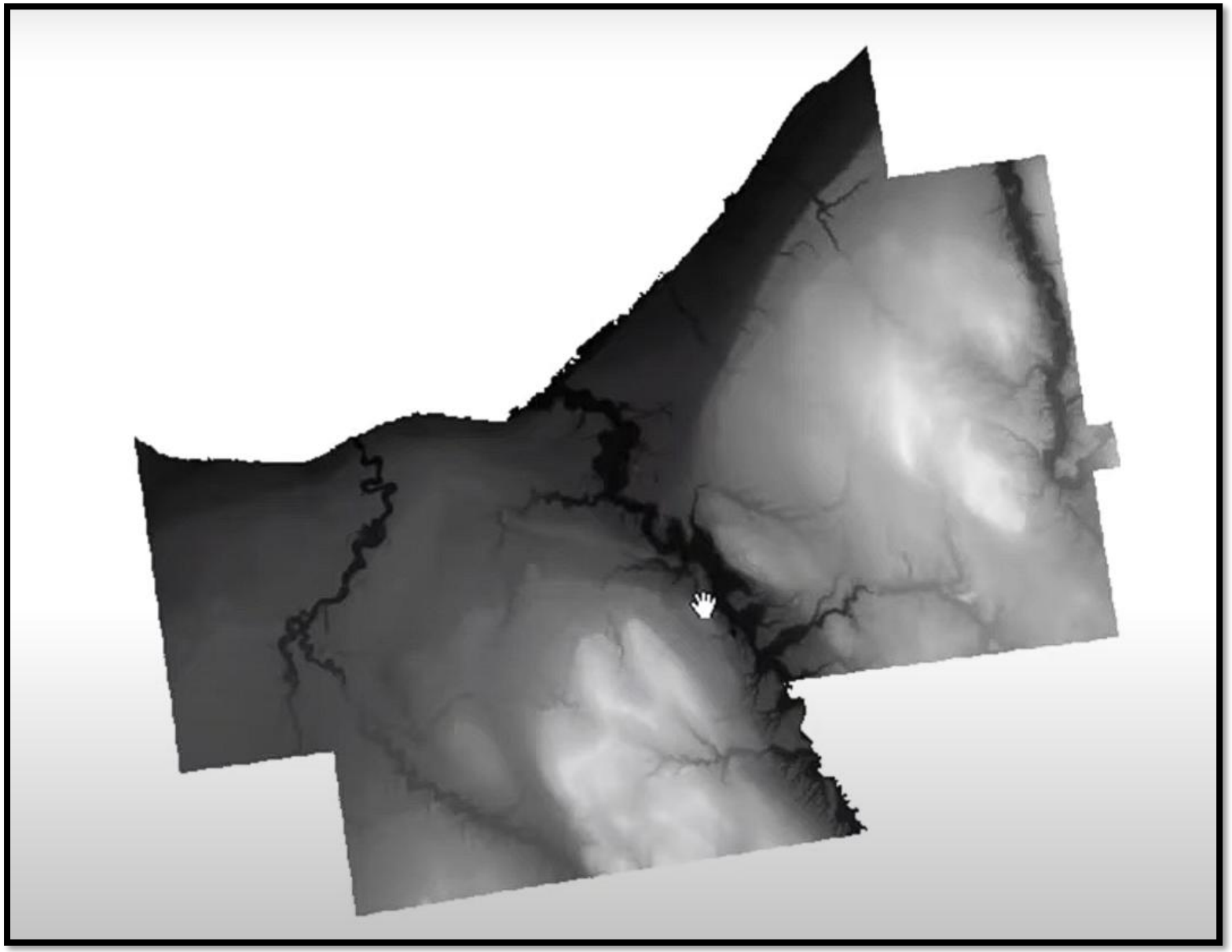



- Here we have flood risk categorized by terrain slope.
- Gentle slopes allow water to accumulate, increasing flood potential — shown here in red.
- Steep terrains, where water runs off quickly, are marked as lower risk.
- This map highlights flood-prone basins and flatlands which are otherwise masked in elevation-only assessments.

# Hydrology Analysis



DEM data : Each pixel/cell of raster gives us the elevation at each point

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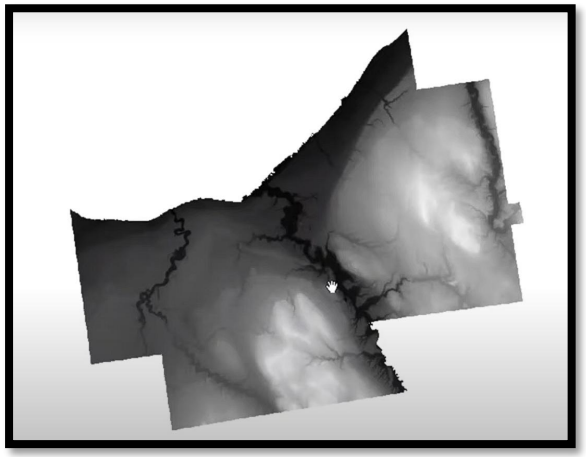
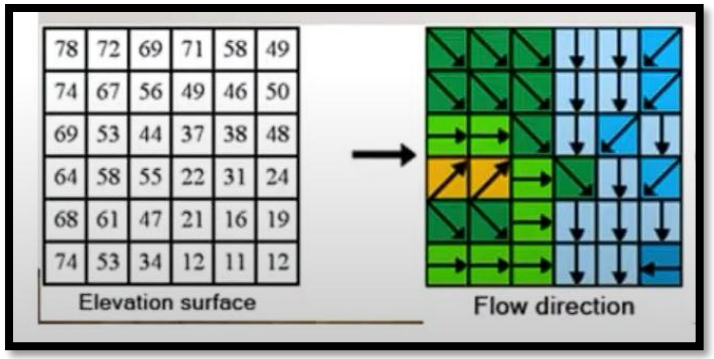


Flow Direction : Determine the direction of flow from every cell in the raster




- This function computes the flow direction for a given grid.
- The values in the cells of the flow direction grid indicate the direction of the steepest descent from that cell.

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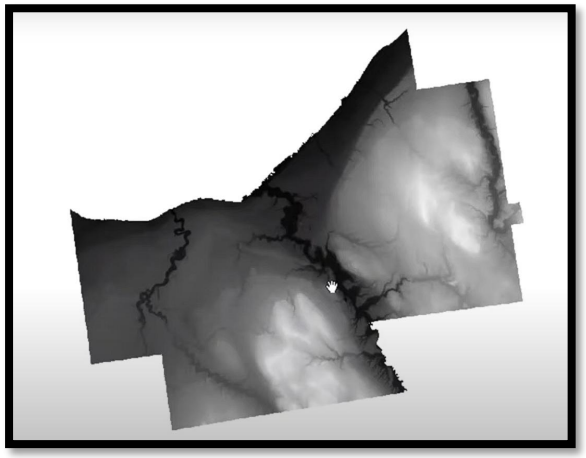

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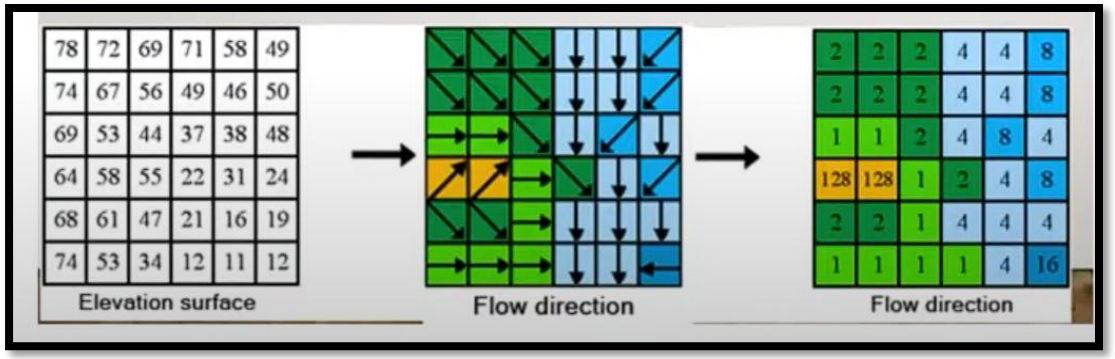


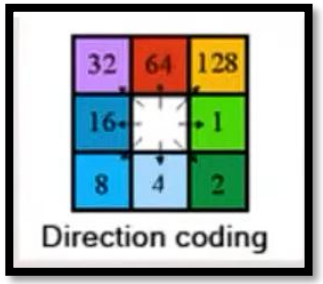

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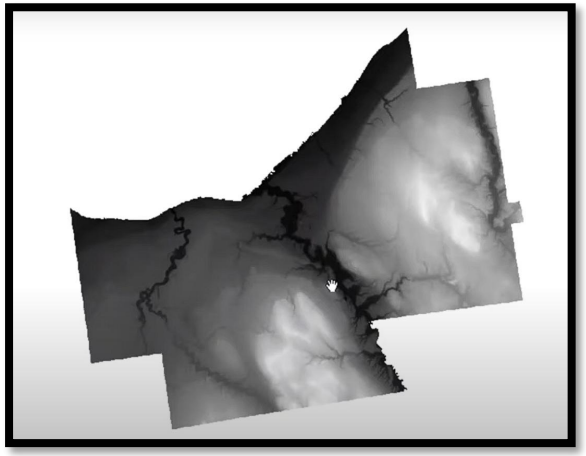

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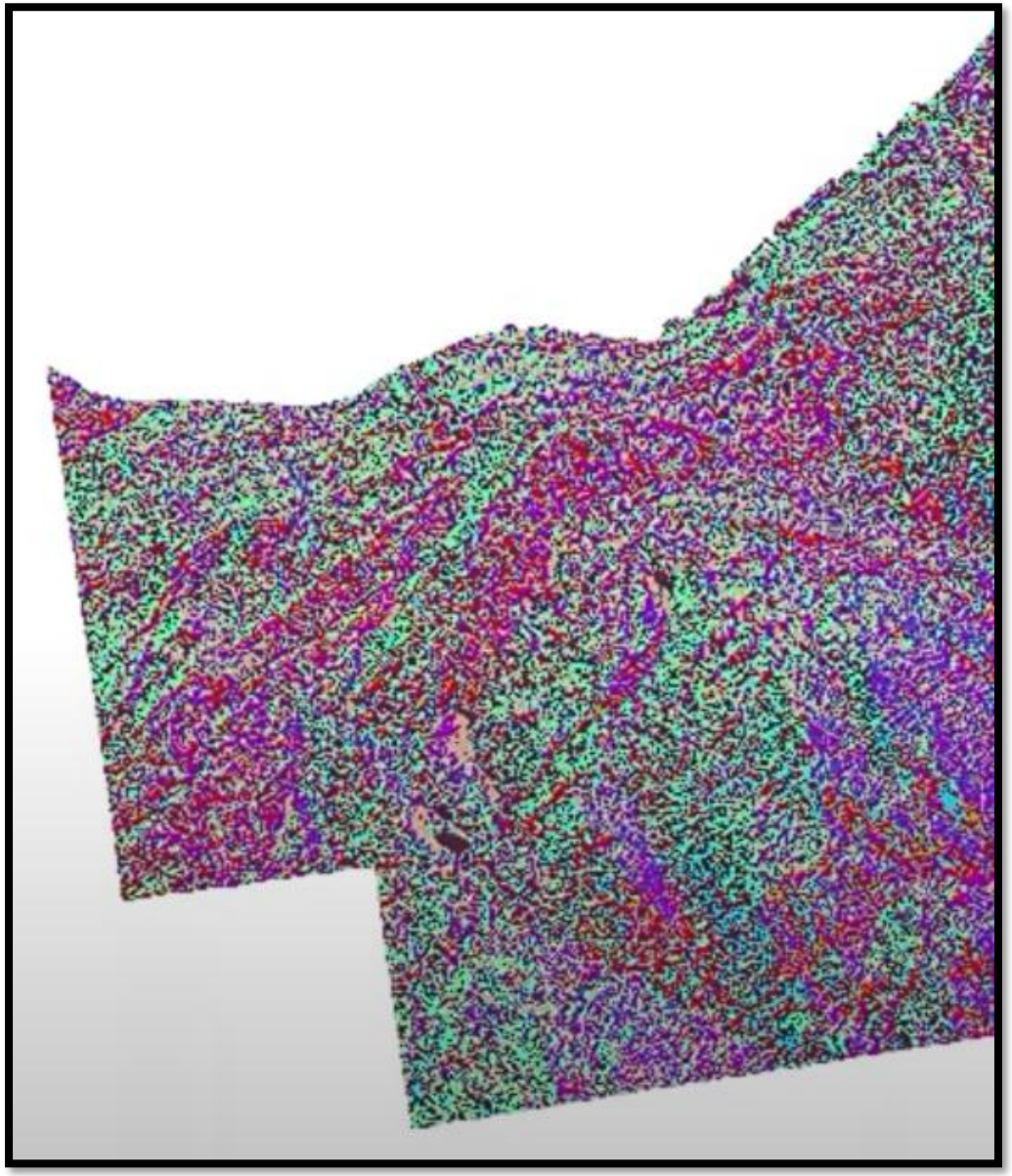

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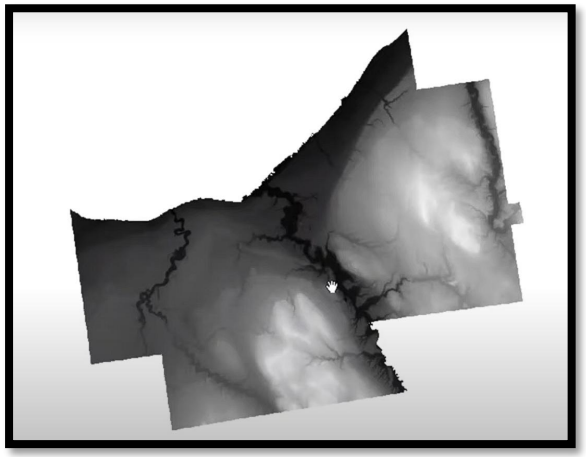

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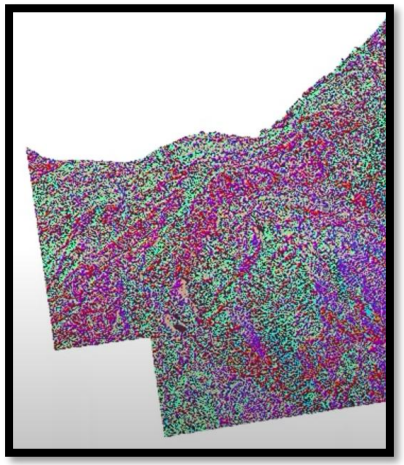

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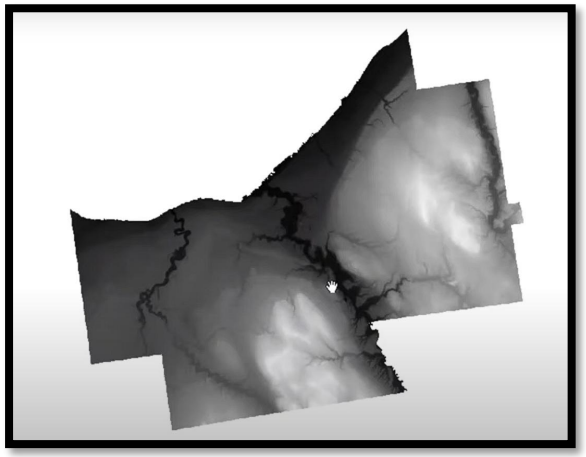

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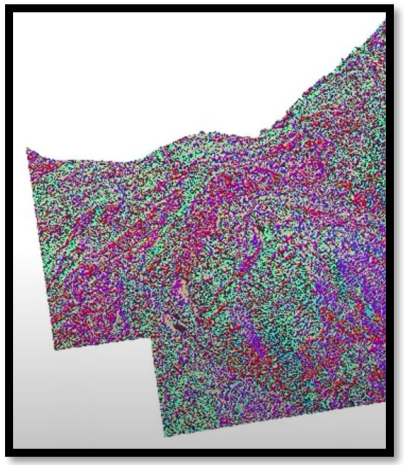

Flow Direction

Next Step:-

Flow Accumulation

- Determine the total amount of water flowing into each cell
- Amount of water or upstream cells that flow into a downslope cell
- This captures the small streams which connect to become large streams and then to rivers

