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# Climate Variability and Child Undernutrition in Cambodia

## Spatial Analysis of DHS 2021–2022 and Satellite-Derived Environmental Data

Presented by –
PAV Pichsokkim

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## ✸ Research team members

Mr. UM Samnang

Mrs. PAV Pichsokkim

Mr. PHAN Channarong

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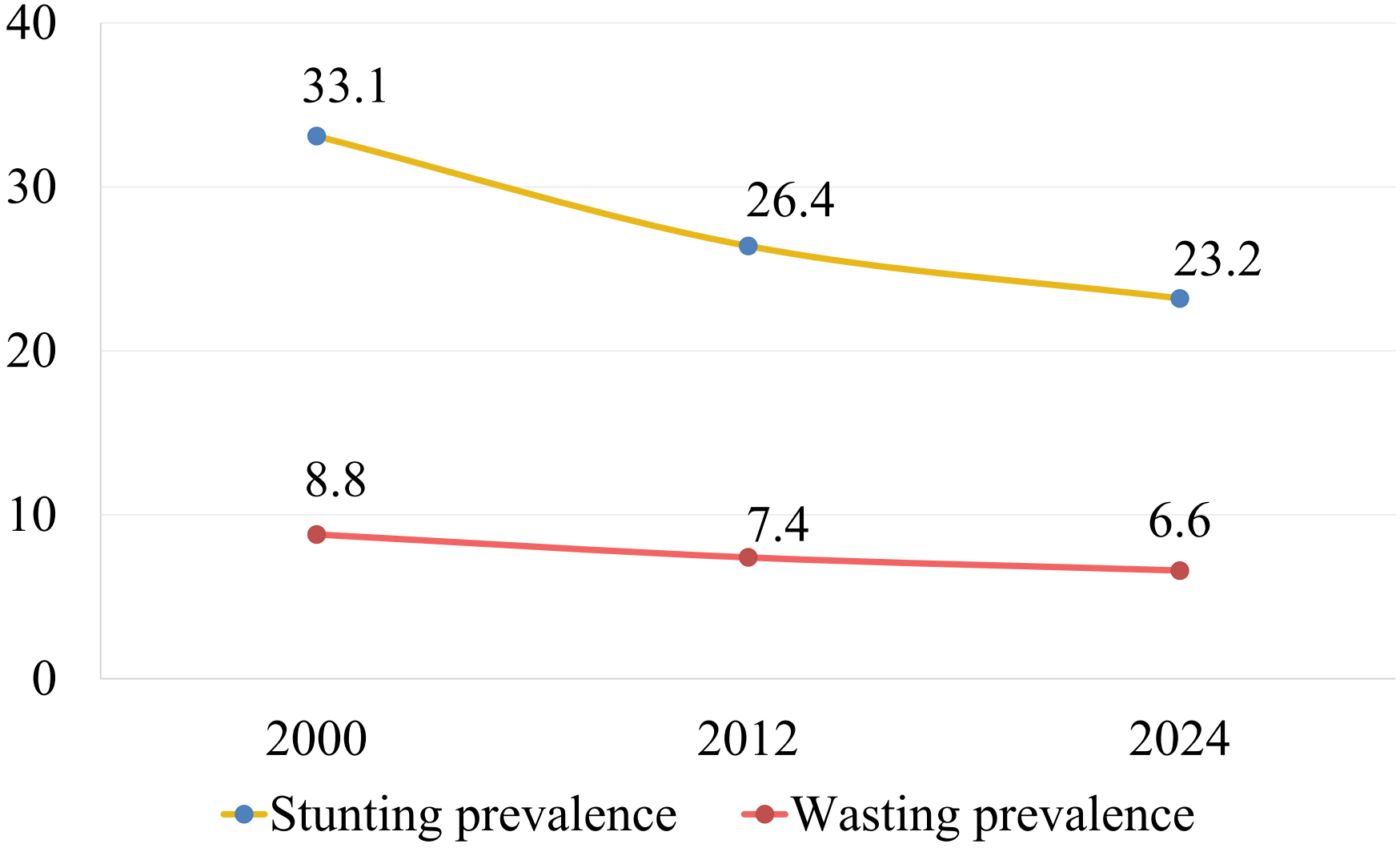
# I. BACKGROUND & RATIONALE

## Global & Regional Context

- Undernutrition contributes to nearly 50% of global child deaths(1).
- Southeast Asia Stunting: ~27.4% (2,3) .
- Cambodia's Target (SDG 2.2): Reduce stunting to 19% and wasting <5% by 2030 (4).

