

MAPPING SOUTH ASIAN REGIONAL FUNCTIONAL AGROBIODIVERSITY TO SUSTAINABLY IMPROVE PRODUCTION, FOOD, AND NUTRITION OUTCOMES

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RATIONALE

- Functional agricultural biodiversity enhances food system outcomes. It -
 - mitigates production risks.
 - extends and diversifies incomes and livelihoods.
 - supports healthy diets.
- Large-scale regional patterns and relationships of agricultural biodiversity in South Asia are underexplored.
- A greater understanding of these patterns can inform decision-making and strategies.
- The goal is to sustainably increase productivity and food and nutritional diversity in South Asia.

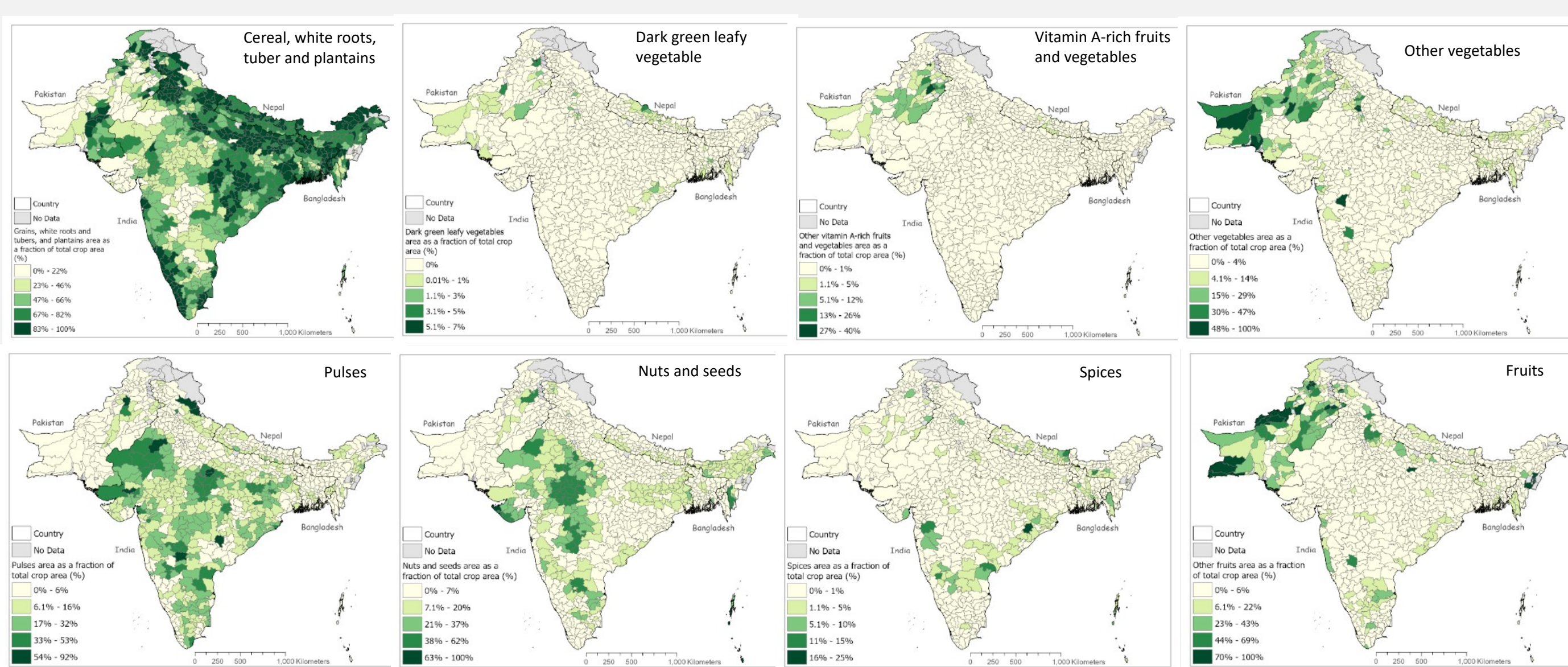


Fig 1. Where foods are grown. Crop area as a fraction of total agricultural area in a district by major crop type.