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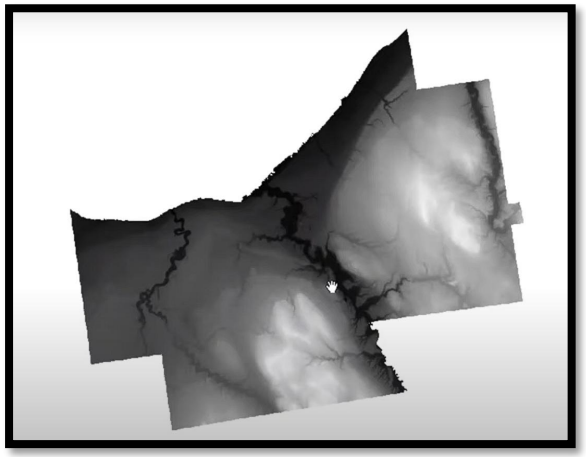

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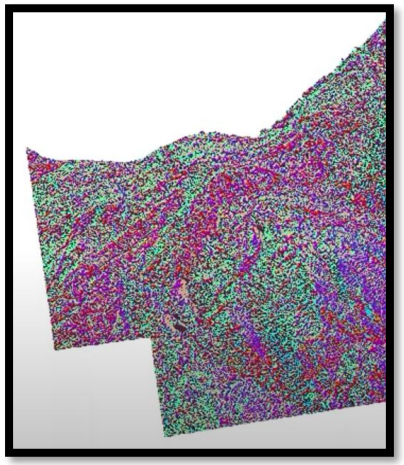

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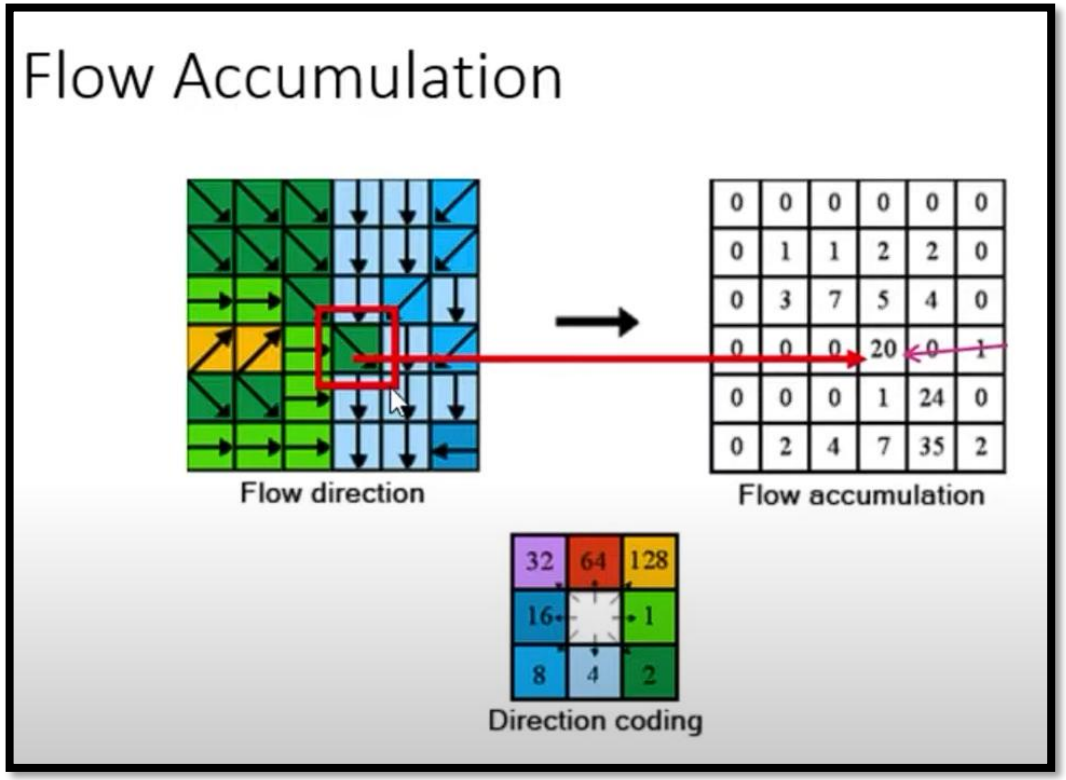

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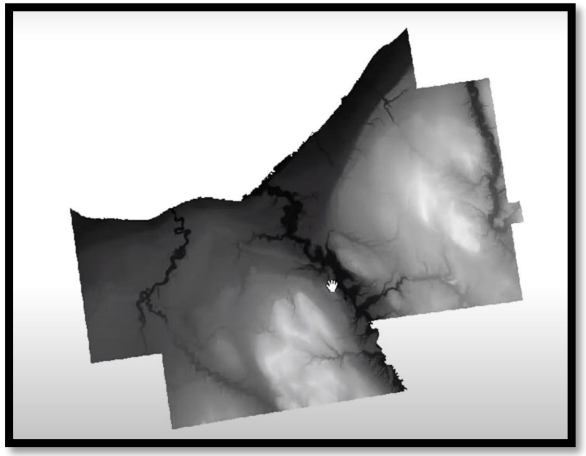

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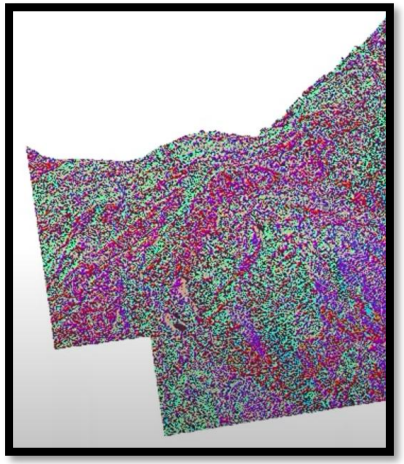

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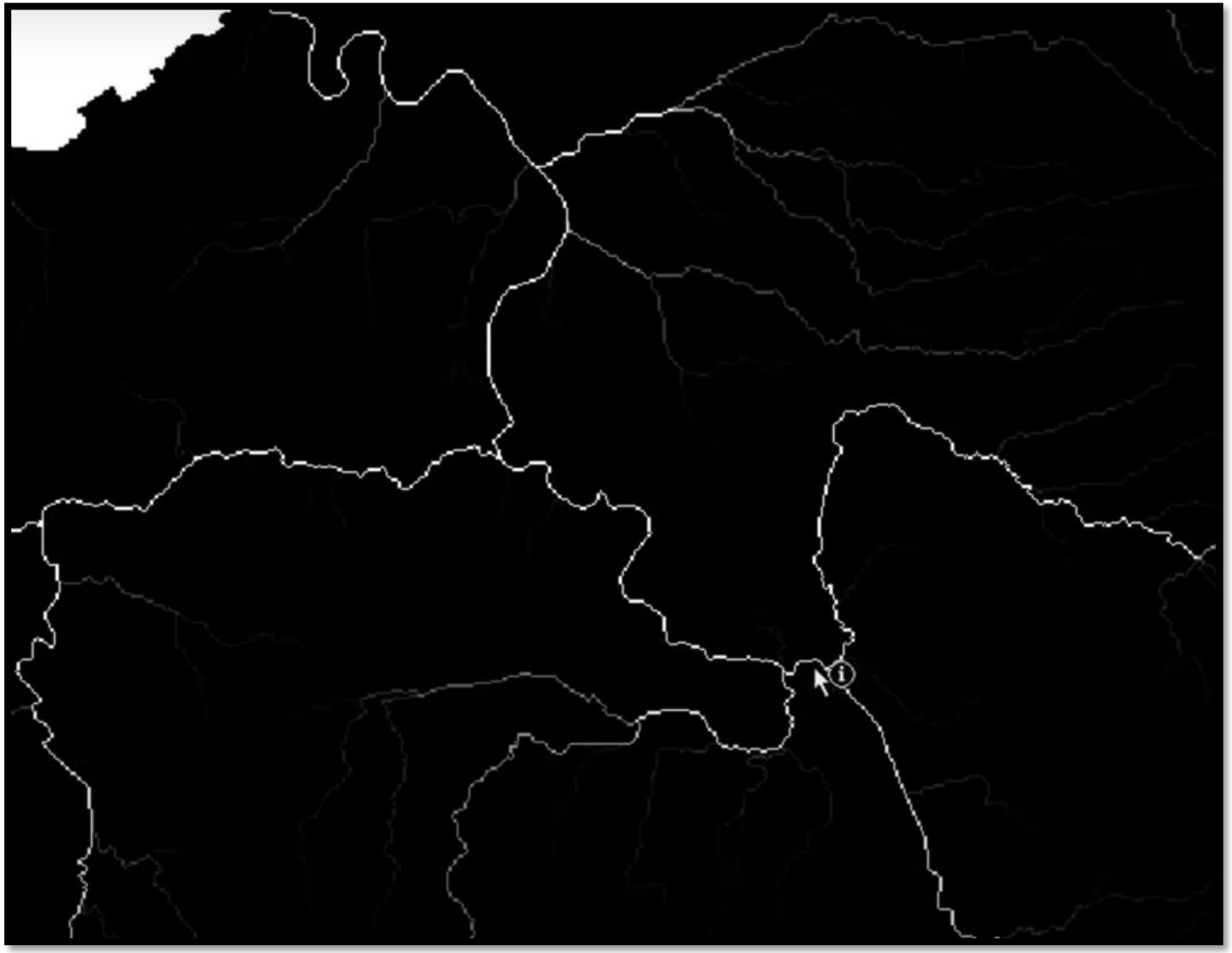

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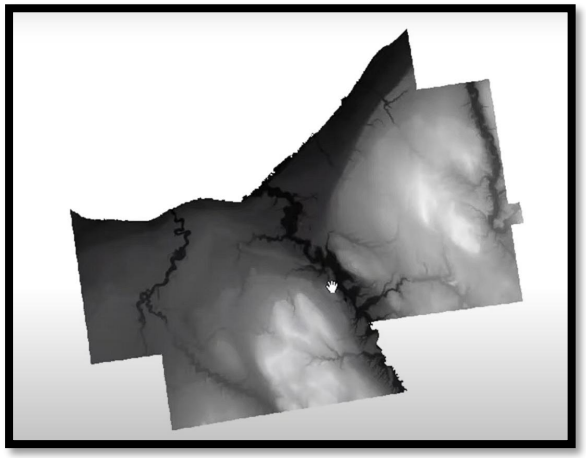

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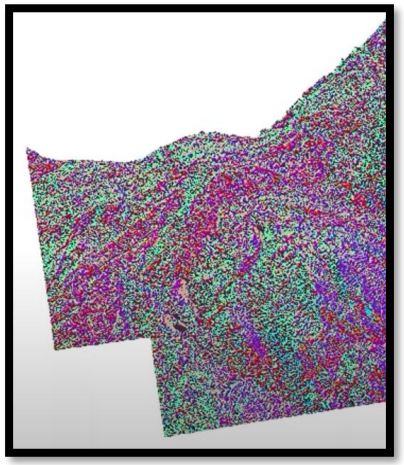

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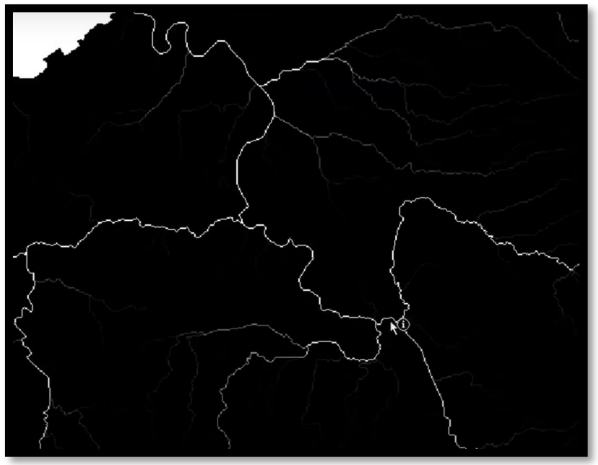

Flow Accumulation

Next Step:-

Euclidean Distance: Determine the distance from each cell in the raster to the closest stream

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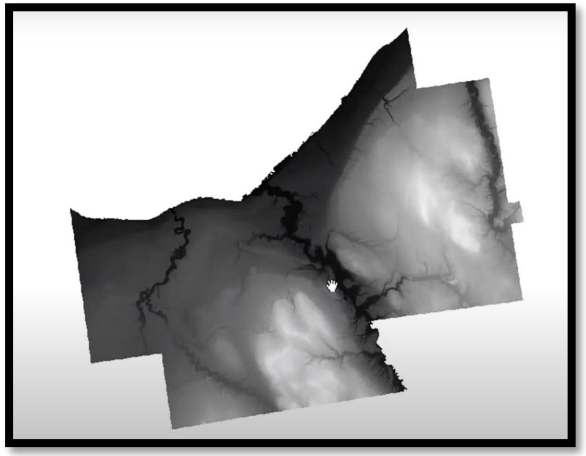

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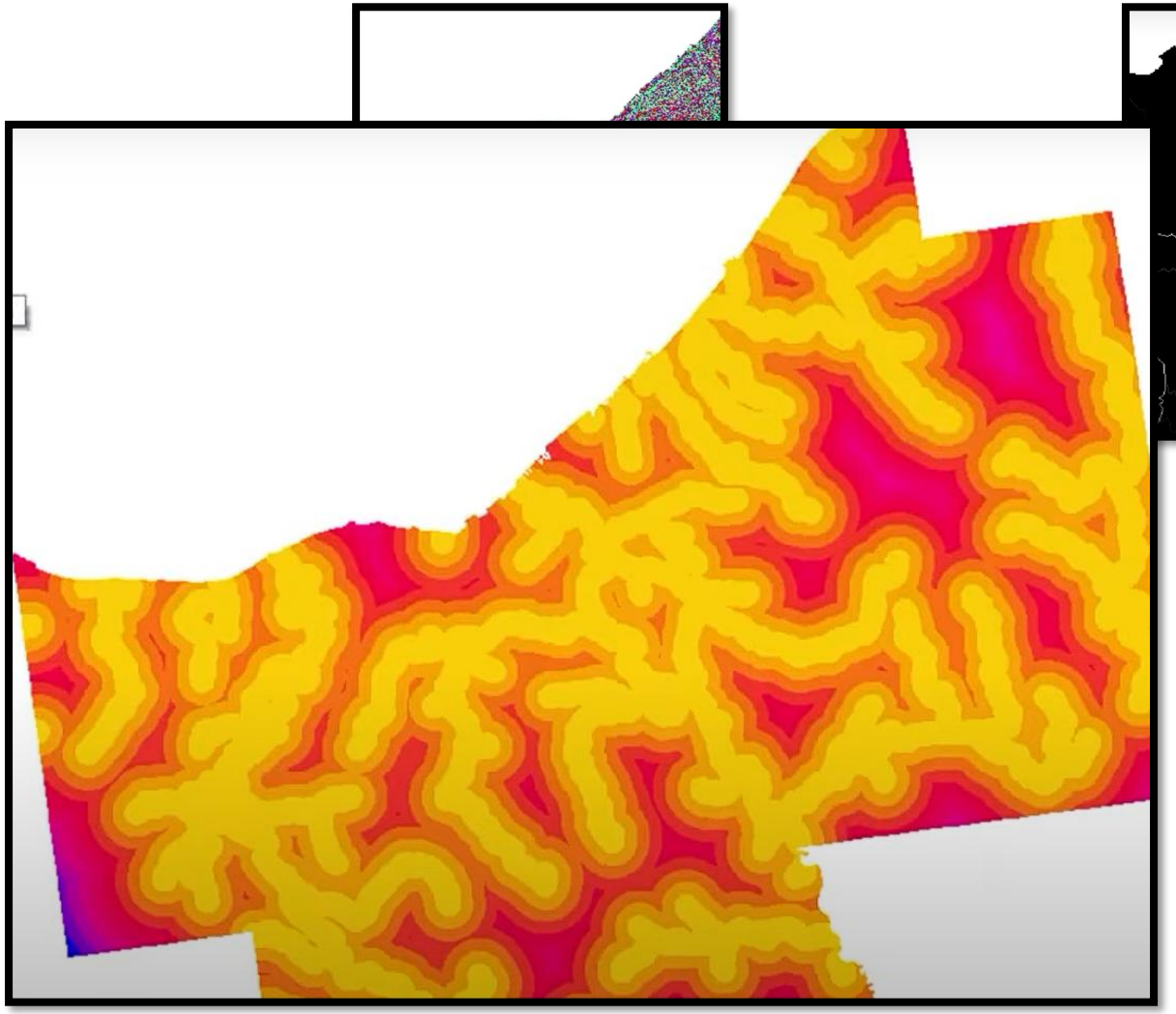