# Global context: progress in child malnutrition has slowed




**2024 global burden**

**150.2 million**

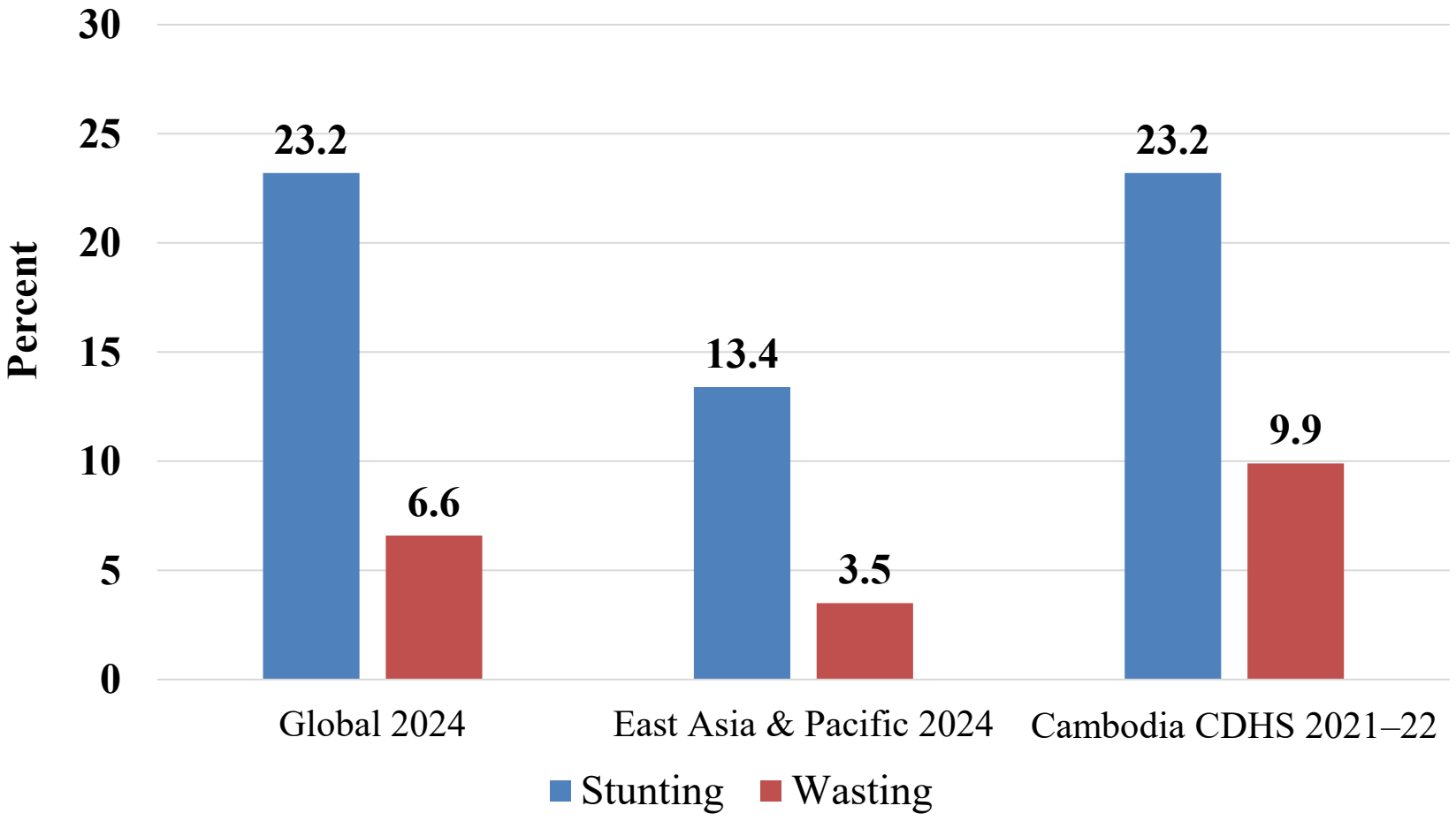
children affected by stunting

**42.8 million**

children affected by wasting

Source: UNICEF/WHO/World Bank JME, 2025

# Cambodia’s burden exceeds the East Asia and Pacific average




## Descriptive comparison

Cambodia’s stunting prevalence was similar to the global estimate but substantially higher than the regional average.

Wasting was higher than both reference estimates.

Cambodia's Target (SDG 2.2): Reduce stunting to 19% and wasting <5% by 2030.