Fig 2. Production in terms of food group. Top left (Bangladesh), top right (India), bottom left (Nepal) and bottom right (Pakistan)

OBJECTIVE

- To explore the spatial distribution and pattern of available recent crop production data from district level and by dietary food group
- To quantify their species and functional diversity score and analyze the spatial pattern for hotspot and cold spot at production and diversity level.

METHODS

- Created a latest South Asian regional agricultural biodiversity composite database (2016 - 2021) from sub-national open crop production and area data from Bangladesh, India, Nepal, and Pakistan.
- Geolocated the data and generated district-level production maps of major food groups and classify them into a composite dietary food group as per Household Dietary Diversity Score (HDDS) & Minimum Dietary Diversity for Women (MDD-W).
- Assessed dietary food group production diversity/functional agrobiodiversity based on the classified production data using Shannon entropy diversity index.

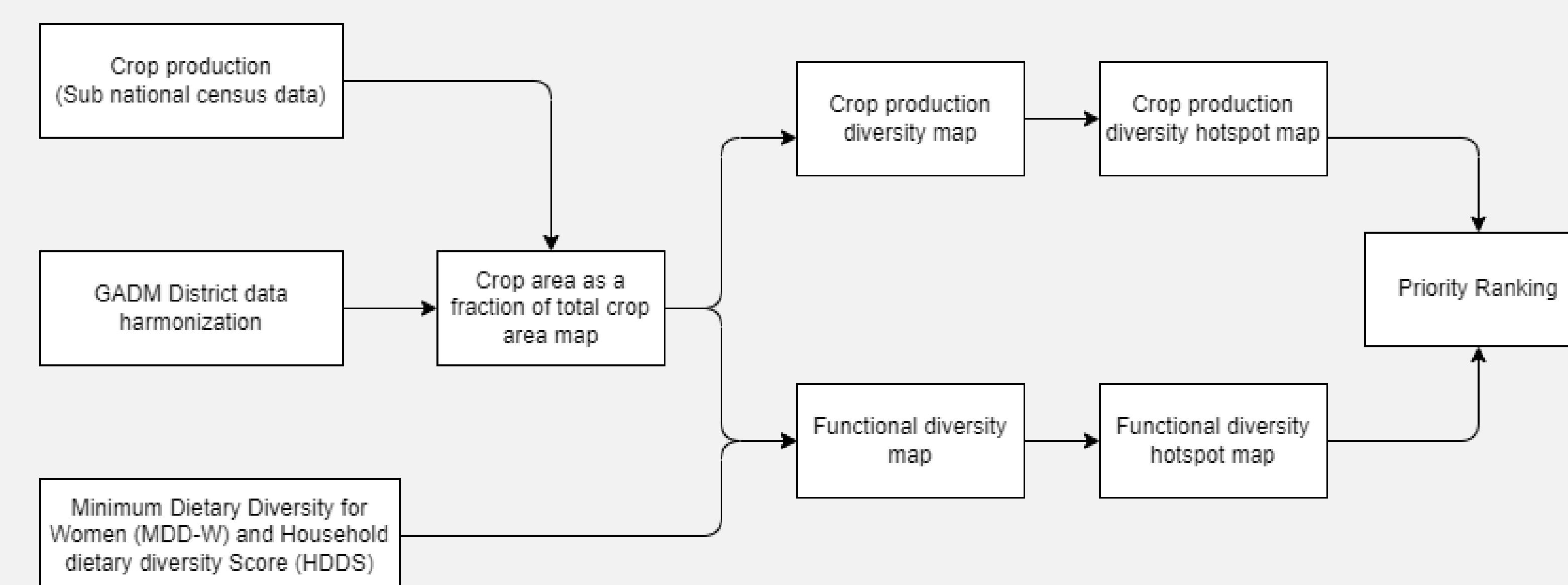


Fig 3. Methodological framework

Shannon diversity calculation function

$$H = -\sum_{i=1}^S (P_i \times \ln P_i)$$

Where:

