

# South Asian Food Systems Futures & the Smallholder farmer

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NUTRITION

CORNELL UNIVERSITY

The Post-2015 Development Agenda links hunger, nutrition and agriculture under the SDG framework...

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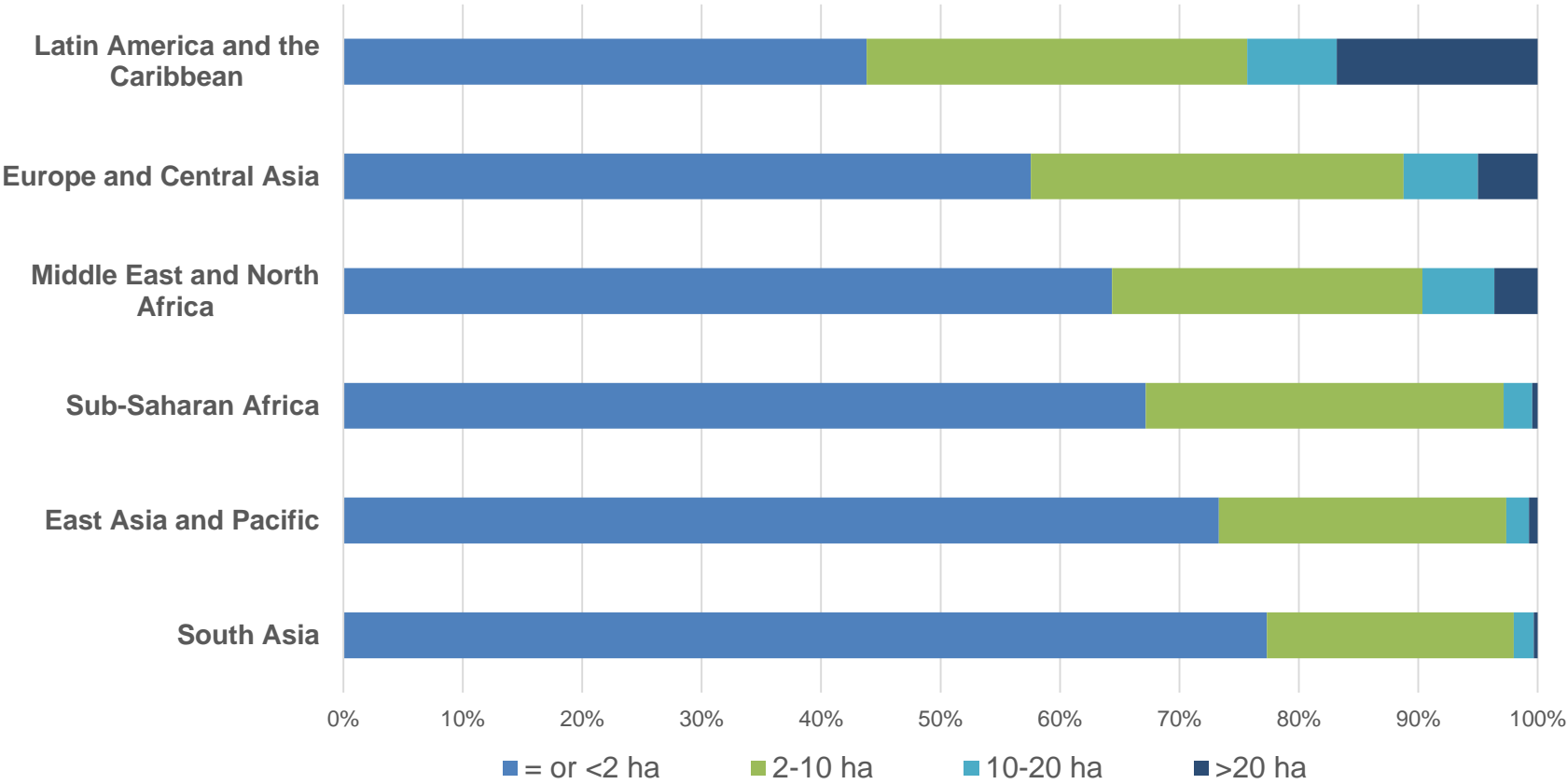
**GOAL 2**

END HUNGER, ACHIEVE FOOD SECURITY AND  
IMPROVED NUTRITION AND PROMOTE  
SUSTAINABLE AGRICULTURE

**SUSTAINABLE DEVELOPMENT GOALS**  
More at [sustainabledevelopment.un.org/sdgsproposal](http://sustainabledevelopment.un.org/sdgsproposal)