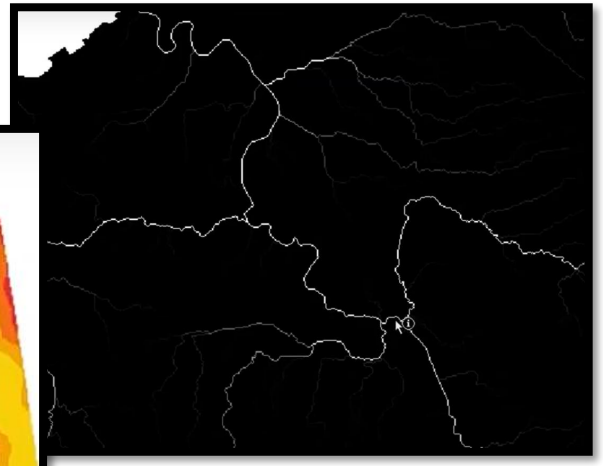

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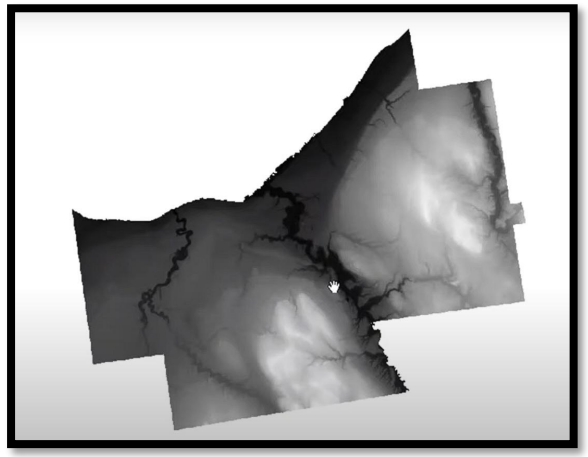

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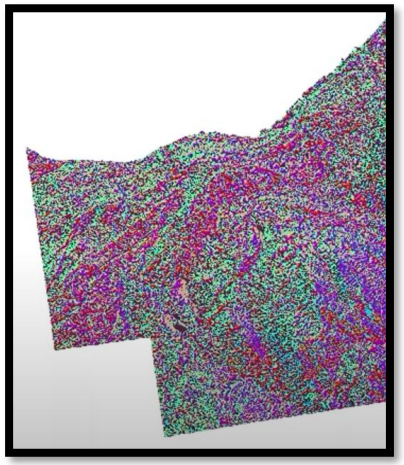

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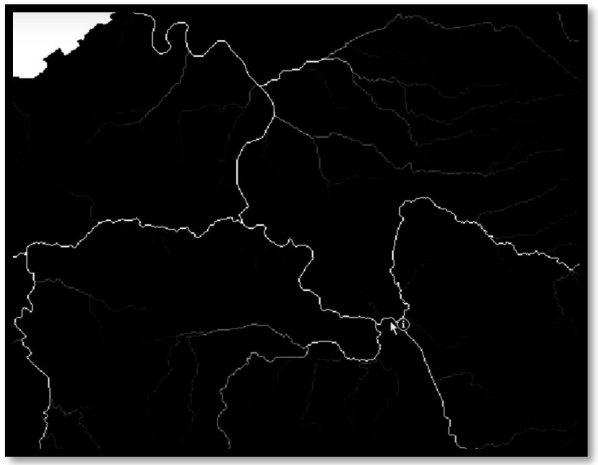

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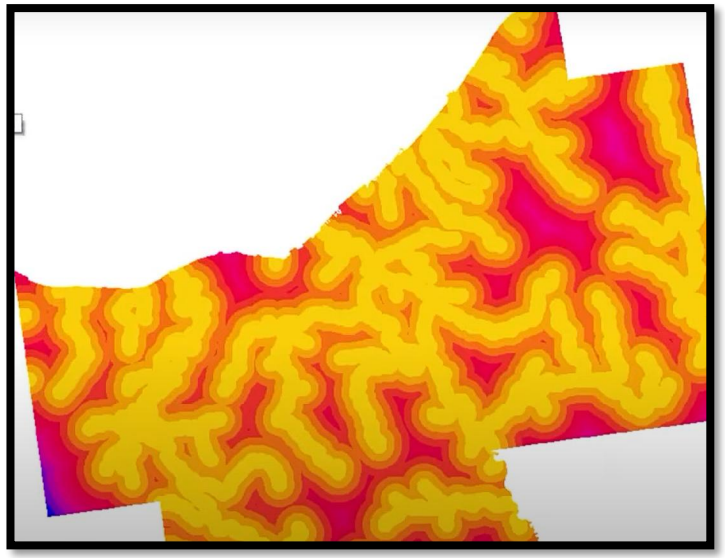
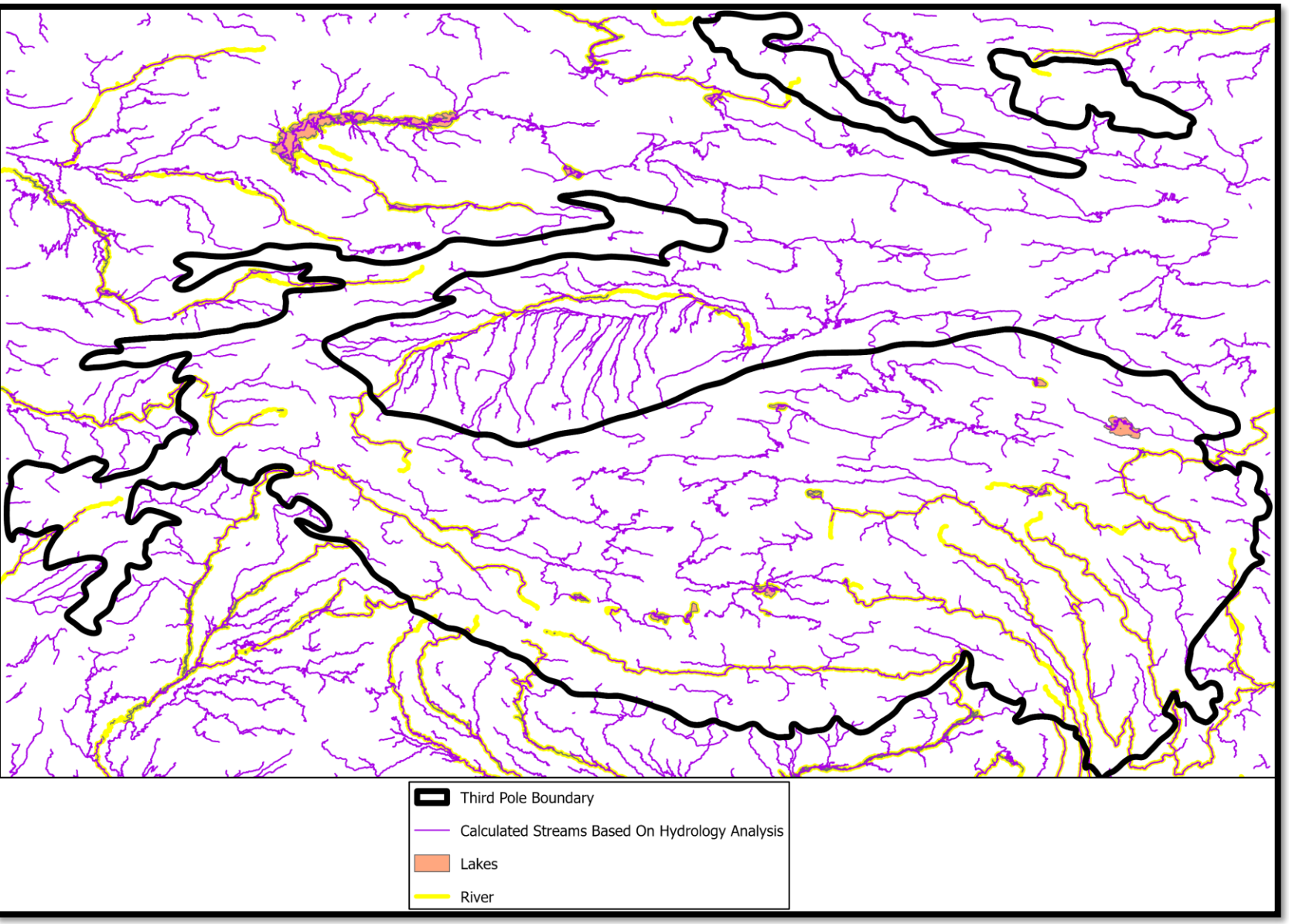


Distance From Streams

| Step | Output Layer | Purpose |
|---|---|---|
| **Sink Filling** | Hydrologically corrected DEM | Enables continuous uninterrupted flow routing |
| **Flow Direction (D8)** | Flow direction raster | Determines direction of surface runoff |
| **Flow Accumulation** | Accumulation raster | Identifies water convergence zones |
| **Stream Extraction** | Binary stream mask | Defines primary hydrological pathways |
| **Proximity to Streams** | Distance raster | Supports risk modeling based on stream closeness |

# Hydrological Stream Network Validation and Insights




- This map visualizes the **Third Pole hydrological stream network**, derived using **flow accumulation data**, overlaid with **existing rivers and lakes**.

- A clear spatial alignment between the calculated streamlines and known rivers/lakes demonstrates the accuracy and reliability of our hydrological modeling.
- This confirms that the derived stream network effectively replicates real-world flow patterns even in complex mountainous terrain.

The calculated streams extend beyond the mapped river boundaries, offering insight into:

- Potential overflow paths during extreme rainfall or glacier melt.
- Likely snowmelt drainage corridors in high-altitude basins.
- Identification of ephemeral or unmapped channels which are critical for flood modeling.

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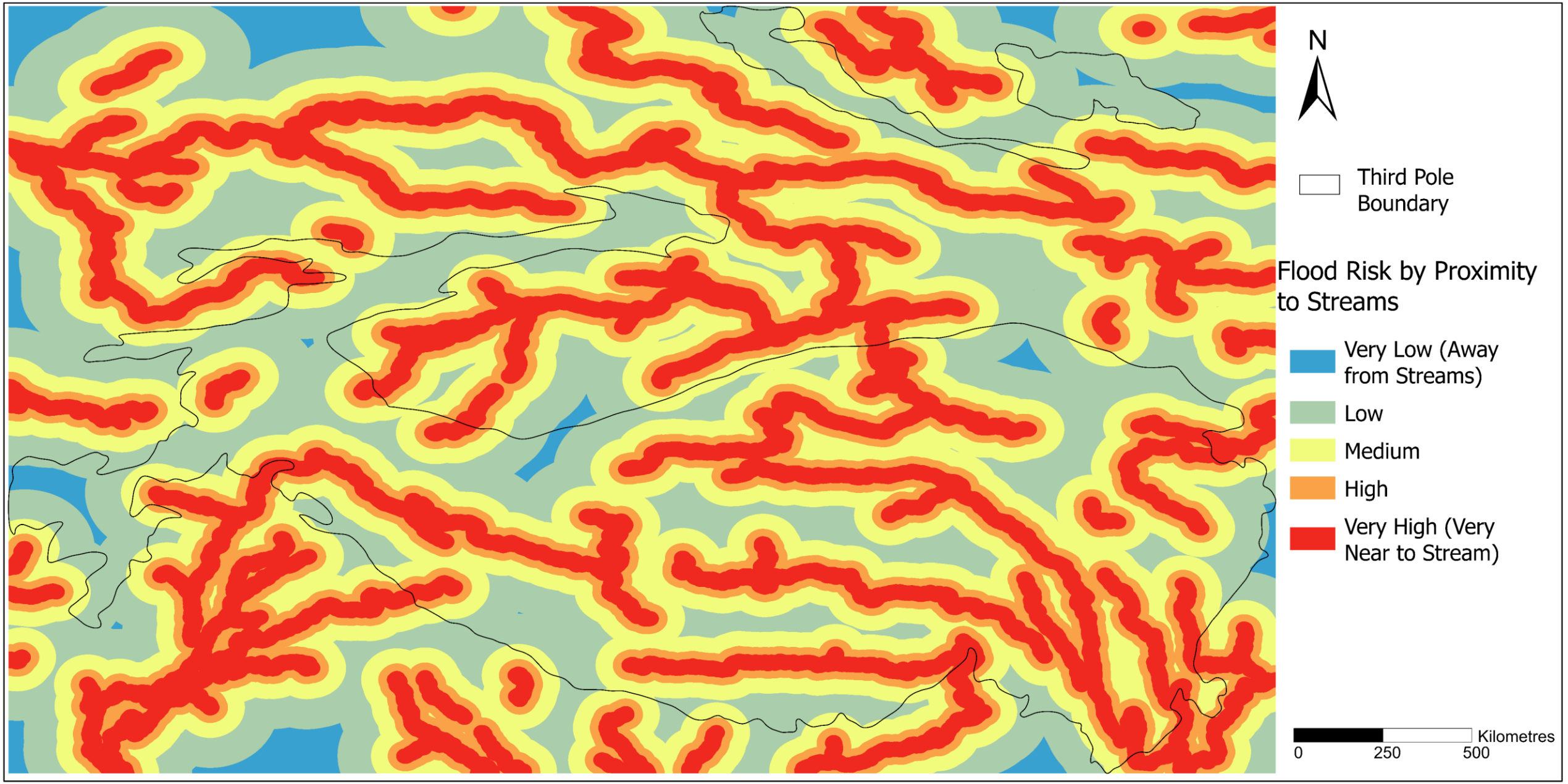
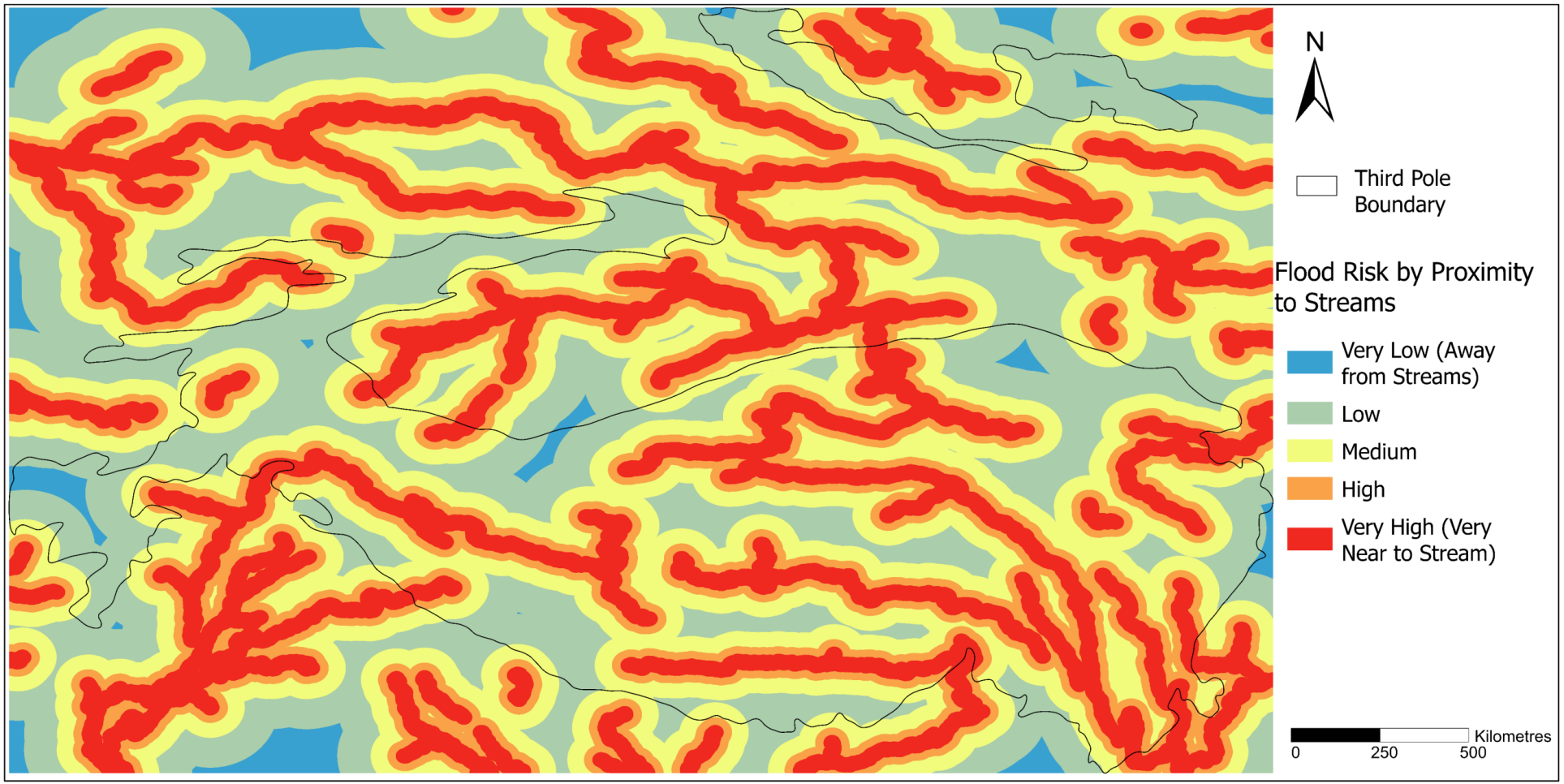
# Flood Risk Based on Distance from Streams



# Flood Risk Based on Distance from Streams




- This layer classifies flood risk based on distance from stream networks.
- Areas closer to rivers and streams are more vulnerable during heavy rainfall or glacial melt events. These high-risk zones are shown in red.
- This layer is particularly useful for identifying linear flood corridors along major rivers.