H = Shannon

P_i = fraction of the entire population made up of species i

$\ln(P_i)$ = the natural log of above

S (numbers of species encountered) = sum from species from species 1 to species S

Pattern Detection and Clustering

- Pattern: Spatial Autocorrelation (Global Moran's I statistic)
- Cluster (Hot and Cold Spot): Optimized Hot Spot Analysis

RESULTS

- The functional diversity was generally low (0.75 to 1.15) across all four countries.
- Higher dietary food group production diversity was observed in Southwestern regions of Bangladesh and India, Central eastern Pakistan, and throughout Nepal.
- Crop/species diversity scores were significantly higher for Bangladesh (2.52) and Nepal (2.42) compared to India (1.35) and Pakistan (1.42) and almost double compared to their functional diversity.
- Found low to moderate positive spatial autocorrelation (Clustered Pattern) for all the food group and diversity indices.
- Identified 4 hotspot (red) and 6 coldspot (blue) of functional diversity with a spatial covering in all 4 country (fig.8).
- Finally, 9 priority cluster identified based on species and functional diversity from low-low diversity coldspot to high-high diversity hotspot (fig. 9) and the Indian Indo-Gangetic Plain from Punjab to west of West Bengal showed mostly the low-low to low-moderate cluster.

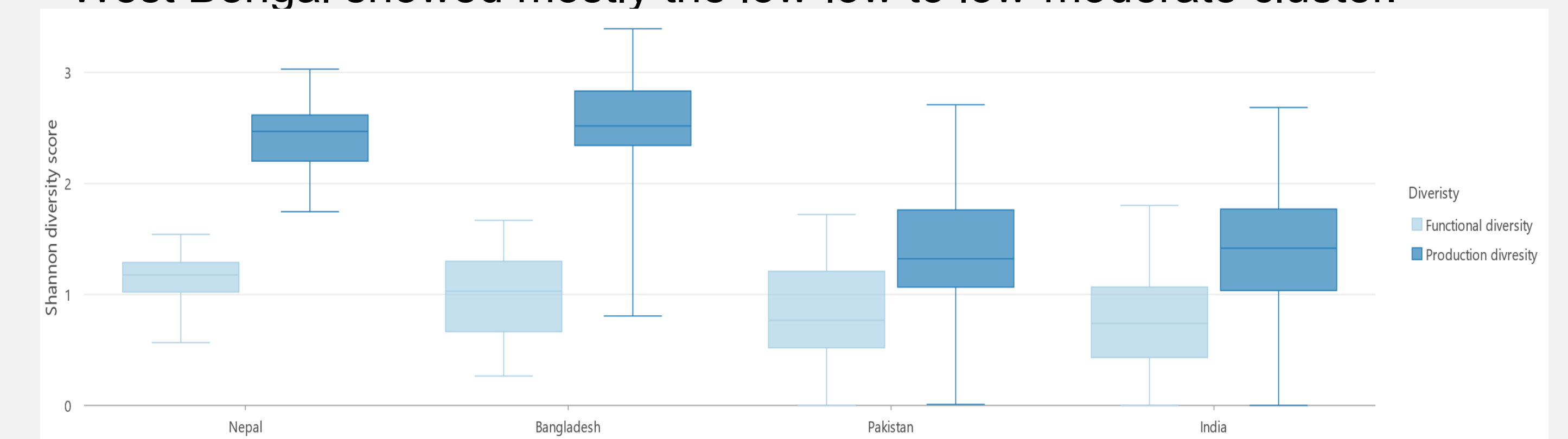


Fig 4. Distribution of production and dietary food group diversity

IMPLICATIONS

- Innovative mapping for examining spatial diversity in crop and dietary food group production.
- Aims to ensure healthier diets and enhance climate-resilient food production.
- Supports researchers and policy makers in understanding food system diversification.
- Helps target and identifies districts and regions for improved agrobiodiversity and increased nutrient production through dietary diverse production and consumption system in South Asia.