Source: UNICEF/WHO/World Bank JME, 2025

# I. BACKGROUND & RATIONALE

- Cambodia faces increasing climate-related threats (e.g., droughts, floods, irregular rainfall, and increasing temperature) that damage agriculture and food systems.
- The Cambodia Climate Change Strategic Plan (2024–2033) (5) emphasizes protecting vulnerable populations, including children. Child undernutrition remains a major public health challenge—one of the leading causes of morbidity and mortality among children under five.
- The government's School Feeding Policy (2024–2035) (6) targets nutritional improvement in school-age children, especially in food-insecure regions.
- There is a critical evidence gap linking climate change and child nutritional outcomes using national data.
- This study uses the 2022 Cambodia DHS and remote sensing data to explore how climate data and environmental stressors impact child malnutrition across regions.
- Findings will support climate-resilient nutrition strategies and targeted public health interventions.

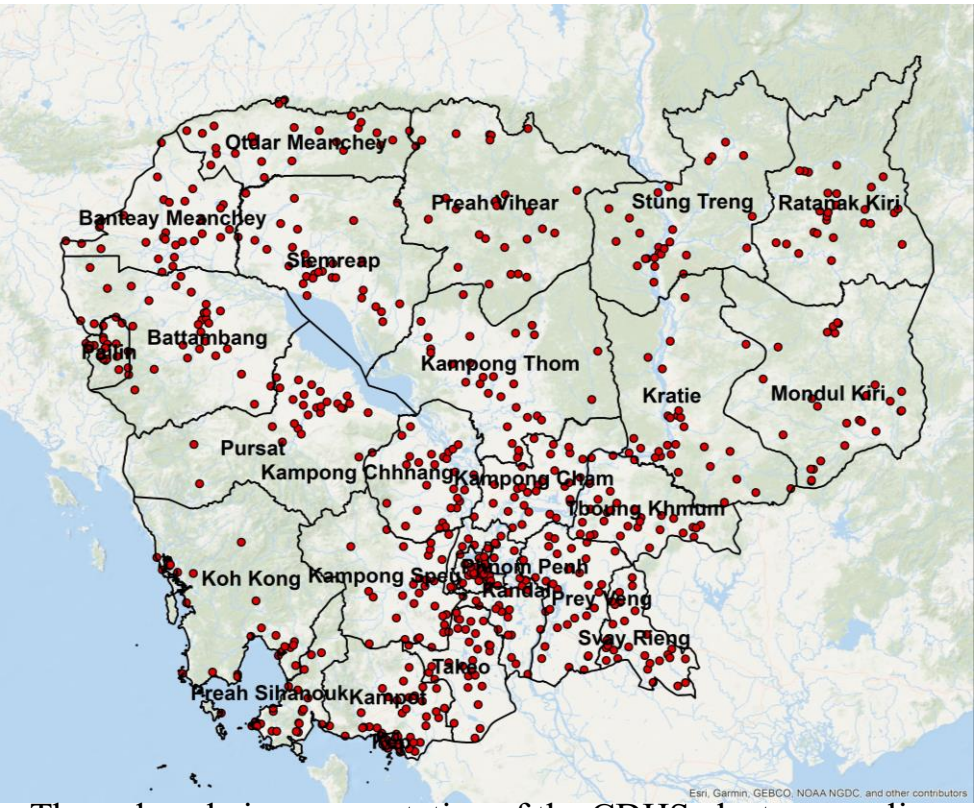
# I. BACKGROUND & RATIONALE

## The Knowledge Gap

- Socioeconomic factors are well-documented, but **climate variability** remains under-researched.
- How do temperature, rainfall, and drought intersect with maternal education and poverty across space?

**Objective: Assess spatial clustering of undernutrition and evaluate cluster-level ecological associations with hydro-climatic vulnerabilities.**