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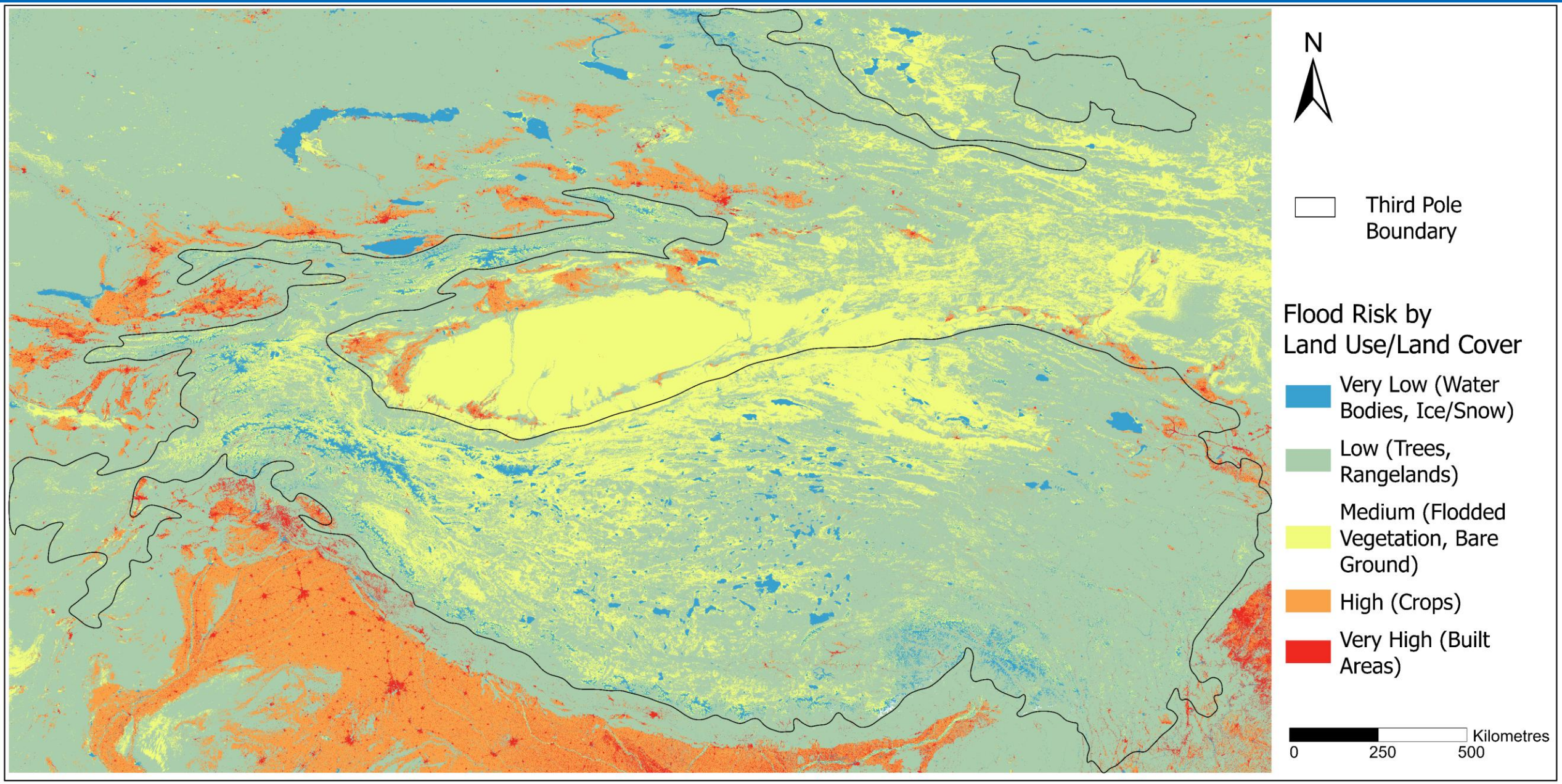
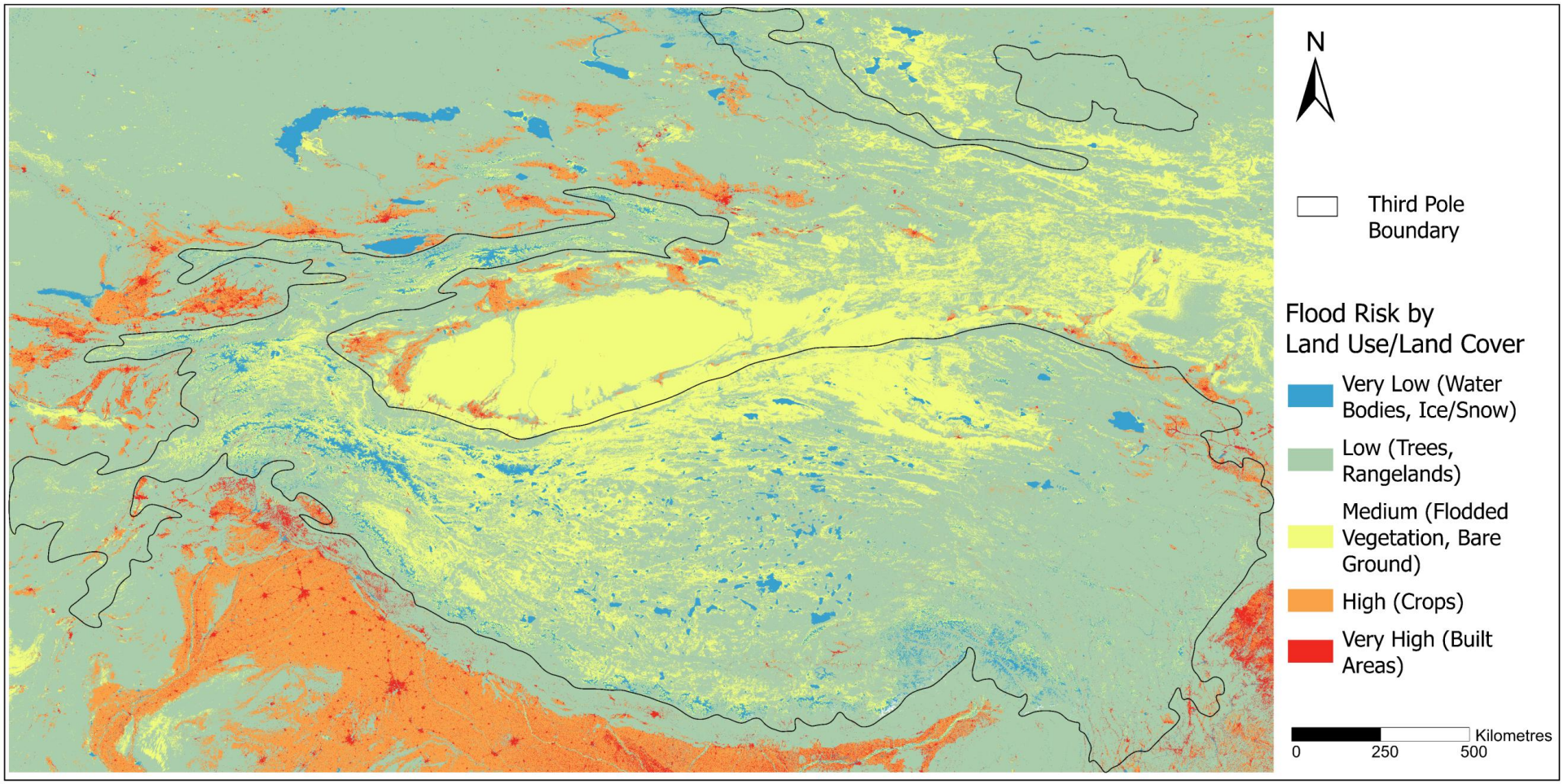
# Flood Risk by Land Use and Land Cover (Exposure by Land Type)



# Flood Risk by Land Use and Land Cover (Exposure by Land Type)




- This map evaluates flood risk through land cover types.
- Built-up areas and agricultural lands — both highly susceptible to flood damage — are shown as high-risk zones in red and orange.
- Meanwhile, forests, water bodies, and snow/ice-covered regions are categorized as low risk, either due to resilience or lower asset exposure.

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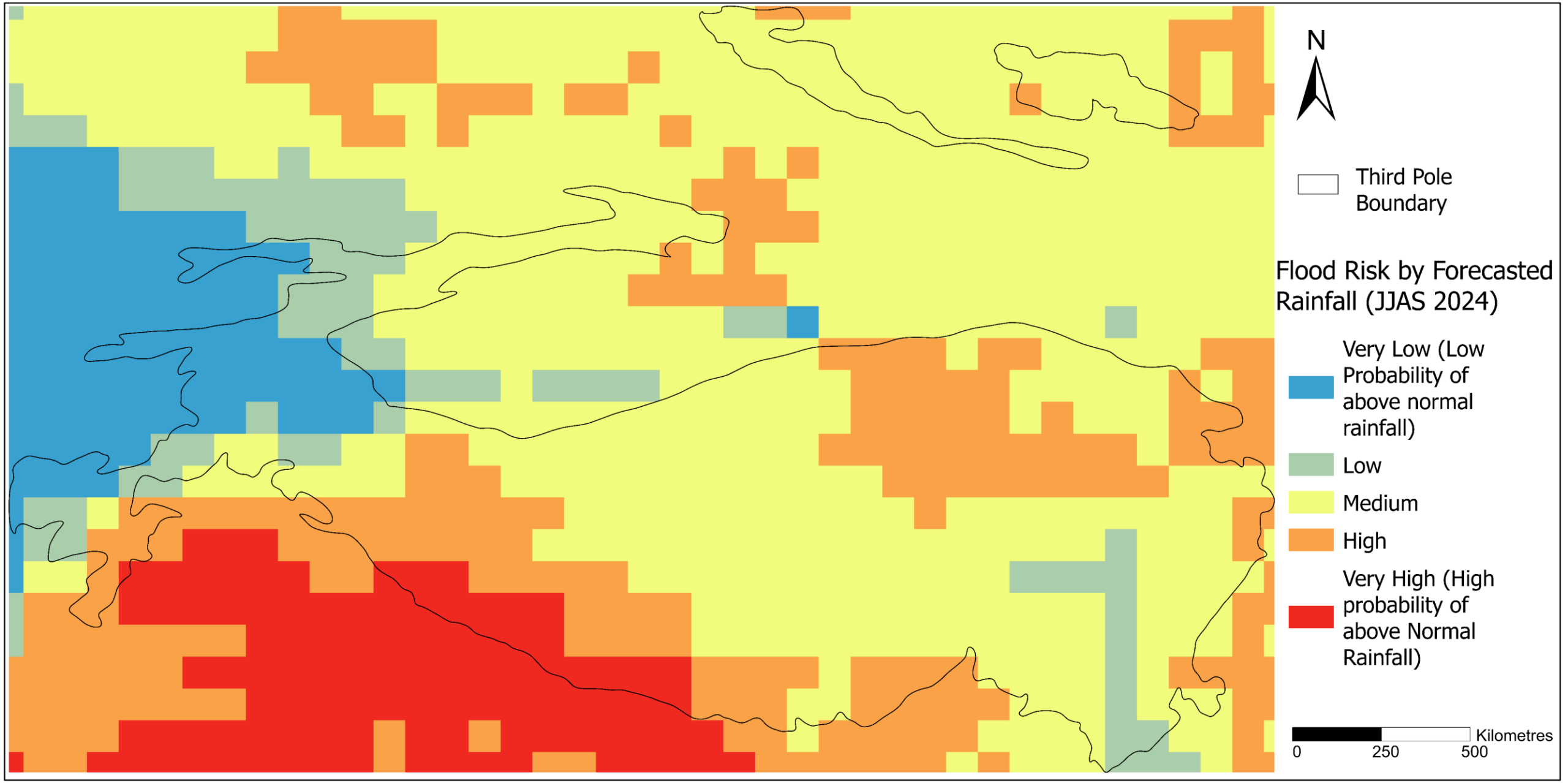
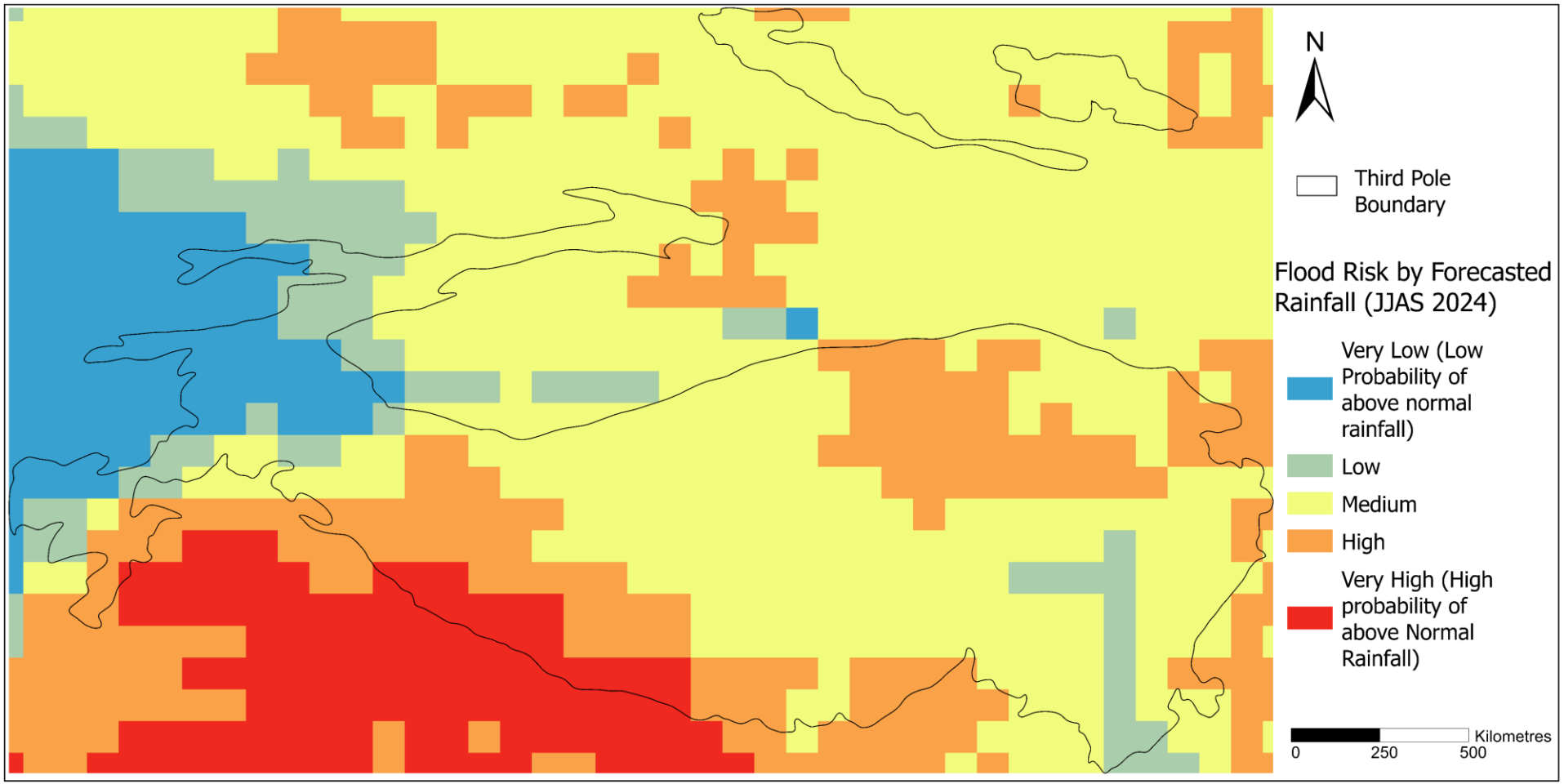
# Seasonal Rainfall-Induced Flood Risk (DJF 2024-25 Forecast)



# Seasonal Rainfall-Induced Flood Risk (DJF 2024-25 Forecast)




- This map reflects flood risk for JJAS 2024 season, based on seasonal rainfall forecasts.
- Regions with a high probability of above-normal rainfall are assigned higher risk categories.
- This forecast-based risk layer adds a dynamic, time-sensitive dimension to the analysis.