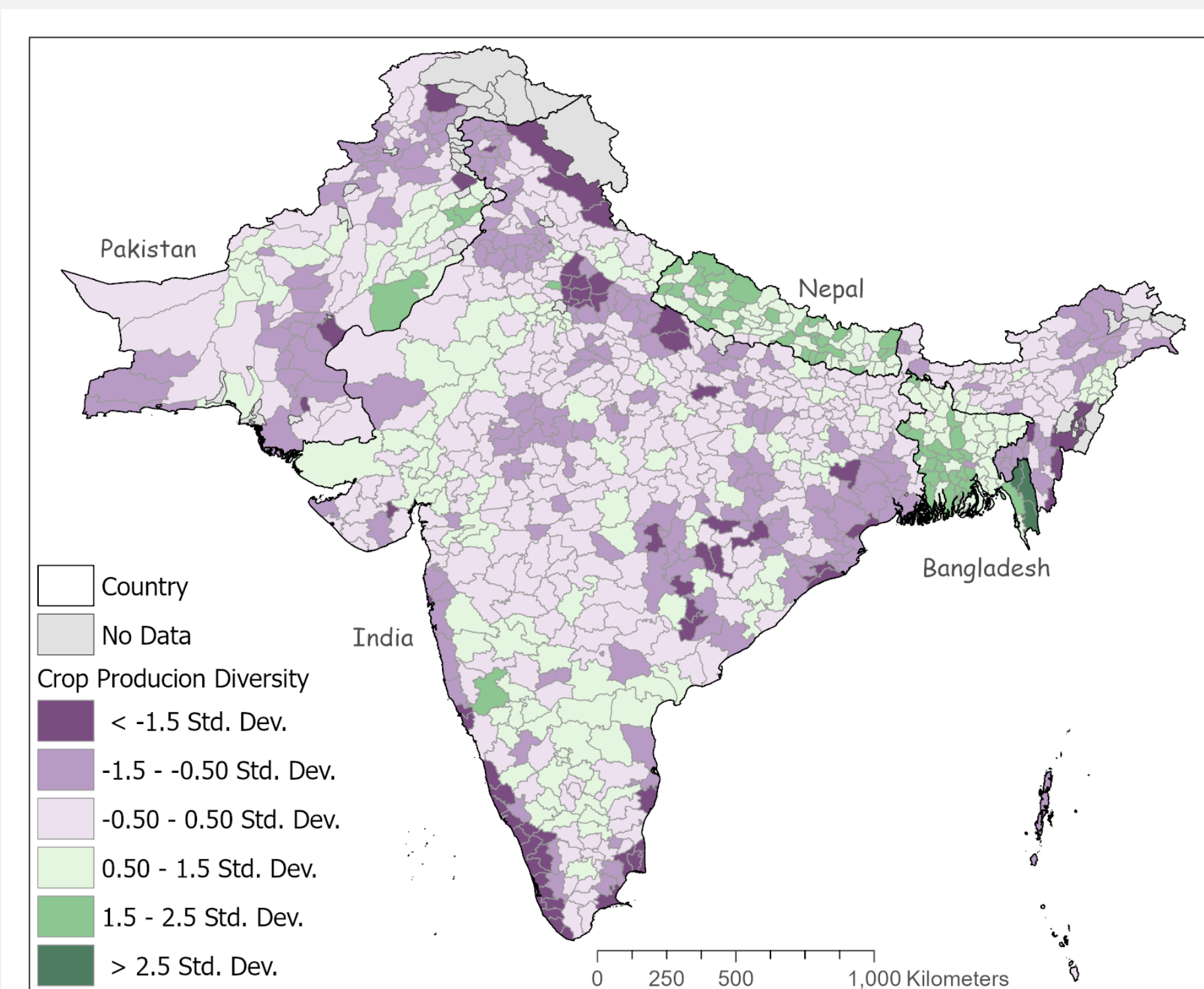


Fig 5. Distribution of crop production diversity score