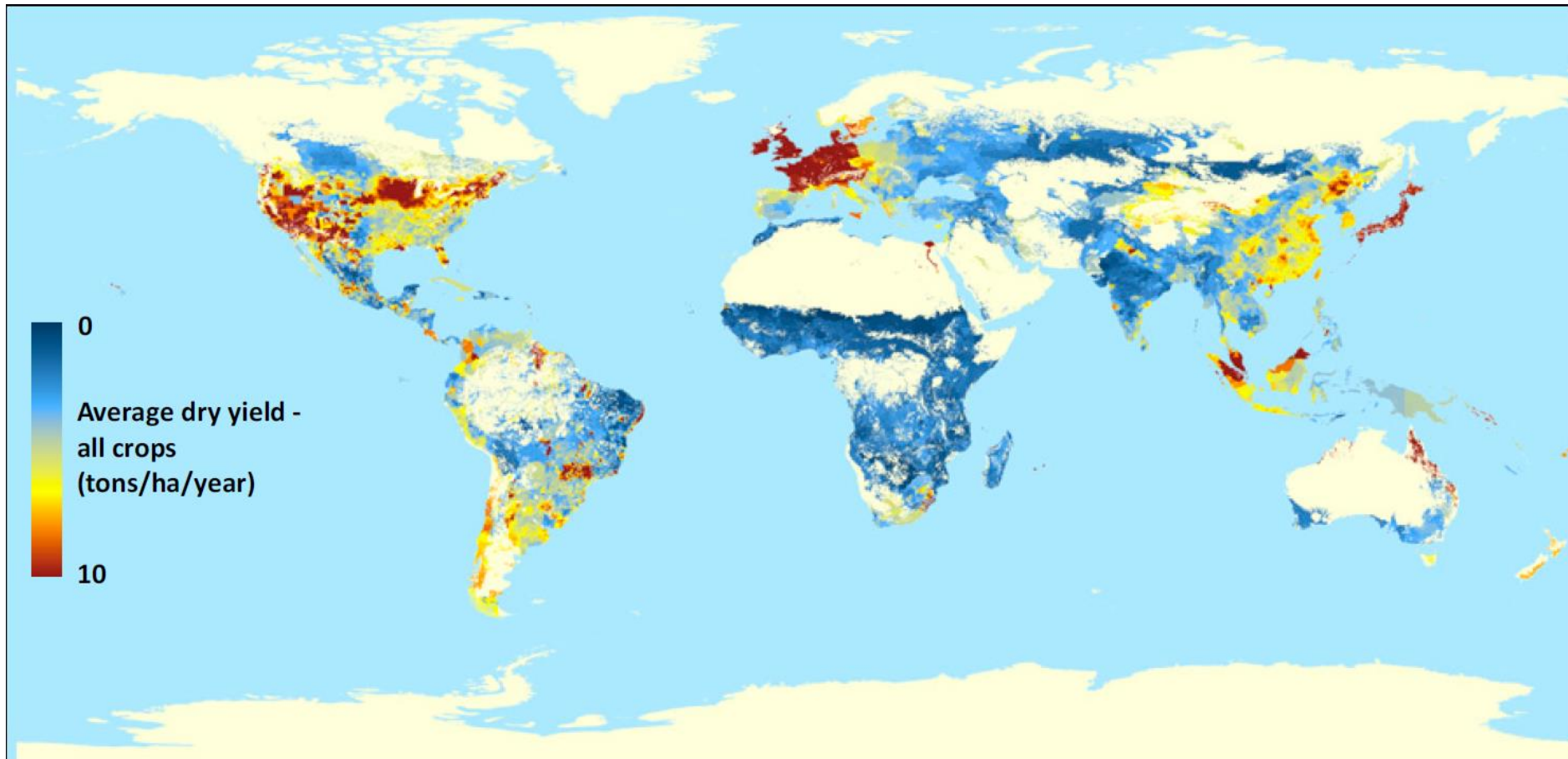
# Smallholder farms are central to achieving SDG2

**Average Share of Agricultural Holdings by Land Size Class**



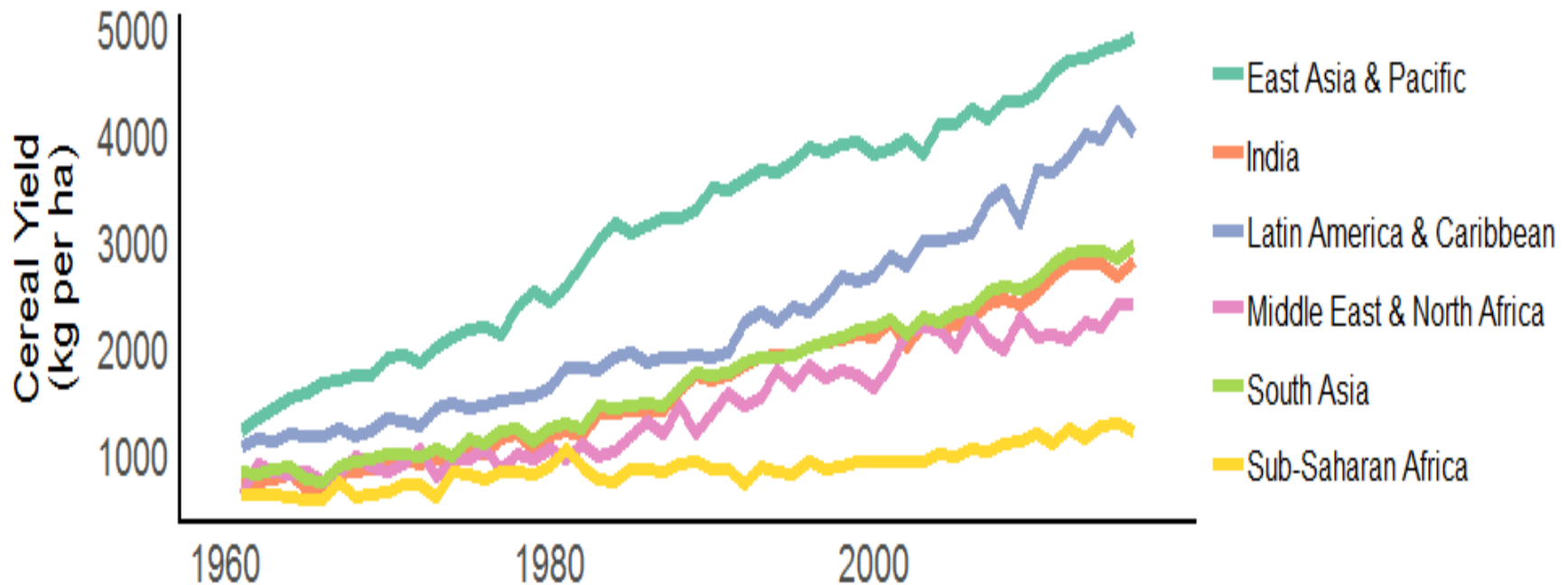
# Significant Opportunities to Boost Productivity