# II. Methodology - Data Management and Source

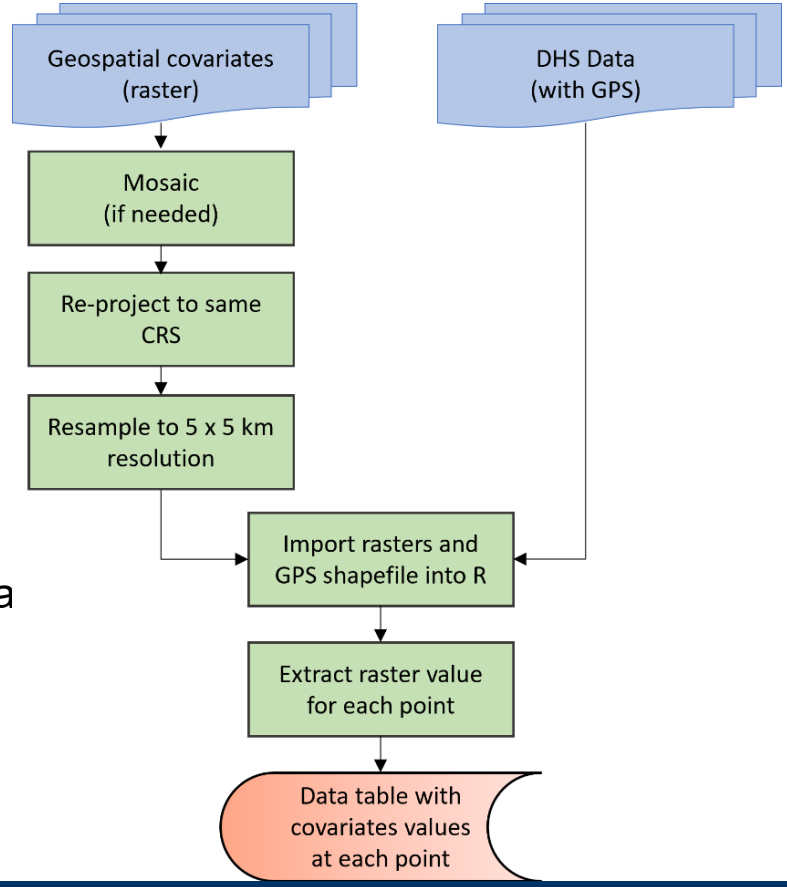



The red cycle is representative of the CDHS cluster sampling

**This project will use data from three sources:**

**1.** Child anthropometric and individual-level data were obtained from the Cambodia DHS 2021–2022. We recalculated the outcome variables—stunting, wasting, and underweight—based on children's age, sex, height, and weight (WHO 2006).

**2.** Climate and environmental variables were generated through raster-based calculations from remote sensing and global datasets, extracted using R software.




3. The Cambodia boundaries shapefile was obtained from Open Development Cambodia (ODC). https://opendevelopmentcambodia.net/layers

4. Finally, all datasets were cleaned and merged into a single georeferenced dataset for analysis.

# II. DATA INTEGRATION FRAMEWORK

### Health Data

CDHS 2021-2022

706 georeferenced clusters

Stunting, Wasting, Underweight prevalence

### Satellite Data

MODIS (LST, EVI)

CHIRPS (Rainfall, Wet Days)

CRU TS (Air Temp, PET)

### Spatial Analysis

UTM Zone 48N Projection

Buffer-based raster extraction

Getis-Ord Gi* Hotspots

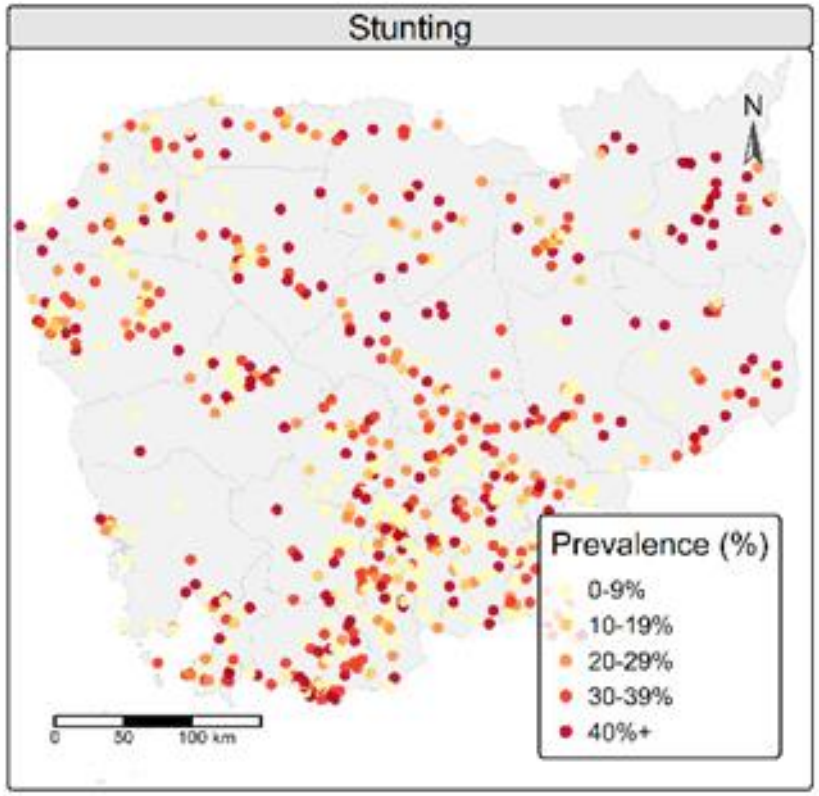
**Statistical Approach:** Multivariable linear regression models controlling for household poverty, maternal education, and cluster-level WASH access.