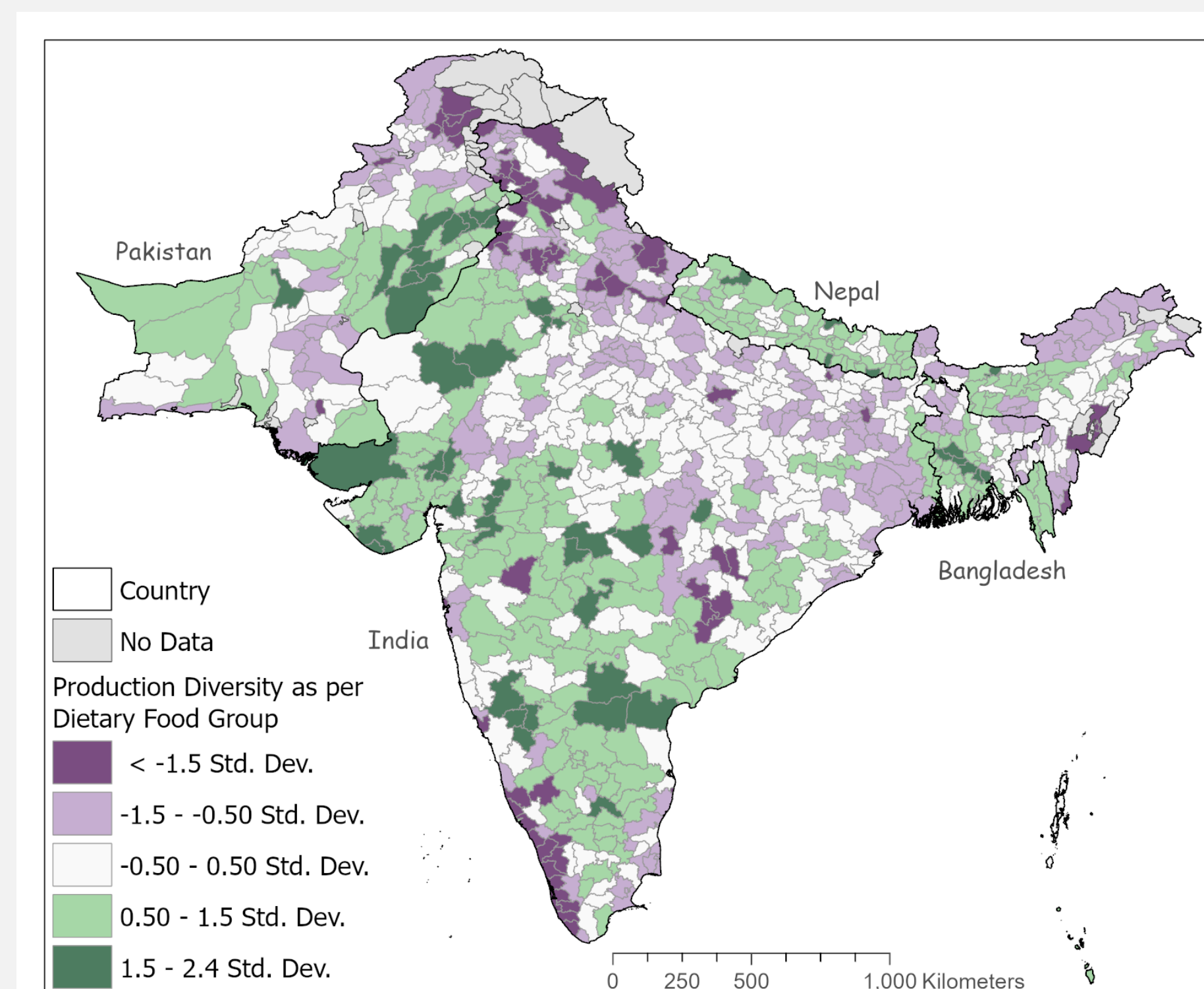


Fig 6. Distribution of functional diversity score