Cropland distribution and average annual yield



Source: West, P.C, et al., Nov 2010, "Trading Carbon for Food: Global comparison of carbon stocks vs. crop yields on agricultural land". PNAS, vol. 107, no. 46, 19647

# Global Trends in Cereal Yields



Regional trends in cereal yields, 1961 - 2016. (Data source: WDI, 2018).

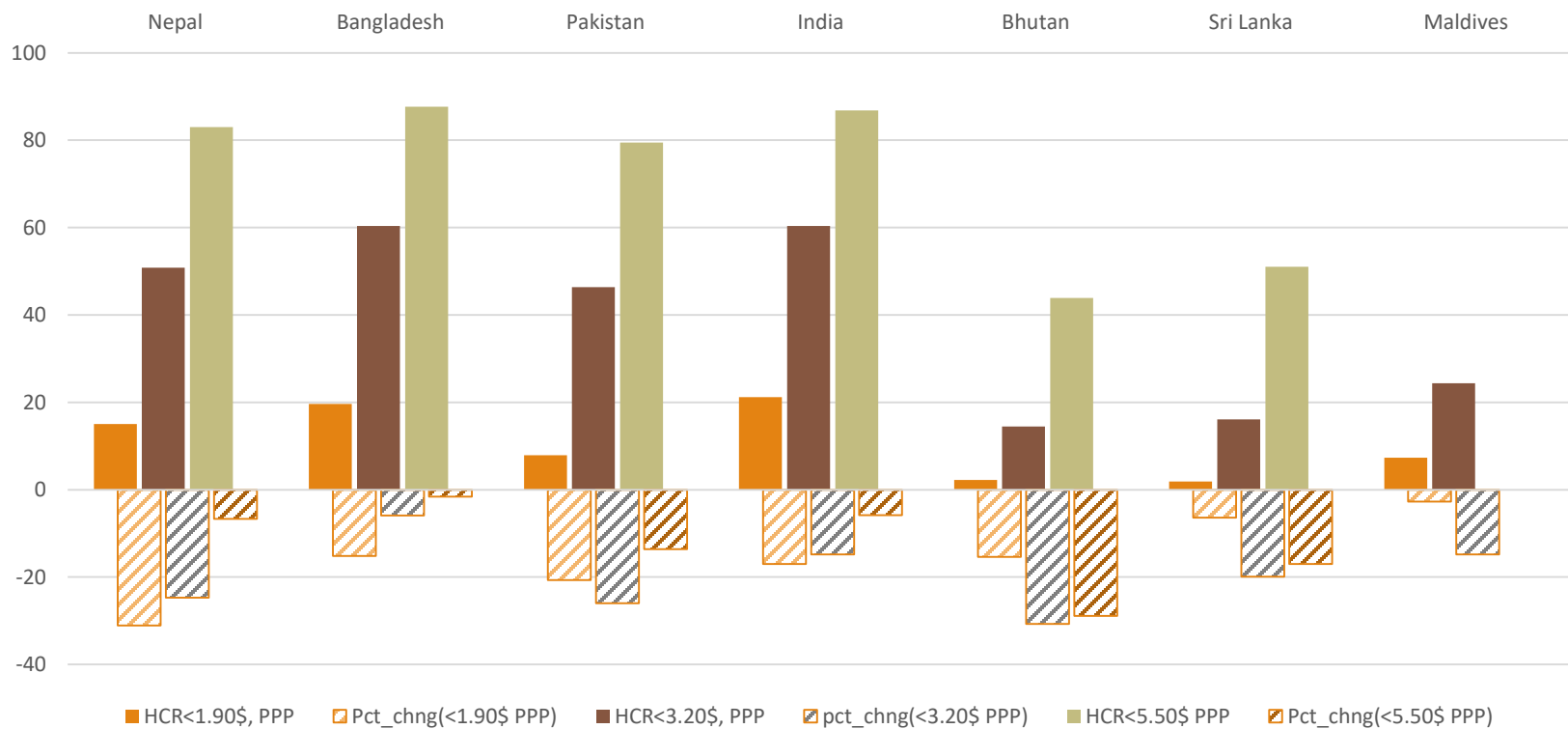
# A “Perfect Storm” of Opportunities & Challenges

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- Rising incomes, urbanization and the growth in the middle class
- Changing diets & rapid rise in over-nutrition and epidemic of NCDs even as malnutrition rates remain high
- Global environmental and sustainability challenges, including climate shocks and extreme events
- Trade integration and declining competitiveness of developing country agriculture