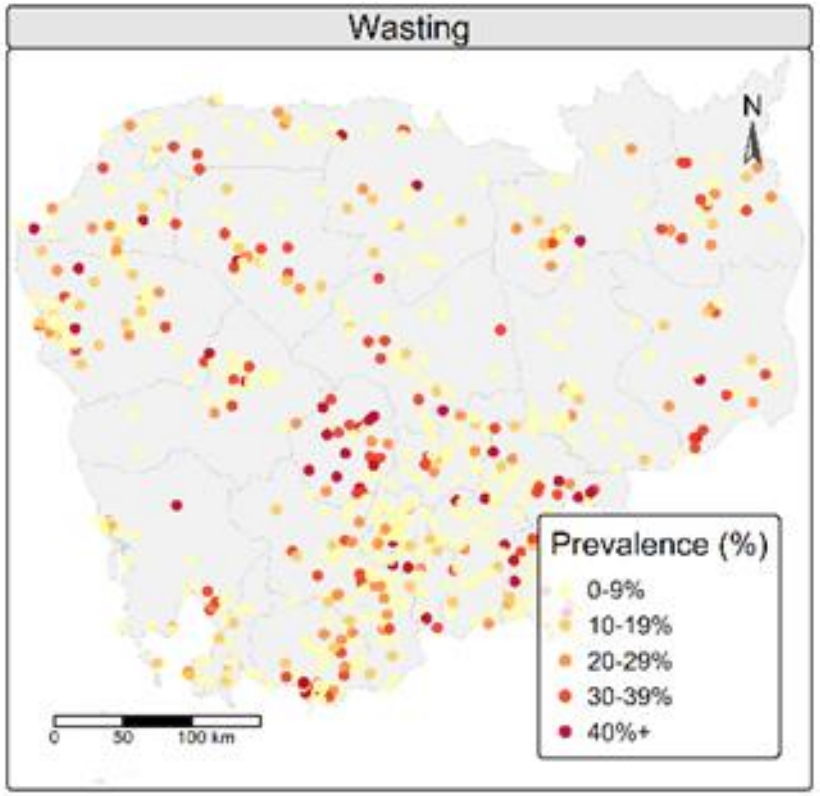
# III. a. SPATIAL DISTRIBUTION OF UNDERNUTRITION

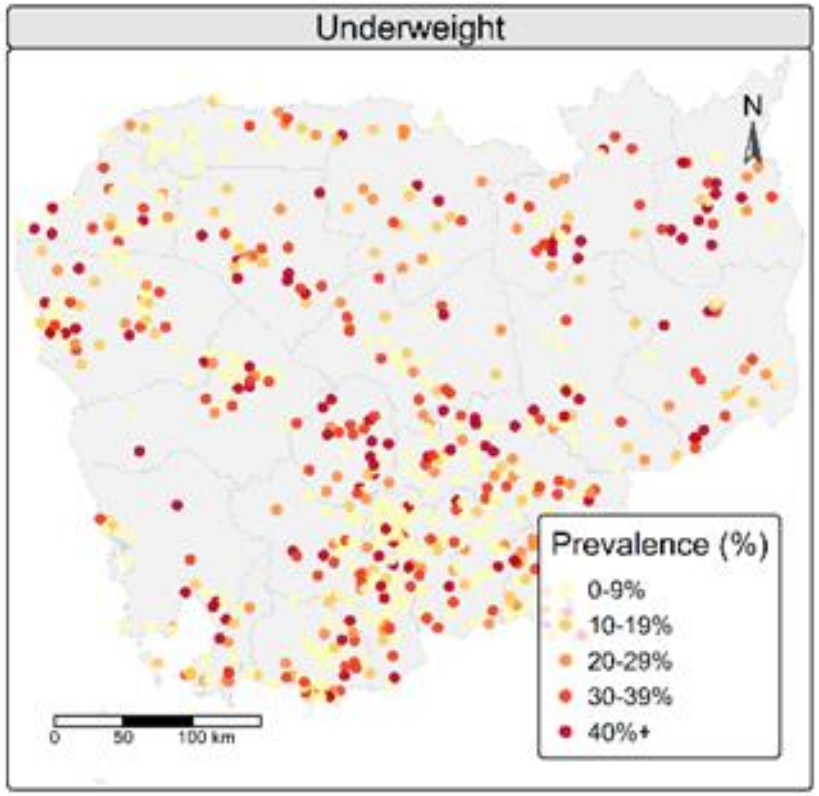
Stunting was 23.2%

Wasting was 10%

Underweight was 16.4%



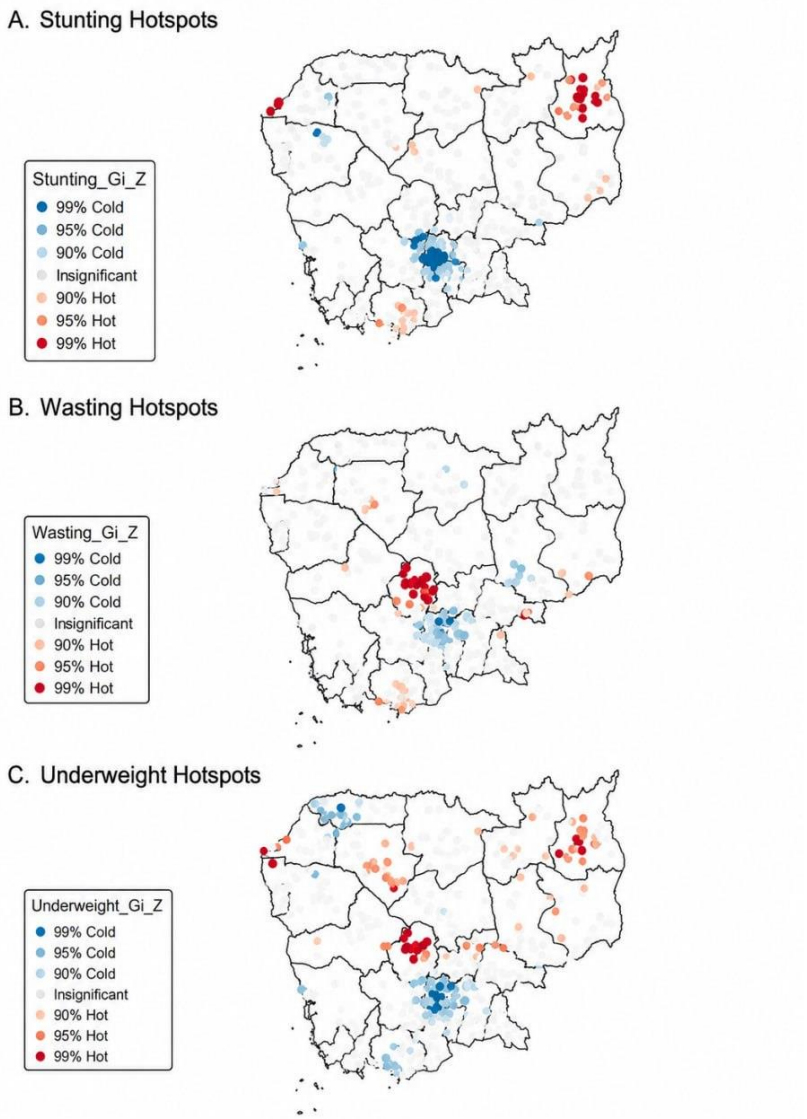




**Stunting Concentration:** Northeast provinces (Ratanakkiri, Mondulkiri).

**Wasting Patterns:** Dispersed in southern and central regions.

**Overlap:** High underweight rates overlap significantly with stunting hotspots.

# III. b.STATISTICAL RISK MAPPING (GI*)




## Hotspot Identification

**Stunting Hotspots:** Heavily clustered in the Northeast corridor. β = 1.33 for EVI suggests isolation in forest regions.