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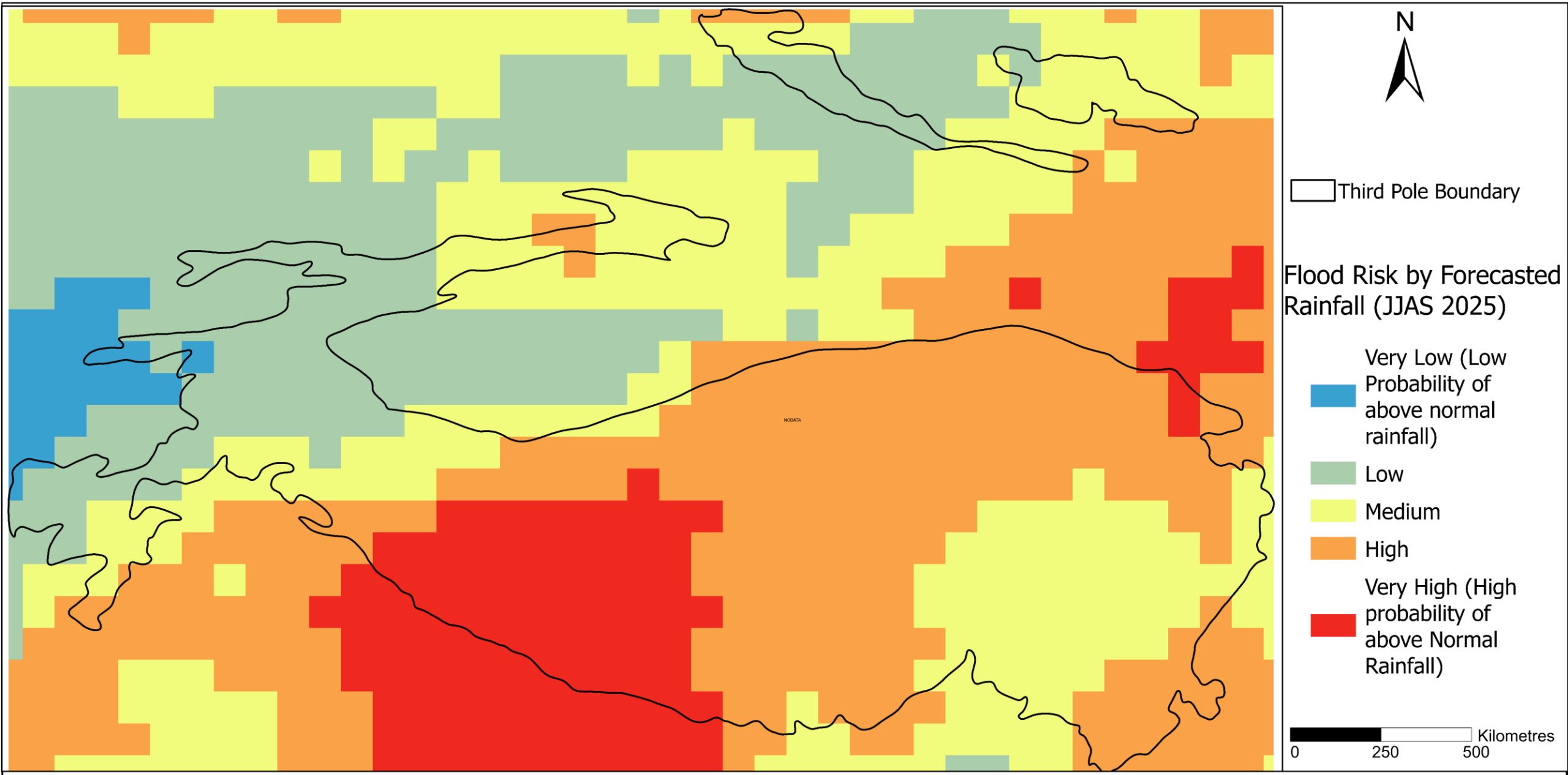
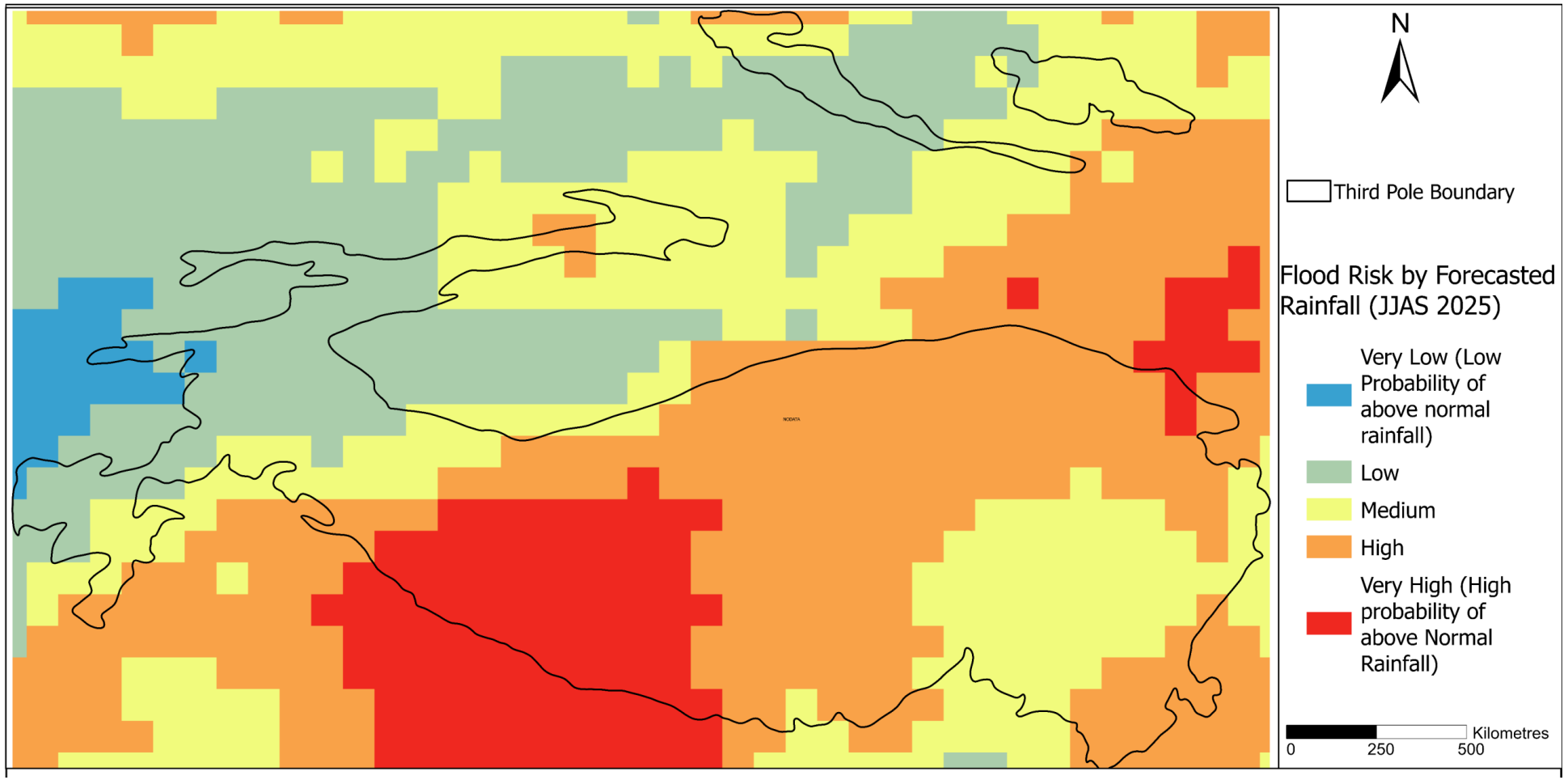
# Seasonal Rainfall-Induced Flood Risk (DJF 2024-25 Forecast)



# Seasonal Rainfall-Induced Flood Risk (DJF 2024-25 Forecast)



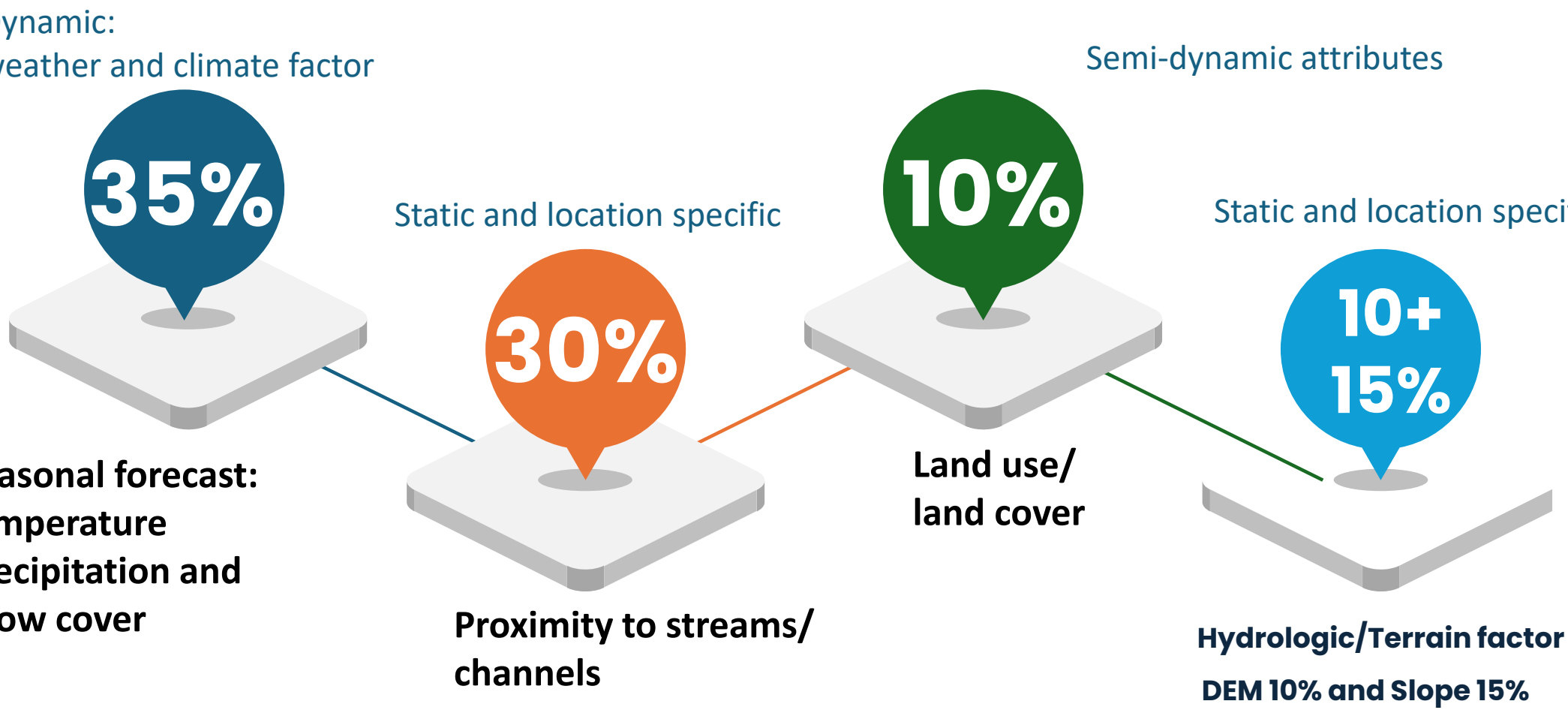

- This map reflects flood risk for the upcoming JJAS 2025 season, based on seasonal rainfall forecasts.
- Regions with a high probability of above-normal rainfall are assigned higher risk categories.
- This forecast-based risk layer adds a dynamic, time-sensitive dimension to the analysis.

# Summary of Reclassified Inputs

| Step | Output Layer | Purpose |
|---|---|---|
| **Sink Filling** | Hydrologically corrected DEM | Enables continuous uninterrupted flow routing |
| **Flow Direction (D8)** | Flow direction raster | Determines direction of surface runoff |
| **Flow Accumulation** | Accumulation raster | Identifies water convergence zones |
| **Stream Extraction** | Binary stream mask | Defines primary hydrological pathways |
| **Proximity to Streams** | Distance raster | Supports risk modeling based on stream closeness |

Each of the five input layers is converted into a raster with pixel values ranging from 1 to 5, where higher values represent higher flood susceptibility based on the individual variable.

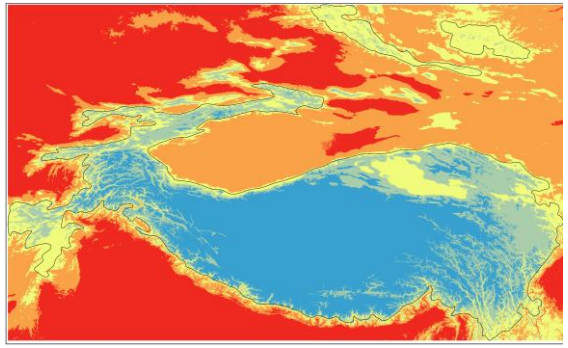
# Impact Drivers/Risk Matrix : Weightage Factors



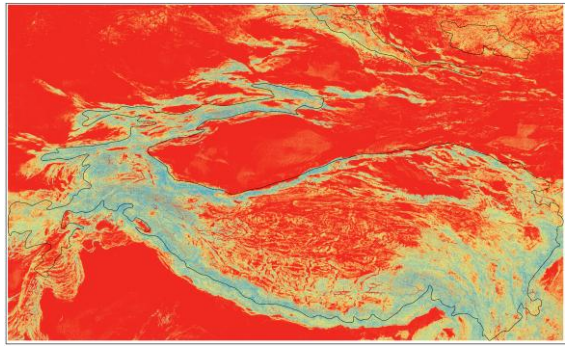

**Weighting scheme adapted from Sharma & Saharia (2025)**
*(DeepSARFlood, Scientific Reports in Remote Sensing)*
https://doi.org/10.1016/j.srs.2025.100203

# Weighted Sum Analysis

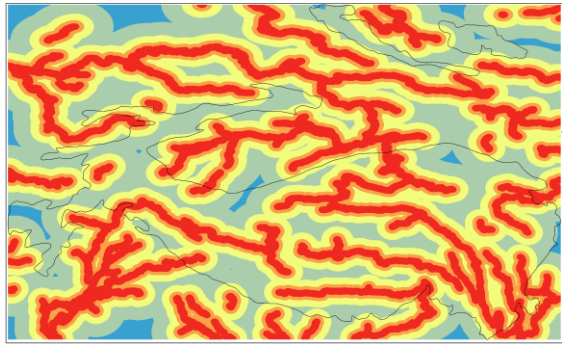
All hazard-contributing variables were reclassified onto a common ordinal risk scale (1 to 5), and then integrated through a multi-hazard weighted overlay analysis.