# Reduction in severe poverty in South Asia

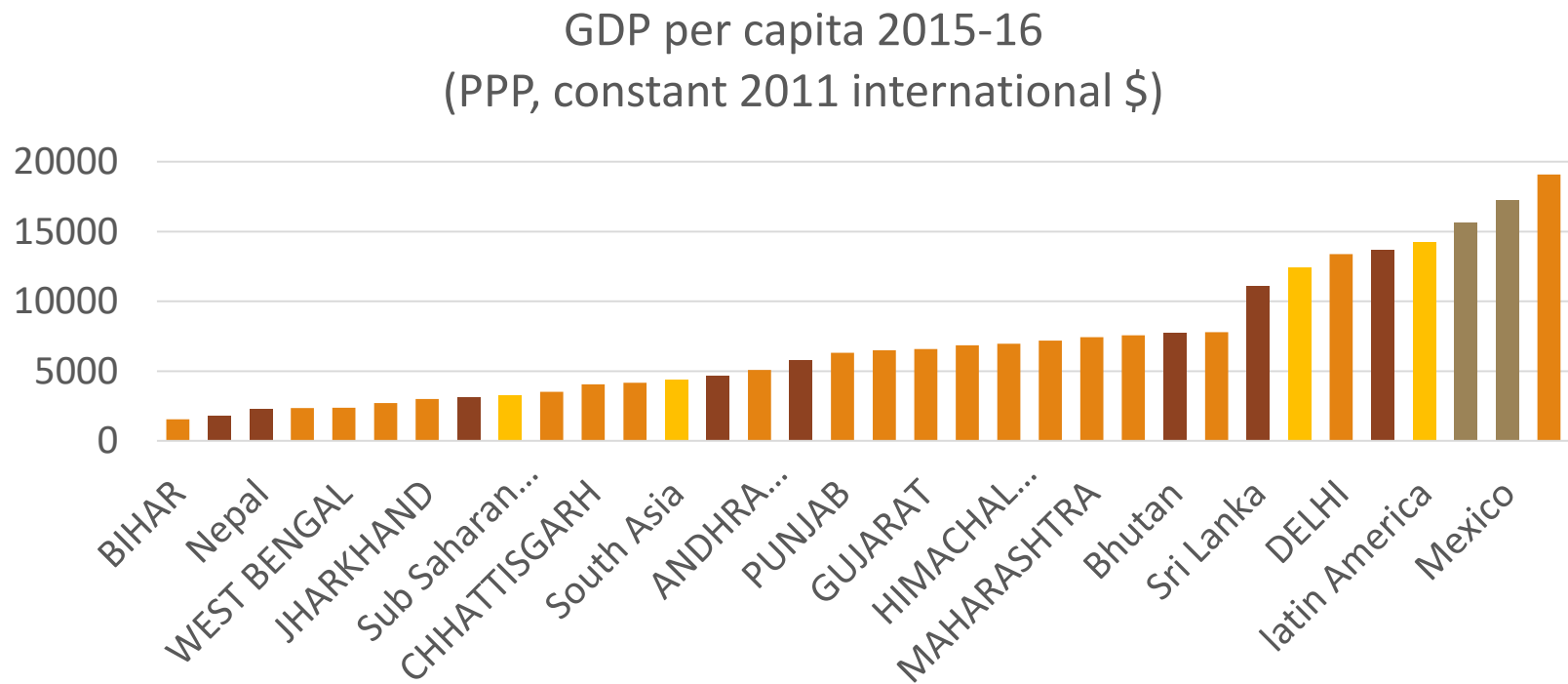
Poverty Headcount Ratios for 2010-2015 and change from 2001-2005



*Based on Authors calculations from WDI Indicators, 2019*



# Regional disparities in incomes

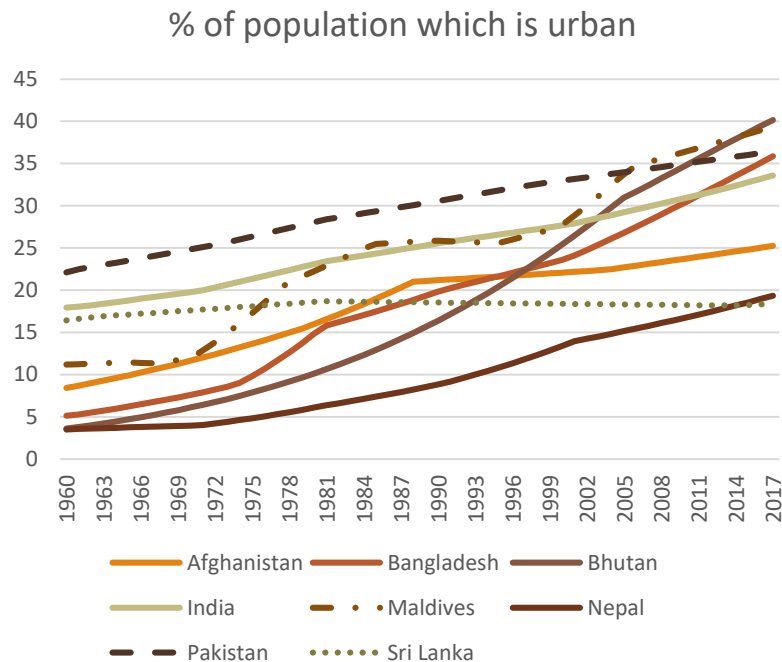


*Based on Authors calculations from National Accounts Statistics in India & WDI Indicators, 2019*