**Coldspots:** Concentrated in urban cores (Phnom Penh) and central lowland plains.

**Significance:** Nutritional risk is not randomly distributed; it follows structural ecological and regional lines.

# III. c.THE ENVIRONMENTAL CONTEXT

**Temperature**

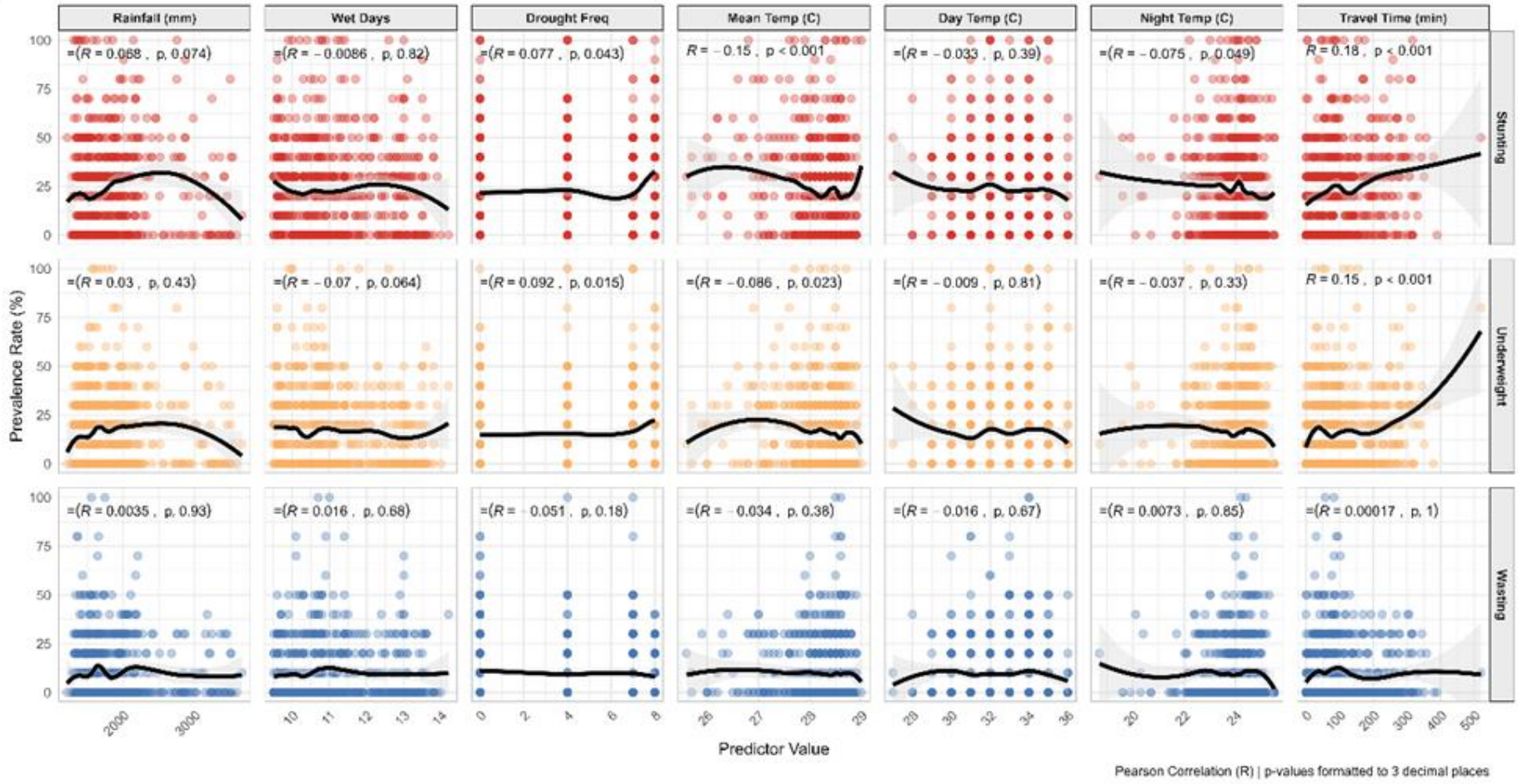
Day LST Mean: 32.9°C
Max LST: 36.4°C

**Moisture**

Annual Rainfall: 1,814 mm
Wet Days: 11/year

**Landscape**

EVI: 0.3 (Mean)
Elevation Max: 813.7m



# III. d.DETERMINANTS OF STUNTING (MULTIVARIABLE)

**β = 1.33**

**Enhanced Vegetation Index (EVI)**

A 0.1 unit increase in EVI is associated with a significant rise in stunting log-prevalence (p = 0.014).

**β = 0.27**

**Low Maternal Education**

Universal risk factor across all nutritional phenotypes (p = 0.009).

**The "Greenness Paradox":** In the Northeast, high EVI acts as a proxy for **spatial isolation** and primary forest rather than agricultural productivity. Isolation limits access to diverse food markets and MoH services.

# III. e. DRIVERS OF UNDERWEIGHT & WASTING

### Underweight & Wet Days

$\beta = -0.16$

Higher frequency of annual **wet days** is a protective factor (p = 0.013).

Consistent rain supports "homestead food production" (gardens/poultry).