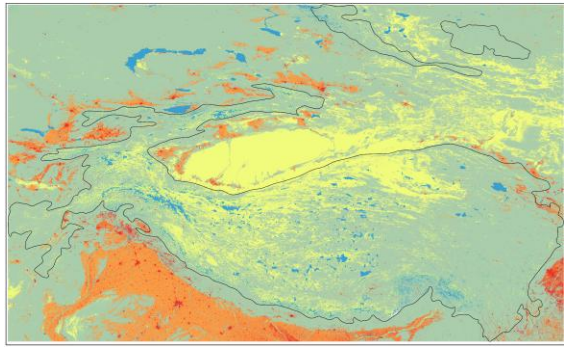
DEM



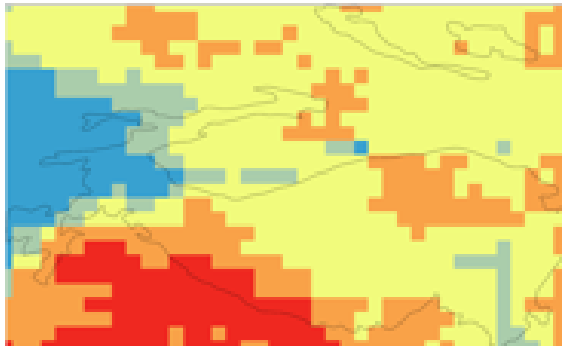
Slope



Distance from Streams



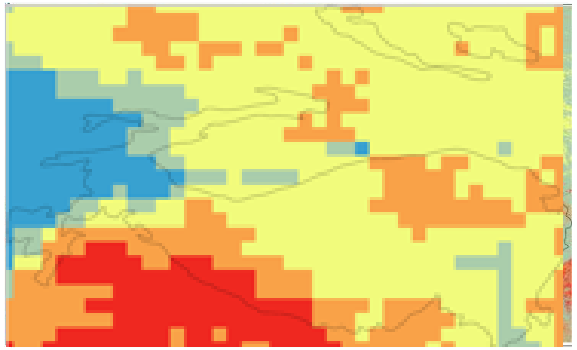
Land use/ Land Cover



Seasonal Forecast Rainfall Data
(JJAS 2024)

# Weighted Sum Analysis

All hazard-contributing variables were reclassified onto a common ordinal risk scale (1 to 5), and then integrated through a multi-hazard weighted overlay analysis.



## Purpose of Weighted Overlay:-

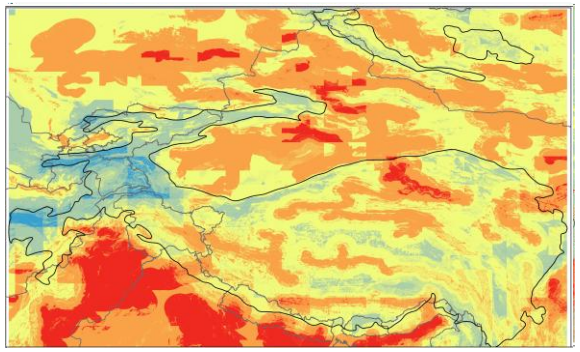
- **To aggregate multiple geospatial layers that contribute to flood risk.**
- **To assign greater influence to variables deemed more critical in flood generation.**
- **To produce a cumulative flood susceptibility index, where higher values represent zones of greater concern.**

## 5.4 Overlay Calculation

The cumulative flood index was computed using a weighted sum overlay:

Where:

- Each layer's reclassified value (1–5) is multiplied by its assigned weight.
- The sum is computed cell by cell over the entire study area. Each pixel in the resulting raster carries a continuous flood risk score, with higher values denoting greater risk.



To get our final cumulative flood risk map for JJAS 2024 season

### Summary – Weighted Overlay Framework

| Step | Description |
|---|---|
| **Inputs** | 5 reclassified layers (1–5 scale) |
| **Method** | Weighted Sum Overlay |
| **Weight Assignment** | Based on flood relevance in Third Pole |
| **Output** | Continuous flood susceptibility raster |

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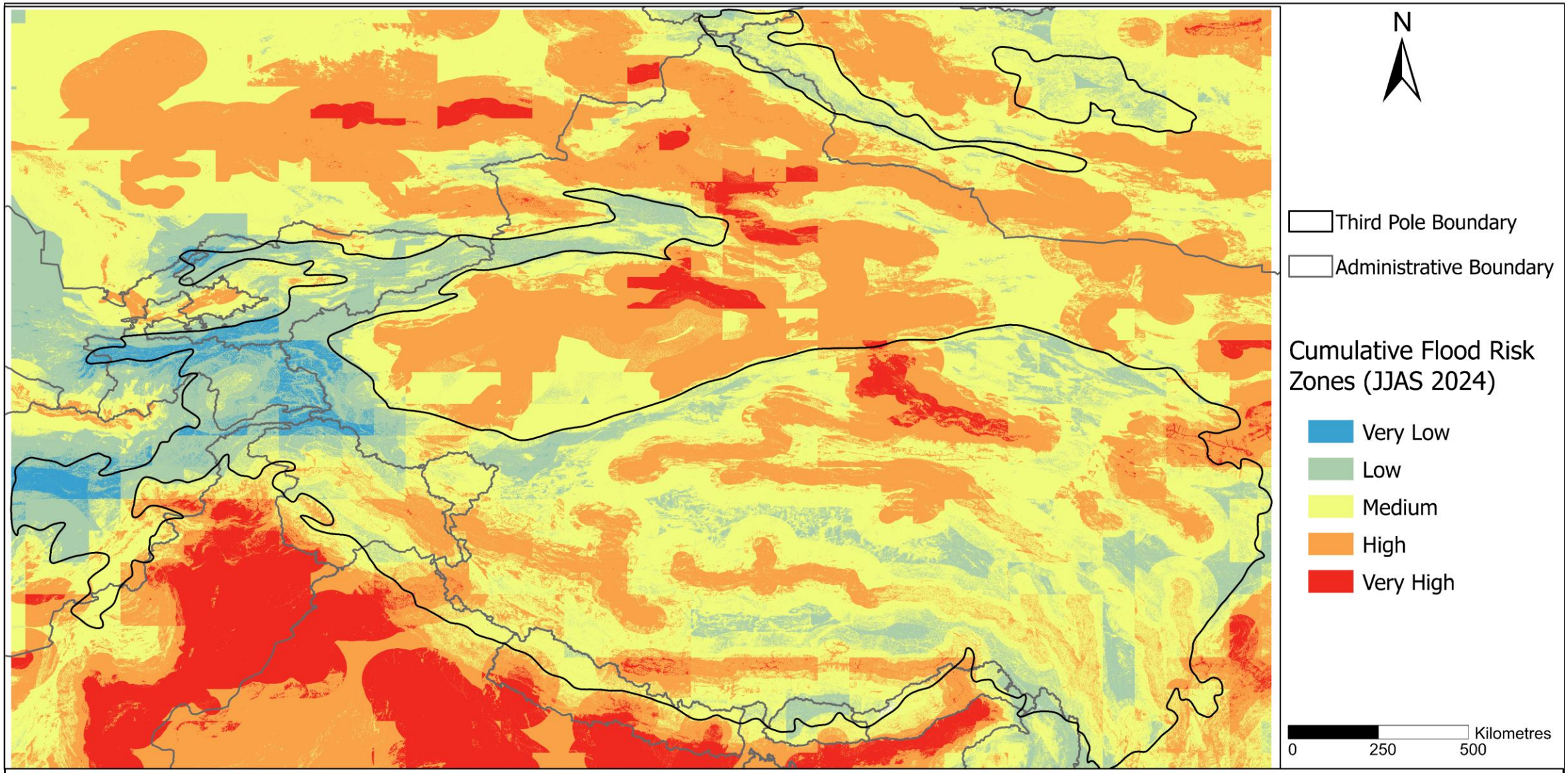
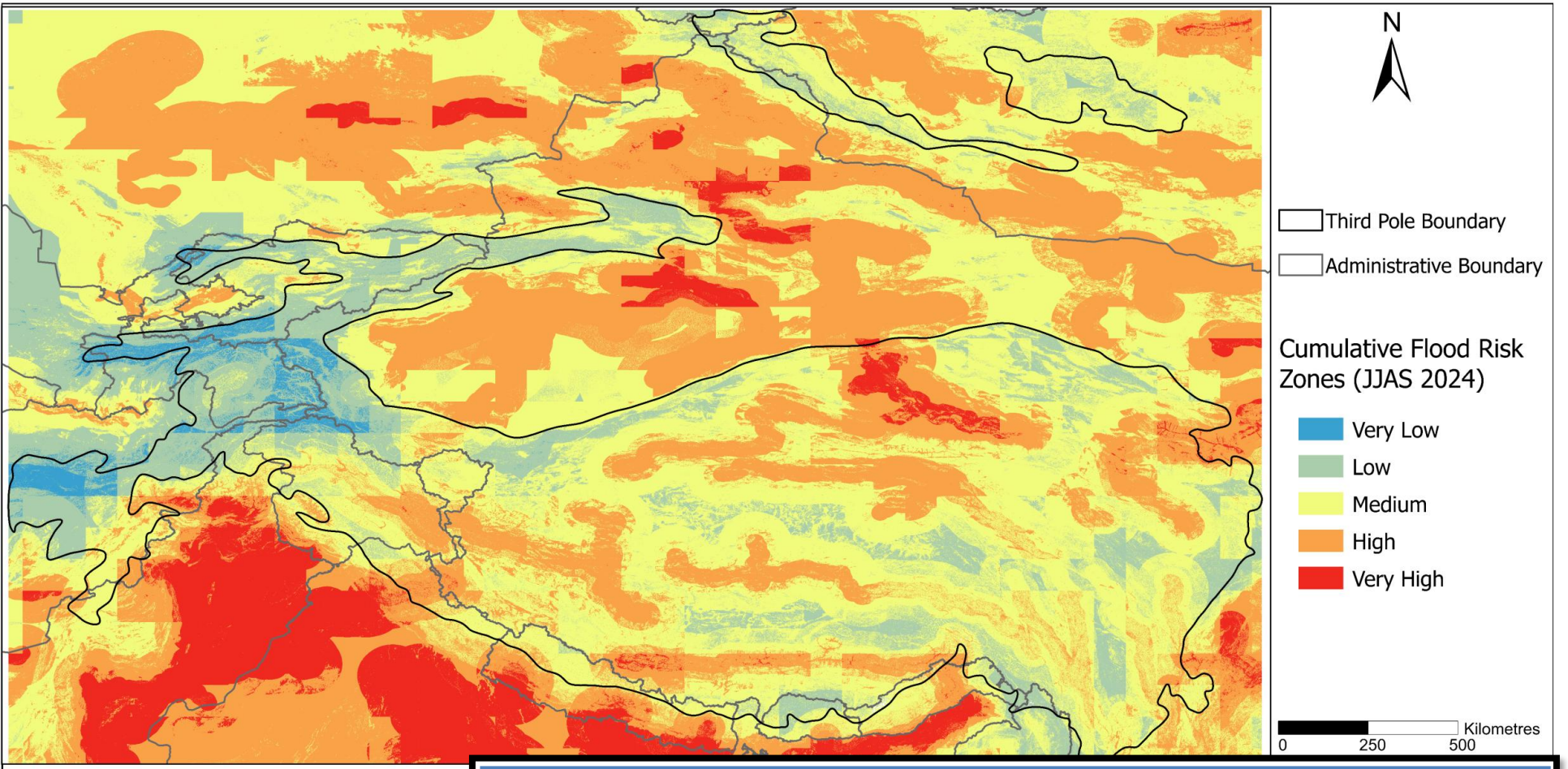
# Integrated Flood Risk Zones – Weighted Overlay of Multiple Factors




Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

# Integrated Flood Risk Zones – Weighted Overlay of Multiple Factors



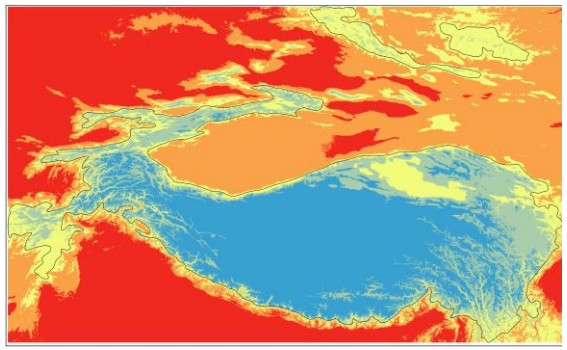

Disclaimer: The boundaries and names shown and the designati
in Jammu and Kashmir agreed upon by India and Pa

| Risk Category | Score Range | Interpretation |
|---|---|---|
| **Very Low** | Lowest break | Minimal to no flood susceptibility |
| **Low** | | Minor susceptibility |
| **Moderate** | | Potential flood concern |
| **High** | | Likely flood-prone |
| **Very High** | Highest break | Critical flood risk zone |

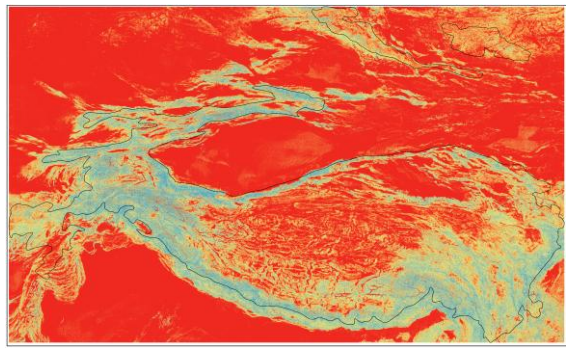
- Finally, this composite map integrates all the previous layers — terrain, hydrology, land use, and rainfall forecast — using a weighted sum model.
- Areas shown in red represent zones where multiple risk factors align, indicating heightened vulnerability.

# Weighted Sum Analysis

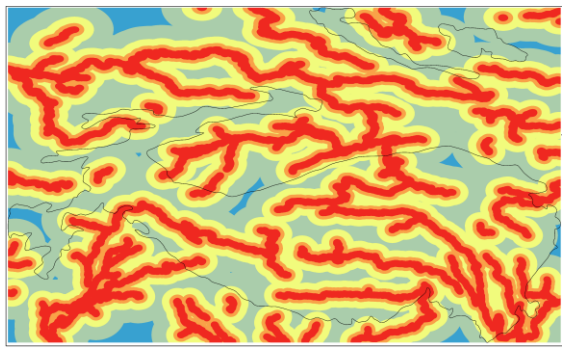
DEM, Slope, Distance from Streams and Land Use/ Land cover are static datasets, so we again combined the same variable but this time with the latest upcoming JJAS 2025 risk categorized seasonal forecast rainfall data



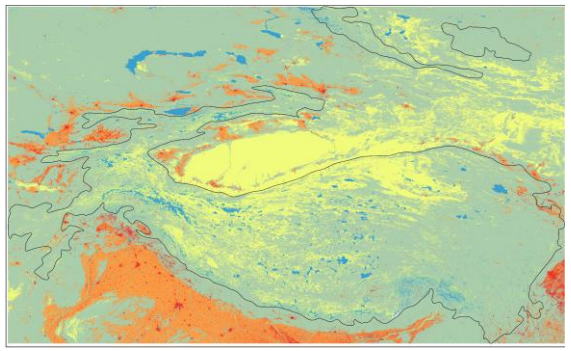
DEM



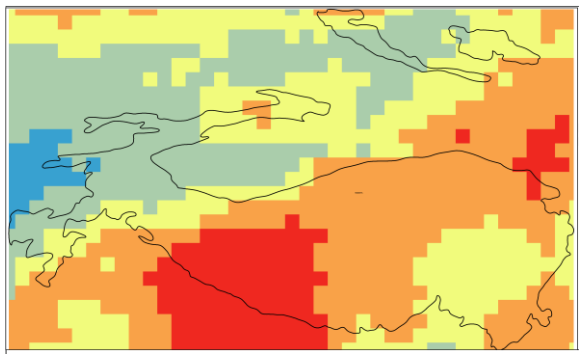
Slope



Distance from Streams



Land use/ Land Cover



Seasonal Forecast Rainfall Data

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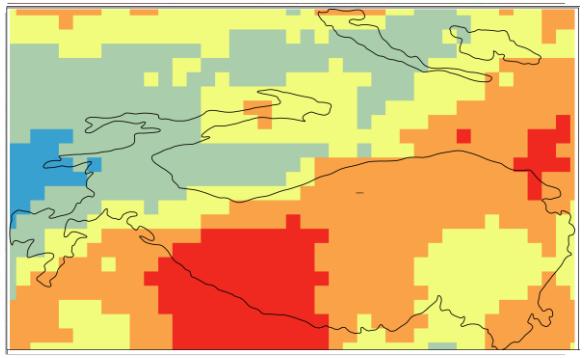
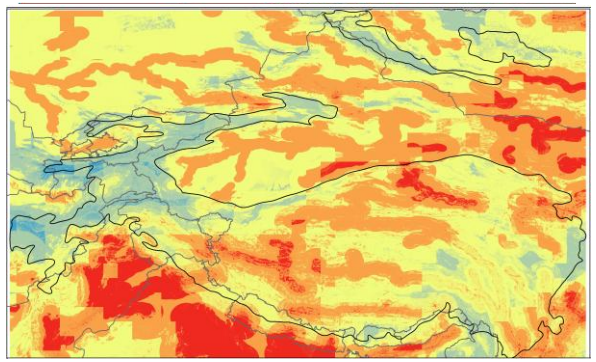