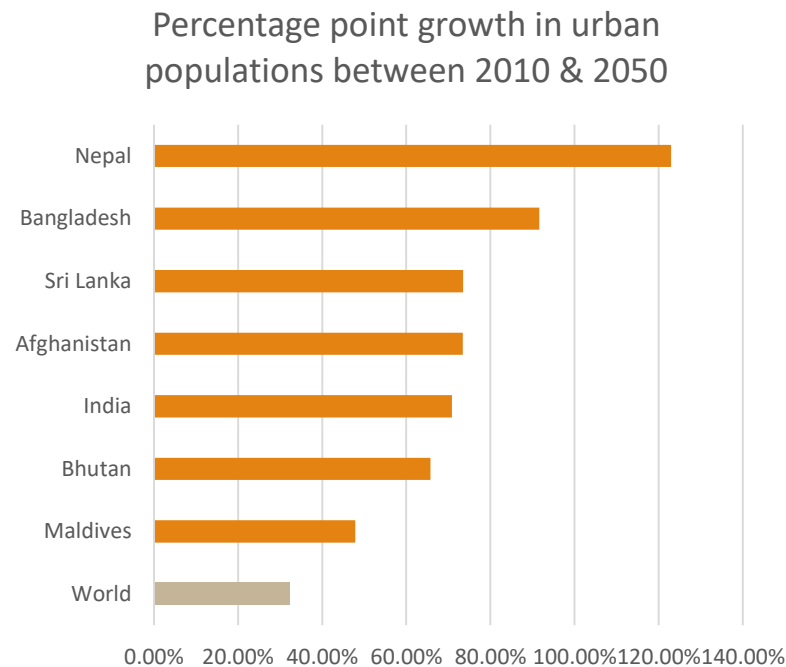


# Feeding urban populations – THE food policy challenge

## RAPIDLY RISING URBANIZATION RATES



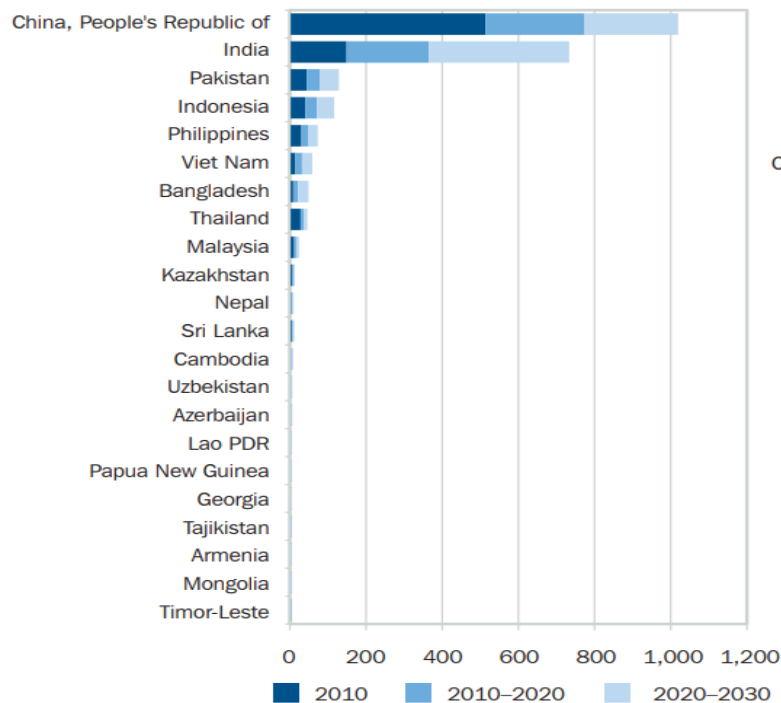
## PROJECTED URBANIZATION GROWTH RATES



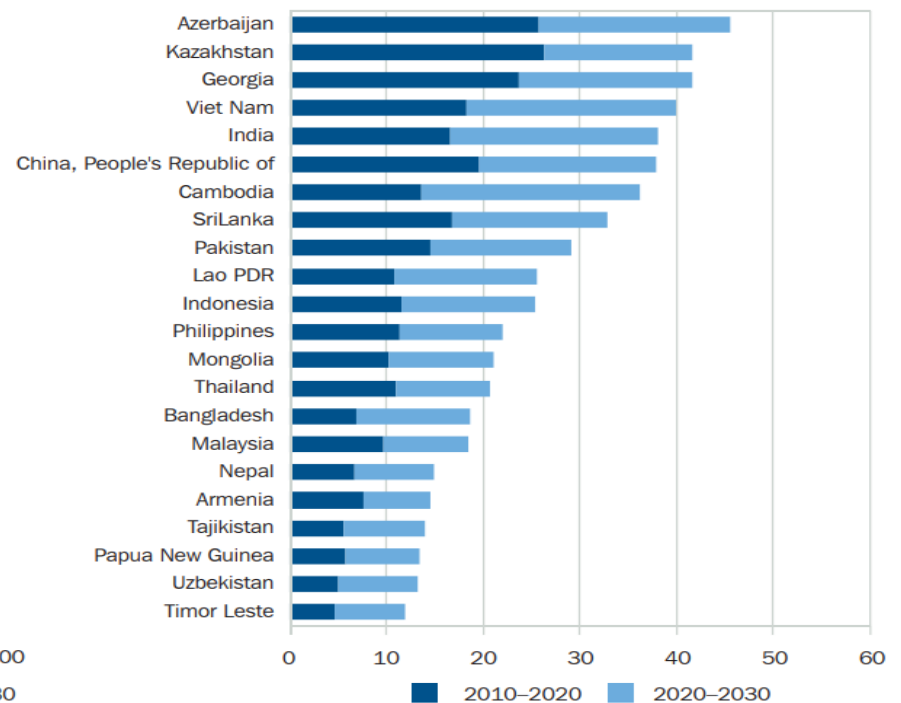
*Based on Authors calculations from WDI Indicators, 2019*