### Wasting & Drought

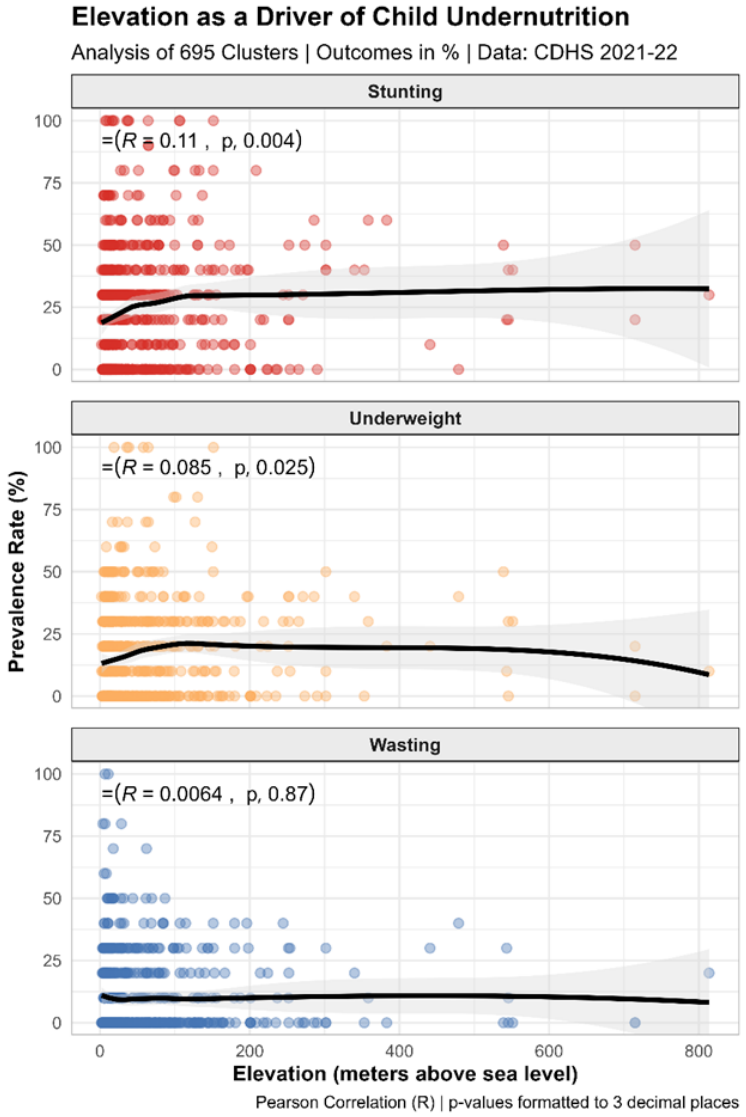
$p = 0.064$

Drought frequency shows marginal positive association with acute wasting.

Lack of irrigation buffers (only 6.8% coverage) makes southern plains vulnerable.

**Socioeconomic Constants:** Household poverty (β=0.24, p=0.011) remains a fundamental distal driver for underweight children.

# III. d.LANDSCAPE BARRIERS: ELEVATION & REMOTENESS




## Elevation Gradient

Significant positive correlation with Stunting (R=0.11) and Underweight (R=0.08).

## Travel Time Isolation

Mean travel time to cities in NE exceeds 100 minutes. Physical distance creates barriers to decentralized health services.

# IV. STRATEGIC RESPONSE FRAMEWORK

## Rapid Response (Short-Term)

- Integrate satellite hydro-climatic data into community nutrition surveillance.
- Strengthen **Early Warning, Early Action (EWEA)** systems
- Deploy mobile health outreach to high-EVI forest clusters.

## Building Resilience (Med-Term)

- Scale up culturally tailored, **climate-smart SBCC** (Social & Behavior Change) programs.
- Expand irrigation infrastructure to stabilize the "wet days" effect in agricultural zones.
- Strengthen sub-national health system capacity for climate shocks.

# IV. MULTI-SECTORAL POLICY INTEGRATION

**Unified Strategy 2025–2030**

Integrating the **National Strategy for Food Security & Nutrition** with the **National Climate Change Action Plan for Public Health.**

### Infrastructure

Reduce geographic disparities in the Northeast Plateau through investments in infrastructure, improved access to quality health services, and the equitable allocation of health resources

### Livelihoods

Promote diversified, climate-resilient farming to reduce forest reliance.

### WASH

Targeted water security in drought-prone southern clusters.

# SUMMARY

**Clear Spatial Signature:** Child stunting in Cambodia is not random; it is concentrated in Northeast highland corridors.

**Climate-Health Nexus:** High vegetation (isolation) and rainfall variability (wet days) are critical, non-traditional predictors.

**Maternal Education:** Remains the primary mediator of climate risk and household health resilience.

**Action Required:** Transition from generic support to **climate-sensitive, geographically targeted** interventions.

**Thank You for Your Attention**


# Research result dissemination

# V. REFERENCES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**Thank You for Your Attention**