# Weighted Sum Analysis

To get our final cumulative flood risk map for JJAS 2025 season



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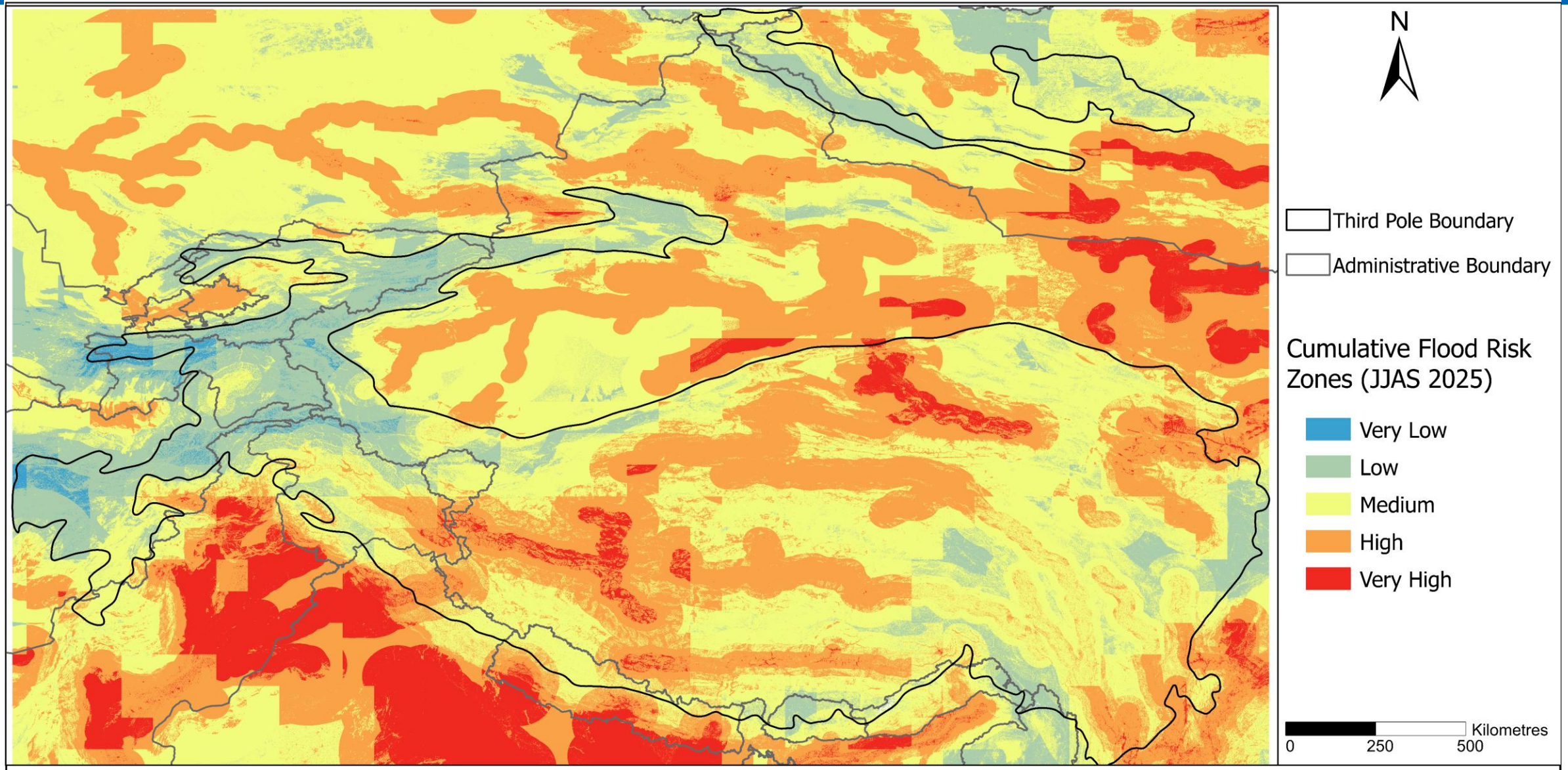
# Integrated Flood Risk Zones – Weighted Overlay of Multiple Factors

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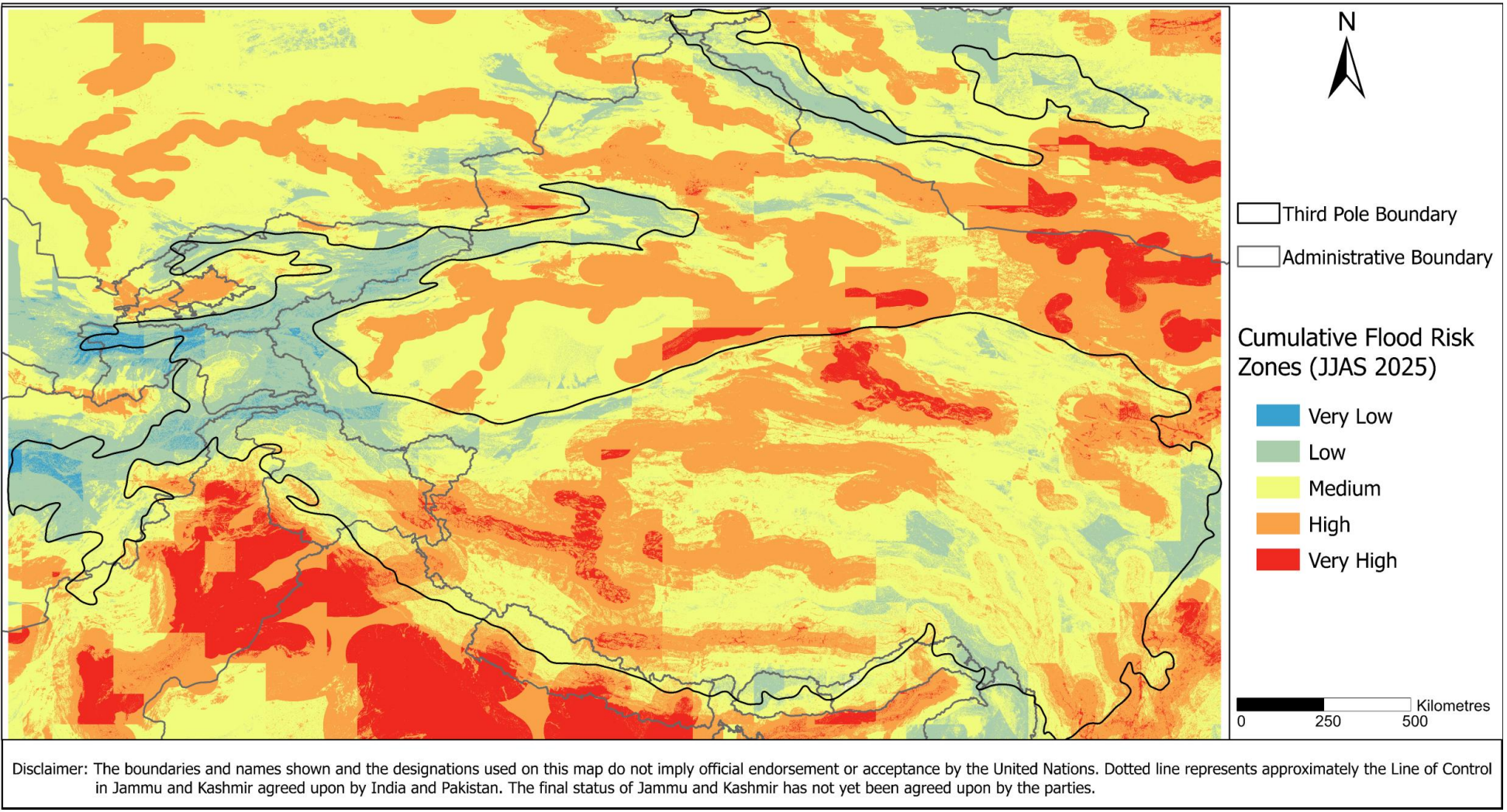


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- Just like the previous map, this composite map also integrates all the previous static layers — terrain, hydrology, land use, with the upcoming JJAS 2025 rainfall forecast — using a weighted sum model.
- Areas shown in red represent zones where multiple risk factors align, indicating heightened vulnerability.

# Third Pole : Population Exposure

| Country | % of Total Population in Third Pole | Population in Third Pole likely exposed to Very Low Flood Risk (%) | Population in Third Pole likely exposed to Low Flood Risk (%) | Population in Third Pole likely exposed to Medium Flood Risk (%) | Population in Third Pole likely exposed to High Flood Risk (%) | Population in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 79.8 | 0.00 | 0.01 | 0.01 | 0.01 | 5.71 |
| Bangladesh | 4.2 | 0.00 | 0.00 | 0.00 | 0.04 | 13.82 |
| Bhutan | 100.0 | 0.00 | 0.00 | 0.01 | 0.01 | 0.30 |
| China | 7.7 | 0.00 | 0.00 | 0.02 | 0.06 | 26.26 |
| India | 33.6 | 0.00 | 0.00 | 0.00 | 0.02 | 68.65 |
| Kazakhstan | 55.4 | 0.00 | 0.01 | 0.05 | 0.02 | 1.08 |
| Kyrgyzstan | 100.0 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00 |
| Mongolia | 25.0 | 0.00 | 0.00 | 0.03 | 0.02 | 3.30 |
| Myanmar | 0.8 | 0.00 | 0.00 | 0.14 | 0.01 | 0.00 |
| Nepal | 100.0 | 0.00 | 0.00 | 0.00 | 0.01 | 64.29 |
| Pakistan | 86.0 | 0.00 | 0.00 | 0.00 | 0.01 | 82.19 |
| Russian Federation | 0.0 | 0.00 | 0.00 | 0.06 | 0.03 | 0.00 |
| Tajikistan | 100.0 | 0.00 | 0.01 | 0.02 | 0.01 | 0.00 |
| Turkmenistan | 4.5 | 0.00 | 0.00 | 0.01 | 0.04 | 0.00 |
| Uzbekistan | 81.6 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 |

## JJAS 2024 Season

| Country | % of Total Population in Third Pole | Population in Third Pole likely exposed to Very Low Flood Risk (%) | Population in Third Pole likely exposed to Low Flood Risk (%) | Population in Third Pole likely exposed to Medium Flood Risk (%) | Population in Third Pole likely exposed to High Flood Risk (%) | Population in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 79.8 | 1.7 | 24.0 | 45.3 | 27.1 | 1.9 |
| Bangladesh | 4.2 | 0.0 | 0.0 | 37.3 | 61.0 | 0.7 |
| Bhutan | 100.0 | 0.0 | 21.8 | 68.4 | 11.7 | 0.0 |
| China | 7.7 | 0.0 | 2.4 | 21.8 | 56.2 | 19.4 |
| India | 33.6 | 0.0 | 0.3 | 6.8 | 26.4 | 66.5 |
| Kazakhstan | 55.4 | 0.0 | 4.8 | 71.6 | 23.5 | 0.3 |
| Kyrgyzstan | 100.0 | 0.3 | 15.0 | 56.4 | 28.2 | 0.0 |
| Mongolia | 25.0 | 0.0 | 8.4 | 46.1 | 40.9 | 4.6 |
| Myanmar | 0.8 | 0.0 | 42.0 | 57.4 | 0.1 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 6.9 | 30.3 | 63.8 |
| Pakistan | 86.0 | 0.0 | 0.5 | 5.6 | 34.5 | 59.5 |
| Russian Federation | 0.0 | 0.0 | 10.7 | 82.5 | 7.4 | 0.0 |
| Tajikistan | 100.0 | 3.9 | 33.2 | 37.9 | 25.1 | 0.0 |
| Turkmenistan | 4.5 | 0.0 | 2.9 | 57.0 | 40.0 | 0.0 |
| Uzbekistan | 81.6 | 0.4 | 21.5 | 44.8 | 33.3 | 0.0 |

## Upcoming JJAS 2025 Season

# Third Pole : Female Population Exposure

| Country | % of Total Female Population in Third Pole | Female Population in Third Pole likely exposed to Very Low Flood Risk (%) | Female Population in Third Pole likely exposed to Low Flood Risk (%) | Female Population in Third Pole likely exposed to Medium Flood Risk (%) | Female Population in Third Pole likely exposed to High Flood Risk (%) | Female Population in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 79.0 | 5.9 | 26.8 | 40.0 | 24.1 | 3.3 |
| Bangladesh | 4.1 | 14.3 | 85.1 | 0.5 | 0.0 | 0.0 |
| Bhutan | 100.0 | 0.3 | 18.9 | 61.0 | 18.9 | 0.0 |
| China | 7.7 | 26.5 | 48.1 | 22.8 | 2.4 | 0.0 |
| India | 32.9 | 68.3 | 28.4 | 3.2 | 0.1 | 0.0 |
| Kazakhstan | 55.6 | 1.1 | 23.0 | 61.1 | 14.7 | 0.1 |
| Kyrgyzstan | 100.0 | 0.0 | 24.7 | 51.2 | 22.9 | 1.4 |
| Mongolia | 24.7 | 3.3 | 41.3 | 51.7 | 3.6 | 0.0 |
| Myanmar | 0.7 | 0.0 | 5.8 | 74.0 | 20.0 | 0.0 |
| Nepal | 100.0 | 63.7 | 31.5 | 4.8 | 0.0 | 0.0 |
| Pakistan | 86.0 | 82.1 | 13.1 | 4.4 | 0.3 | 0.0 |
| Russian Federation | 0.0 | 0.0 | 8.8 | 76.7 | 14.4 | 0.1 |
| Tajikistan | 100.0 | 0.0 | 15.4 | 45.7 | 35.3 | 3.7 |
| Turkmenistan | 4.4 | 0.0 | 43.7 | 53.2 | 2.9 | 0.0 |
| Uzbekistan | 81.6 | 0.0 | 19.2 | 57.3 | 23.2 | 0.3 |

JJAS 2024 Season

| Country | % of Total Female Population in Third Pole | Female Population in Third Pole likely exposed to Very Low Flood Risk (%) | Female Population in Third Pole likely exposed to Low Flood Risk (%) | Female Population in Third Pole likely exposed to Medium Flood Risk (%) | Female Population in Third Pole likely exposed to High Flood Risk (%) | Female Population in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 79.0 | 2.0 | 27.4 | 44.7 | 24.2 | 1.7 |
| Bangladesh | 4.1 | 0.7 | 61.7 | 37.5 | 0.0 | 0.0 |
| Bhutan | 100.0 | 0.0 | 11.4 | 67.0 | 20.6 | 0.0 |
| China | 7.7 | 19.6 | 56.2 | 21.7 | 2.4 | 0.0 |
| India | 32.9 | 66.2 | 26.7 | 6.9 | 0.3 | 0.0 |
| Kazakhstan | 55.6 | 0.3 | 23.3 | 71.5 | 4.8 | 0.0 |
| Kyrgyzstan | 100.0 | 0.0 | 29.2 | 56.0 | 14.6 | 0.3 |
| Mongolia | 24.7 | 4.6 | 41.1 | 45.9 | 8.4 | 0.0 |
| Myanmar | 0.7 | 0.0 | 0.1 | 57.1 | 42.6 | 0.0 |
| Nepal | 100.0 | 63.2 | 30.0 | 6.8 | 0.0 | 0.0 |
| Pakistan | 86.0 | 59.5 | 34.5 | 5.5 | 0.5 | 0.0 |
| Russian Federation | 0.0 | 0.0 | 7.3 | 82.0 | 10.6 | 0.0 |
| Tajikistan | 100.0 | 0.0 | 25.2 | 37.8 | 33.1 | 3.9 |
| Turkmenistan | 4.4 | 0.0 | 40.4 | 56.6 | 2.9 | 0.0 |
| Uzbekistan | 81.6 | 0.0 | 33.1 | 45.0 | 21.4 | 0.4 |