# The growing middle class will drive demand for food diversity

Figure 2.10 **Middle Class Emergence to 2030** (> \$4.00 income per person per day)  
 >4\$ standard, population, million

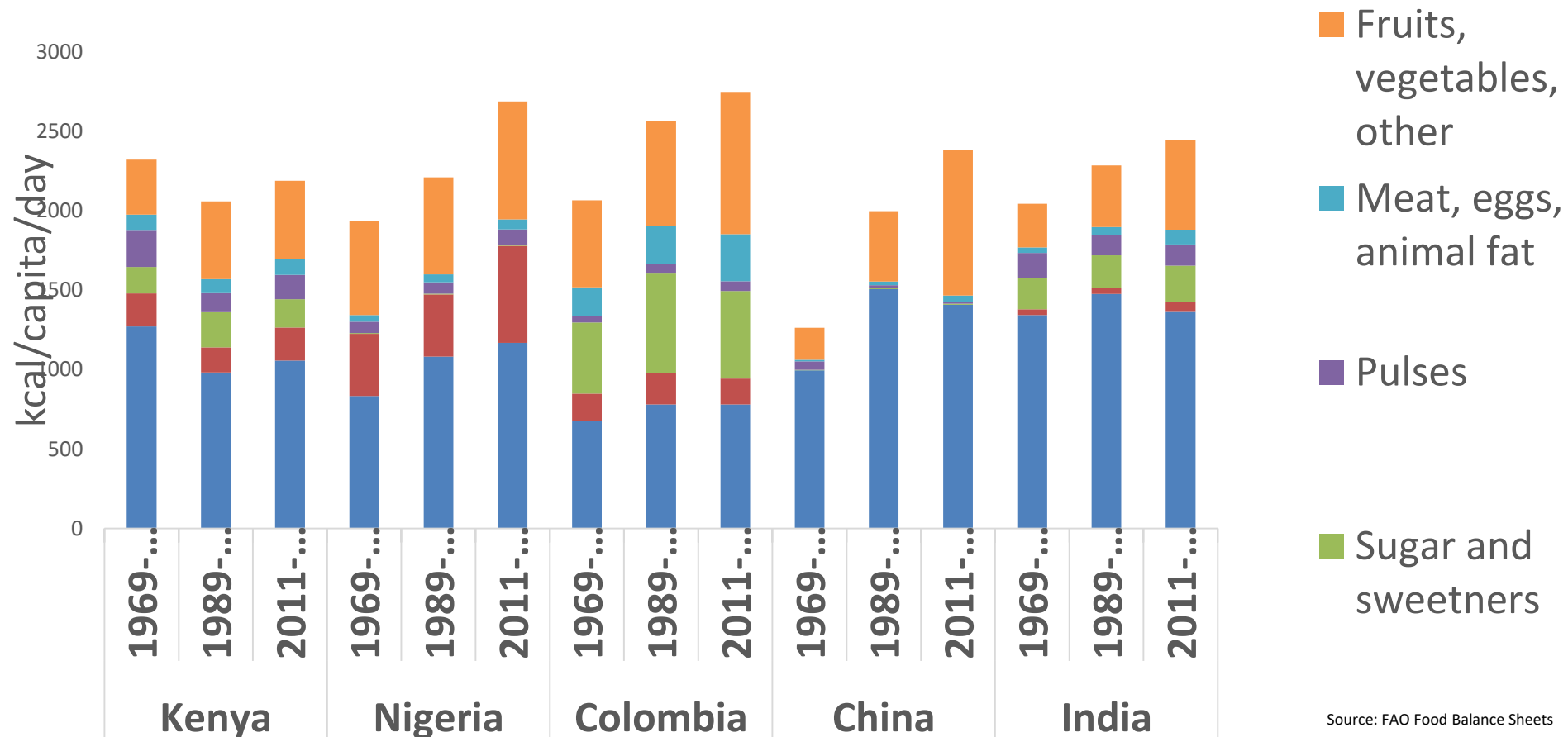


>4\$ standard, % change



Note: Lao PDR = Lao People's Democratic Republic  
 Source: Roland-Holst, Sugiyarto and Loh (2010).