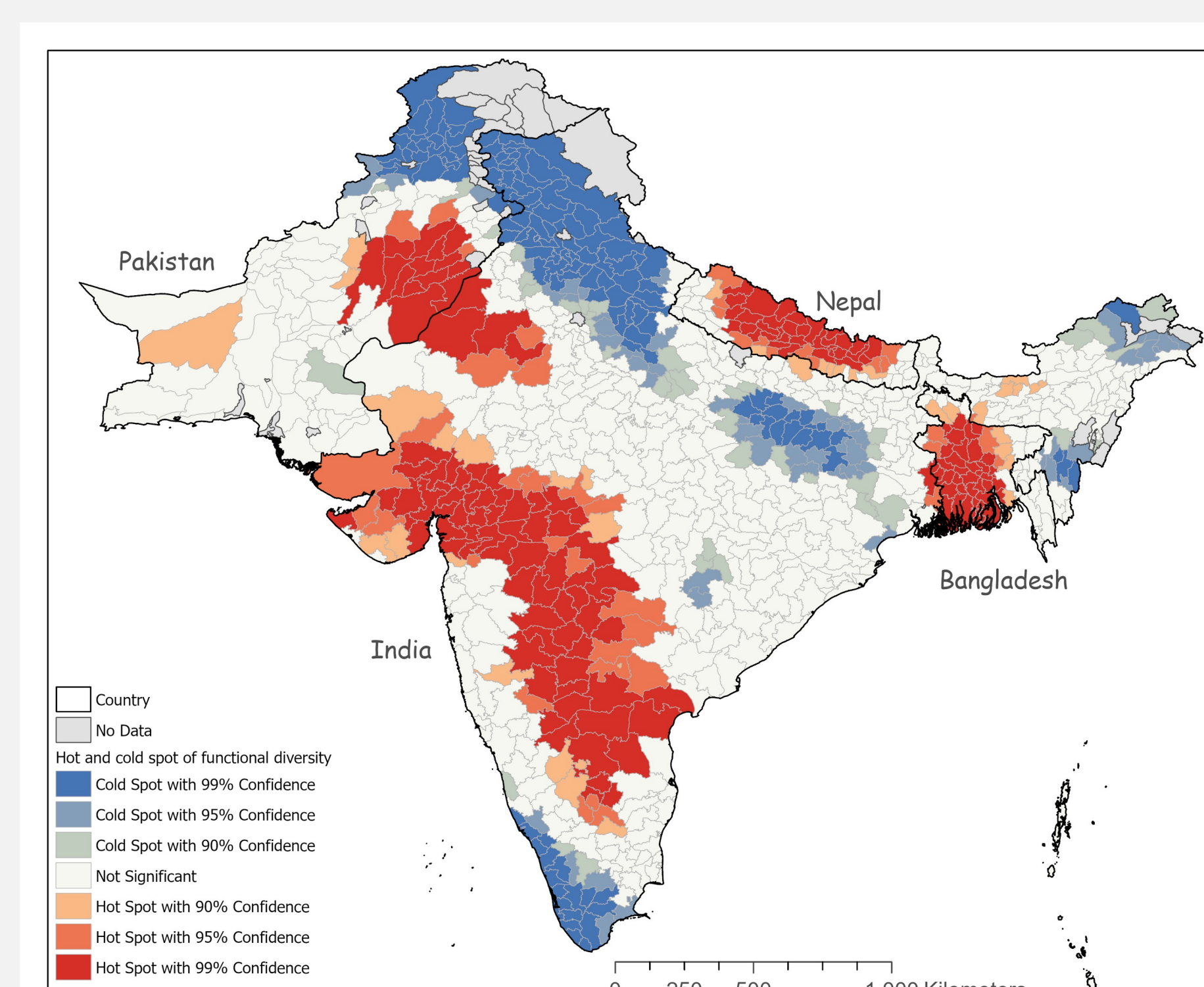


Fig 7. Functional diversity hotspot and coldspot

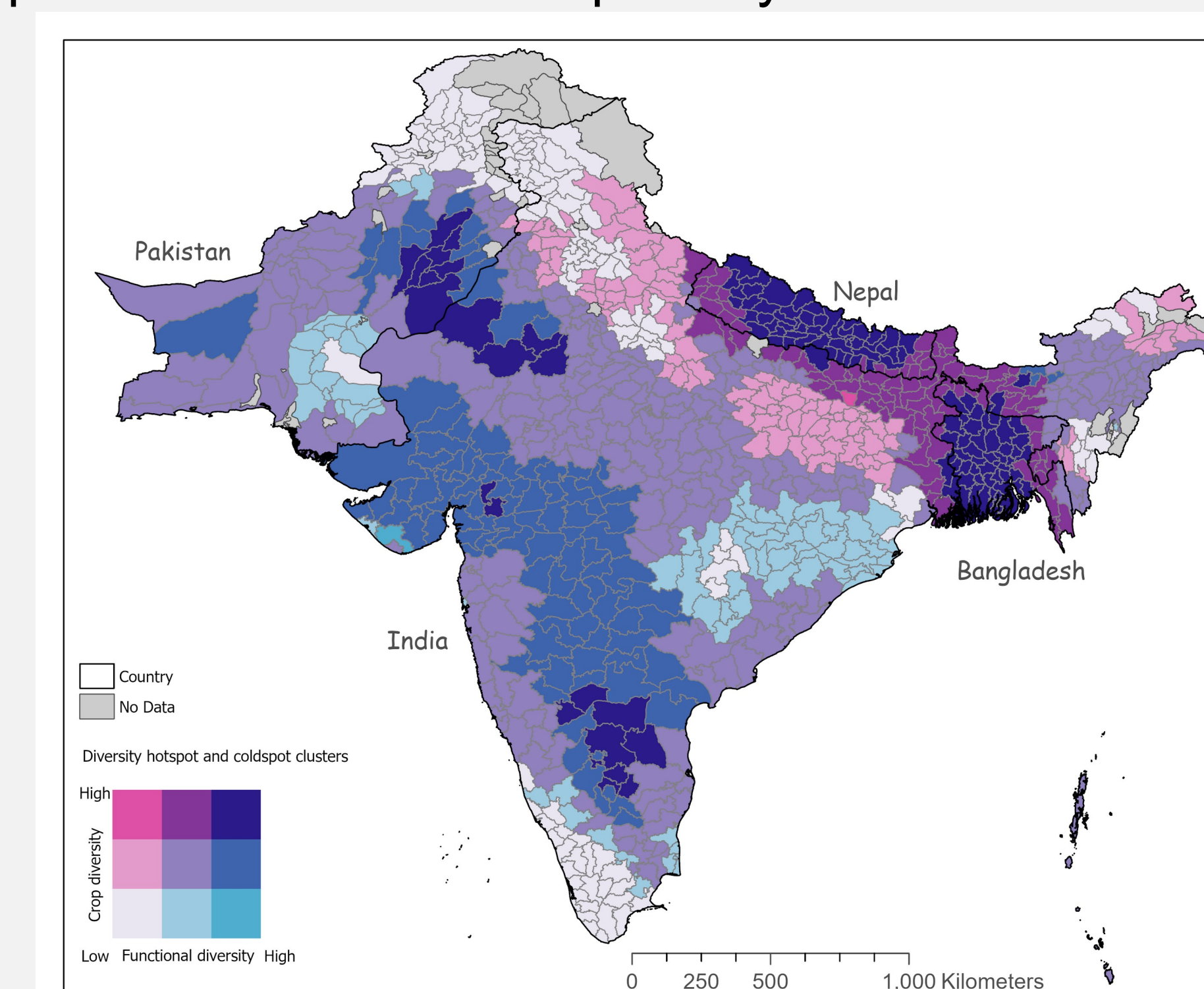


Fig 8. Priority matrix based on species and functional production diversity hotspot and coldspot