Upcoming JJAS 2025 Season

# Third Pole : Elderly Population Exposure

| Country | % of Total Elder Population in Third Pole | Elder Population in Third Pole likely exposed to Very Low Flood Risk (%) | Elder Population in Third Pole likely exposed to Low Flood Risk (%) | Elder Population in Third Pole likely exposed to Medium Flood Risk (%) | Elder Population in Third Pole likely exposed to High Flood Risk (%) | Elder Population in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 82.9 | 2.0 | 23.6 | 46.1 | 23.6 | 4.5 |
| Bangladesh | 3.9 | 0.0 | 0.0 | 0.2 | 82.4 | 15.8 |
| Bhutan | 100.0 | 0.0 | 8.1 | 61.2 | 34.4 | 0.0 |
| China | 7.4 | 0.0 | 1.5 | 16.6 | 51.4 | 30.5 |
| India | 30.4 | 0.0 | 0.1 | 2.2 | 29.8 | 67.9 |
| Kazakhstan | 57.8 | 0.0 | 8.0 | 63.3 | 26.2 | 2.6 |
| Kyrgyzstan | 100.0 | 0.1 | 8.0 | 59.0 | 32.2 | 0.0 |
| Mongolia | 26.6 | 0.0 | 1.3 | 53.7 | 36.5 | 8.4 |
| Myanmar | 1.8 | 0.0 | 0.7 | 91.8 | 7.5 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 1.4 | 27.2 | 72.2 |
| Pakistan | 85.6 | 0.0 | 0.1 | 1.9 | 13.5 | 84.5 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 68.4 | 31.6 | 0.0 |
| Tajikistan | 100.0 | 0.7 | 33.5 | 46.5 | 19.7 | 0.0 |
| Turkmenistan | 4.6 | 0.0 | 0.0 | 16.9 | 83.1 | 0.0 |
| Uzbekistan | 83.7 | 0.0 | 11.7 | 67.0 | 21.4 | 0.0 |

## JJAS 2024 Season

| Country | % of Total Elder Population in Third Pole | Elder Population in Third Pole likely exposed to Very Low Flood Risk (%) | Elder Population in Third Pole likely exposed to Low Flood Risk (%) | Elder Population in Third Pole likely exposed to Medium Flood Risk (%) | Elder Population in Third Pole likely exposed to High Flood Risk (%) | Elder Population in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 82.9 | 1.0 | 20.4 | 51.3 | 25.3 | 2.0 |
| Bangladesh | 3.9 | 0.0 | 0.0 | 38.8 | 58.8 | 0.9 |
| Bhutan | 100.0 | 0.0 | 8.1 | 61.5 | 34.0 | 0.0 |
| China | 7.4 | 0.0 | 1.6 | 17.8 | 56.4 | 24.3 |
| India | 30.4 | 0.0 | 0.1 | 5.8 | 27.0 | 66.9 |
| Kazakhstan | 57.8 | 0.0 | 0.8 | 73.4 | 24.7 | 1.2 |
| Kyrgyzstan | 100.0 | 0.0 | 3.6 | 56.6 | 39.1 | 0.0 |
| Mongolia | 26.6 | 0.0 | 3.1 | 54.1 | 32.6 | 10.2 |
| Myanmar | 1.8 | 0.0 | 4.6 | 95.3 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 2.1 | 27.3 | 71.5 |
| Pakistan | 85.6 | 0.0 | 0.2 | 3.0 | 32.1 | 64.9 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 68.4 | 31.6 | 0.0 |
| Tajikistan | 100.0 | 1.2 | 31.2 | 38.8 | 29.1 | 0.0 |
| Turkmenistan | 4.6 | 0.0 | 0.0 | 19.1 | 80.9 | 0.0 |
| Uzbekistan | 83.7 | 0.0 | 11.3 | 51.7 | 37.1 | 0.0 |

## Upcoming JJAS 2025 Season

# Third Pole : Agriculture Production Exposure

| Country | % of Total Agriculture Production in Third Pole | Agriculture Production in Third Pole likely exposed to Very Low Flood Risk (%) | Agriculture Production in Third Pole likely exposed to Low Flood Risk (%) | Agriculture Production in Third Pole likely exposed to Medium Flood Risk (%) | Agriculture Production in Third Pole likely exposed to High Flood Risk (%) | Agriculture Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 78.2 | 1.8 | 23.2 | 45.8 | 24.4 | 4.3 |
| Bangladesh | 7.5 | 0.0 | 0.0 | 0.0 | 84.0 | 8.1 |
| Bhutan | 100.0 | 0.0 | 12.2 | 84.2 | 32.3 | 0.0 |
| China | 7.6 | 0.0 | 1.9 | 29.8 | 56.3 | 11.9 |
| India | 37.4 | 0.0 | 0.1 | 1.2 | 25.8 | 72.4 |
| Kazakhstan | 27.4 | 0.0 | 12.4 | 53.7 | 40.2 | 0.6 |
| Kyrgyzstan | 100.0 | 0.6 | 26.2 | 61.1 | 10.7 | 0.0 |
| Mongolia | 40.6 | 0.0 | 0.2 | 51.6 | 45.8 | 2.5 |
| Myanmar | 0.4 | 0.0 | 13.6 | 78.1 | 8.6 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 7.2 | 46.6 | 51.9 |
| Pakistan | 88.3 | 0.0 | 0.1 | 1.9 | 5.6 | 93.7 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 2.8 | 34.2 | 44.3 | 18.7 | 0.0 |
| Turkmenistan | 3.8 | 0.0 | 0.0 | 57.8 | 52.1 | 0.0 |
| Uzbekistan | 80.1 | 0.0 | 26.7 | 47.0 | 25.2 | 0.0 |

## JJAS 2024 Season

| Country | % of Total Agriculture Production in Third Pole | Agriculture Production in Third Pole likely exposed to Very Low Flood Risk (%) | Agriculture Production in Third Pole likely exposed to Low Flood Risk (%) | Agriculture Production in Third Pole likely exposed to Medium Flood Risk (%) | Agriculture Production in Third Pole likely exposed to High Flood Risk (%) | Agriculture Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 78.2 | 0.8 | 22.1 | 50.8 | 24.7 | 1.1 |
| Bangladesh | 7.5 | 0.0 | 0.0 | 40.3 | 51.7 | 0.0 |
| Bhutan | 100.0 | 0.0 | 13.2 | 91.8 | 23.6 | 0.0 |
| China | 7.6 | 0.0 | 2.1 | 26.5 | 58.4 | 12.9 |
| India | 37.4 | 0.0 | 0.1 | 3.1 | 25.7 | 70.4 |
| Kazakhstan | 27.4 | 0.0 | 3.8 | 65.3 | 37.7 | 0.1 |
| Kyrgyzstan | 100.0 | 0.0 | 17.0 | 64.9 | 16.7 | 0.0 |
| Mongolia | 40.6 | 0.0 | 3.4 | 54.6 | 37.5 | 4.6 |
| Myanmar | 0.4 | 0.0 | 29.7 | 70.6 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 10.4 | 44.8 | 50.5 |
| Pakistan | 88.3 | 0.0 | 0.1 | 2.4 | 32.6 | 66.1 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 3.3 | 32.5 | 31.2 | 33.0 | 0.0 |
| Turkmenistan | 3.8 | 0.0 | 0.0 | 68.4 | 41.5 | 0.0 |
| Uzbekistan | 80.1 | 0.2 | 25.9 | 35.7 | 37.1 | 0.0 |

## Upcoming JJAS 2025 Season

# Third Pole : Rice Production Exposure

| Country | % of Total Rice Production in Third Pole | Rice Production in Third Pole likely exposed to Very Low Flood Risk (%) | Rice Production in Third Pole likely exposed to Low Flood Risk (%) | Rice Production in Third Pole likely exposed to Medium Flood Risk (%) | Rice Production in Third Pole likely exposed to High Flood Risk (%) | Rice Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 91.0 | 0.2 | 12.6 | 34.9 | 31.6 | 6.7 |
| Bangladesh | 6.6 | 0.0 | 0.0 | 0.0 | 5.3 | 0.7 |
| Bhutan | 100.0 | 0.0 | 27.9 | 100.0 | 100.0 | 0.0 |
| China | 4.5 | 0.0 | 0.0 | 0.5 | 2.8 | 1.2 |
| India | 35.9 | 0.0 | 0.0 | 0.4 | 10.4 | 24.9 |
| Kazakhstan | 44.2 | 0.0 | 0.1 | 27.0 | 17.6 | 0.0 |
| Kyrgyzstan | 100.0 | 0.0 | 23.4 | 38.7 | 27.2 | 0.0 |
| Mongolia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Myanmar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 6.5 | 35.3 | 61.4 |
| Pakistan | 89.5 | 0.0 | 0.0 | 0.3 | 7.4 | 85.7 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 0.3 | 21.3 | 59.6 | 38.6 | 0.0 |
| Turkmenistan | 14.4 | 0.0 | 0.0 | 11.2 | 3.3 | 0.0 |
| Uzbekistan | 52.8 | 0.0 | 16.3 | 22.8 | 16.4 | 0.0 |

## JJAS 2024 Season

| Country | % of Total Rice Production in Third Pole | Rice Production in Third Pole likely exposed to Very Low Flood Risk (%) | Rice Production in Third Pole likely exposed to Low Flood Risk (%) | Rice Production in Third Pole likely exposed to Medium Flood Risk (%) | Rice Production in Third Pole likely exposed to High Flood Risk (%) | Rice Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 91.0 | 0.0 | 5.5 | 34.7 | 43.4 | 2.3 |
| Bangladesh | 6.6 | 0.0 | 0.0 | 2.3 | 3.7 | 0.0 |
| Bhutan | 100.0 | 0.0 | 28.0 | 100.0 | 83.2 | 0.0 |
| China | 4.5 | 0.0 | 0.0 | 0.9 | 2.4 | 1.1 |
| India | 35.9 | 0.0 | 0.1 | 0.9 | 11.5 | 23.2 |
| Kazakhstan | 44.2 | 0.0 | 0.1 | 12.0 | 32.7 | 0.0 |
| Kyrgyzstan | 100.0 | 0.0 | 6.6 | 49.4 | 33.1 | 0.0 |
| Mongolia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Myanmar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 9.1 | 33.1 | 61.1 |
| Pakistan | 89.5 | 0.0 | 0.0 | 0.4 | 28.4 | 64.6 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 1.3 | 19.8 | 38.2 | 60.5 | 0.0 |
| Turkmenistan | 14.4 | 0.0 | 0.0 | 11.2 | 3.3 | 0.0 |
| Uzbekistan | 52.8 | 0.0 | 16.3 | 17.5 | 21.7 | 0.0 |

## Upcoming JJAS 2025 Season

# Third Pole : Maize Production Exposure

| Country | %of Total Maize Production in Third Pole | Maize Production in Third Pole likely exposed to Very Low Flood Risk (%) | Maize Production in Third Pole likely exposed to Low Flood Risk (%) | Maize Production in Third Pole likely exposed to Medium Flood Risk (%) | Maize Production in Third Pole likely exposed to High Flood Risk (%) | Maize Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 65.0 | 0.1 | 5.4 | 27.0 | 22.2 | 10.9 |
| Bangladesh | 22.3 | 0.0 | 0.0 | 0.0 | 17.7 | 0.4 |
| Bhutan | 100.0 | 0.0 | 13.4 | 72.3 | 15.8 | 0.0 |
| China | 7.3 | 0.0 | 0.2 | 2.4 | 4.3 | 0.5 |
| India | 18.6 | 0.0 | 0.0 | 2.1 | 5.7 | 11.1 |
| Kazakhstan | 90.2 | 0.0 | 3.3 | 34.2 | 55.7 | 0.0 |
| Kyrgyzstan | 100.0 | 0.0 | 20.8 | 52.8 | 17.3 | 0.0 |
| Mongolia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Myanmar | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 4.8 | 56.3 | 40.1 |
| Pakistan | 100.0 | 0.0 | 0.1 | 2.3 | 5.3 | 92.6 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 0.9 | 24.8 | 42.7 | 27.4 | 0.0 |
| Turkmenistan | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Uzbekistan | 49.0 | 0.0 | 13.9 | 29.3 | 16.8 | 0.0 |

JJAS 2024 Season

| Country | %of Total Maize Production in Third Pole | Maize Production in Third Pole likely exposed to Very Low Flood Risk (%) | Maize Production in Third Pole likely exposed to Low Flood Risk (%) | Maize Production in Third Pole likely exposed to Medium Flood Risk (%) | Maize Production in Third Pole likely exposed to High Flood Risk (%) | Maize Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 65.0 | 0.1 | 6.6 | 28.1 | 27.5 | 3.4 |
| Bangladesh | 22.3 | 0.0 | 0.0 | 10.7 | 7.3 | 0.0 |
| Bhutan | 100.0 | 0.0 | 14.7 | 78.5 | 8.3 | 0.0 |
| China | 7.3 | 0.0 | 0.2 | 2.2 | 4.3 | 0.5 |
| India | 18.6 | 0.0 | 0.2 | 2.5 | 5.2 | 11.1 |
| Kazakhstan | 90.2 | 0.0 | 0.3 | 31.0 | 61.9 | 0.0 |
| Kyrgyzstan | 100.0 | 0.0 | 9.1 | 54.1 | 27.8 | 0.0 |
| Mongolia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Myanmar | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 6.9 | 57.6 | 36.6 |
| Pakistan | 100.0 | 0.0 | 0.1 | 2.4 | 16.1 | 81.8 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 1.8 | 23.3 | 30.6 | 40.0 | 0.0 |
| Turkmenistan | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Uzbekistan | 49.0 | 0.0 | 13.9 | 23.3 | 22.8 | 0.0 |

Upcoming JJAS 2025 Season

# Third Pole : Wheat Production Exposure

| Country | % of Total Wheat Production in Third Pole | Wheat Production in Third Pole likely exposed to Very Low Flood Risk (%) | Wheat Production in Third Pole likely exposed to Low Flood Risk (%) | Wheat Production in Third Pole likely exposed to Medium Flood Risk (%) | Wheat Production in Third Pole likely exposed to High Flood Risk (%) | Wheat Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 69.2 | 0.7 | 30.1 | 30.1 | 18.5 | 3.5 |
| Bangladesh | 23.1 | 0.0 | 0.0 | 0.0 | 18.6 | 0.1 |
| Bhutan | 100.0 | 0.0 | 82.9 | 82.9 | 20.7 | 0.0 |
| China | 6.4 | 0.0 | 1.8 | 1.8 | 4.1 | 0.5 |
| India | 61.0 | 0.0 | 0.4 | 0.4 | 15.2 | 45.0 |
| Kazakhstan | 12.6 | 0.0 | 6.7 | 6.7 | 3.8 | 0.0 |
| Kyrgyzstan | 100.0 | 0.1 | 79.4 | 79.4 | 9.4 | 0.0 |
| Mongolia | 37.8 | 0.0 | 15.4 | 15.4 | 19.7 | 2.5 |
| Myanmar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.4 | 0.4 | 19.4 | 82.6 |
| Pakistan | 97.7 | 0.0 | 1.2 | 1.2 | 7.5 | 90.3 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 2.8 | 41.3 | 41.3 | 18.7 | 0.0 |
| Turkmenistan | 0.4 | 0.0 | 0.7 | 0.7 | 0.2 | 0.0 |
| Uzbekistan | 71.5 | 0.0 | 32.1 | 32.1 | 18.7 | 0.0 |

## JJAS 2024 Season

| Country | % of Total Wheat Production in Third Pole | Wheat Production in Third Pole likely exposed to Very Low Flood Risk (%) | Wheat Production in Third Pole likely exposed to Low Flood Risk (%) | Wheat Production in Third Pole likely exposed to Medium Flood Risk (%) | Wheat Production in Third Pole likely exposed to High Flood Risk (%) | Wheat Production in Third Pole likely exposed to Very High Flood Risk (%) |
|---|---|---|---|---|---|---|
| Afghanistan | 69.2 | 0.4 | 13.6 | 35.5 | 17.7 | 0.9 |
| Bangladesh | 23.1 | 0.0 | 0.0 | 4.8 | 13.9 | 0.0 |
| Bhutan | 100.0 | 0.0 | 14.6 | 93.9 | 7.5 | 0.0 |
| China | 6.4 | 0.0 | 0.2 | 2.0 | 3.9 | 0.4 |
| India | 61.0 | 0.0 | 0.0 | 1.1 | 15.4 | 44.2 |
| Kazakhstan | 12.6 | 0.0 | 0.5 | 9.8 | 2.9 | 0.0 |
| Kyrgyzstan | 100.0 | 0.0 | 12.5 | 77.5 | 14.0 | 0.0 |
| Mongolia | 37.8 | 0.0 | 2.4 | 14.7 | 16.2 | 4.5 |
| Myanmar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nepal | 100.0 | 0.0 | 0.0 | 0.4 | 19.7 | 82.4 |
| Pakistan | 97.7 | 0.0 | 0.0 | 1.5 | 31.8 | 65.8 |
| Russian Federation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tajikistan | 100.0 | 4.4 | 34.9 | 29.8 | 31.4 | 0.0 |
| Turkmenistan | 0.4 | 0.0 | 0.0 | 0.7 | 0.2 | 0.0 |
| Uzbekistan | 71.5 | 0.0 | 19.9 | 23.6 | 27.4 | 0.0 |

## Upcoming JJAS 2025 Season

ESCAP
Economic and Social Commission for Asia and the Pacific

# THANK YOU !!