# Diets are changing across the Developing World



Source: FAO Food Balance Sheets

# Transformation of urban food markets creates new farm and non-farm jobs



## Photo Sources

Left photos: Kiera Crowley

Top photo: <https://www.freshfruitportal.com/news/2017/01/16/india-supermarkets-gain-from-demonetization-pain/>

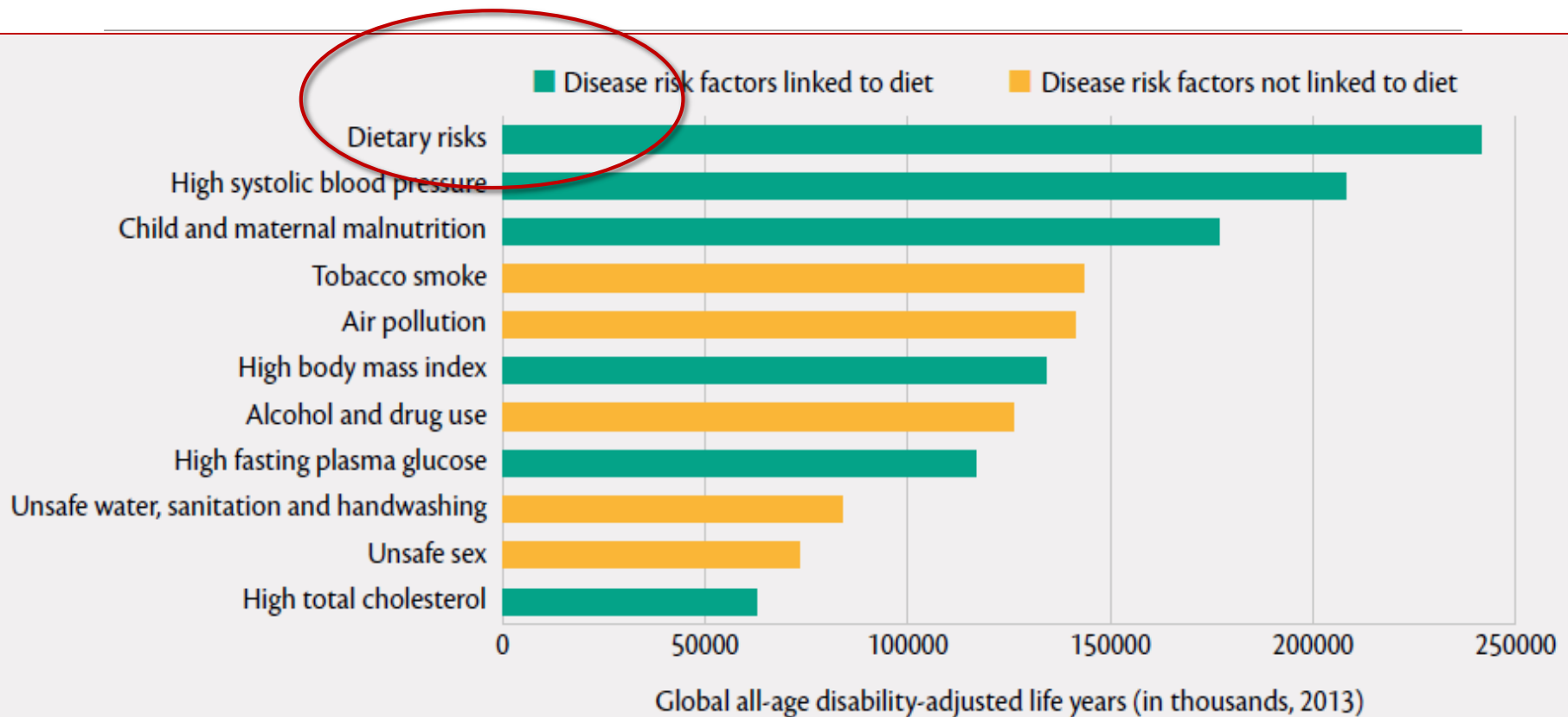
# Urbanization & changing diets – implications for smallholders

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- A shift from agriculture as a “way of life” to “agriculture as a business”
- “Provisioning the Cities” provides new growth opportunities for smallholders
- High transactions costs could exclude lagging regions and asset poor communities from integrating into urban food value chains
- Rising consumption of processed & convenience food could lead to increasing obesity trends in LDCs, even with gains in under nutrition



# Most global burden of disease risk factors are linked to diet

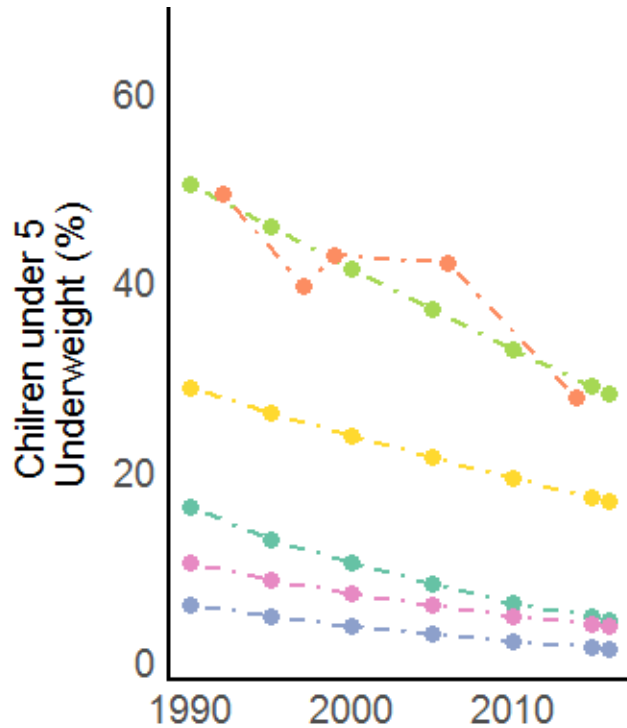


Source: Global Burden of Disease Study 2013 Collaborators (2015), Figure 5

Note: The graph shows global disability-adjusted life years (DALYs) attributed to level 2 risk factors in 2013 for both sexes combined.

# Slow Progress in Tackling Child Malnutrition

## Underweight



Prevalence of underweight children by region, 1990 - 2016.  
(Data source: WDI, 2018).

## Stunting



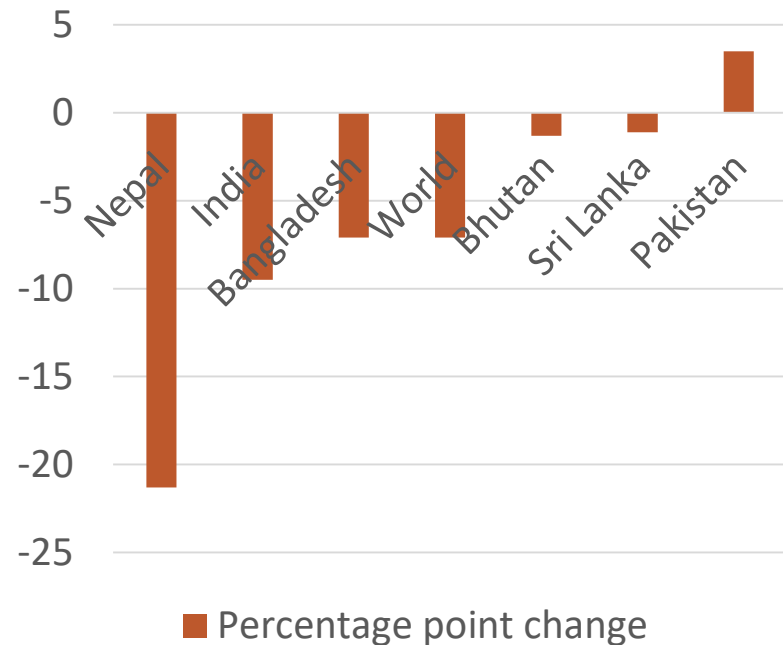
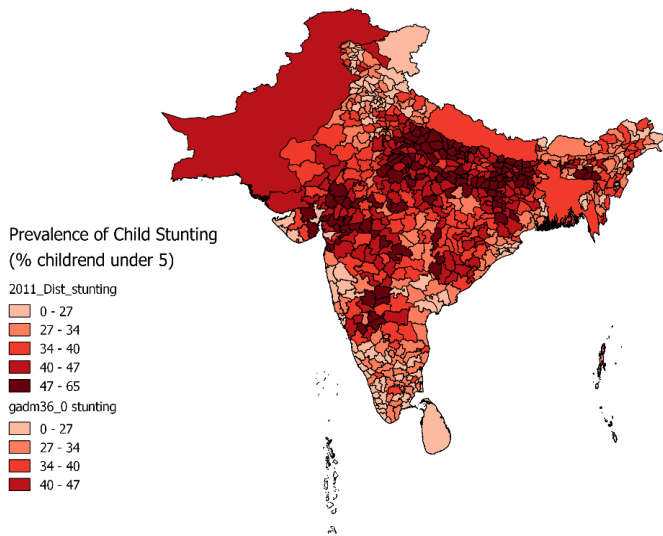
Prevalence of stunted children by region, 1990 - 2016.  
(Data source: WDI, 2018).



# Child stunting varies drastically both across and within the region

PERCENT OF CHILDREN WHO ARE STUNTED (HAZ<-2 SD)

PROGRESS MADE OVER TIME (%CHANGE BETWEEN 2001-05 AND 2010-15)

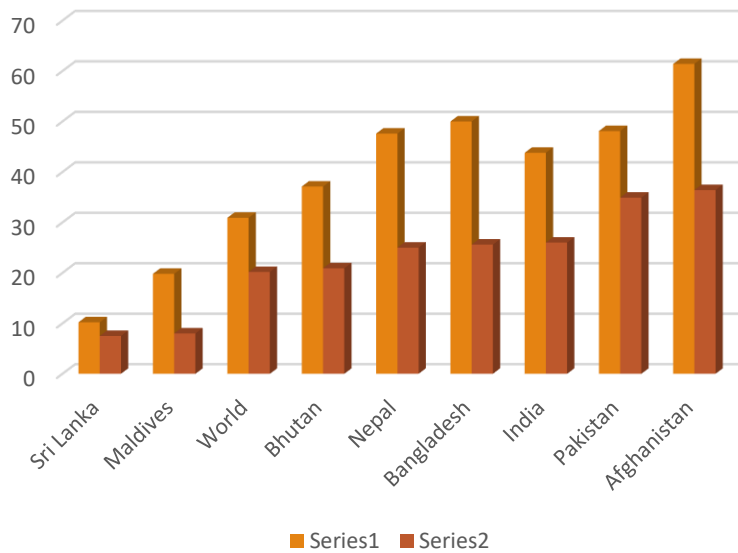


Based on Authors calculations from WDI Indicators, 2019

# While there has been progress in reducing risks for communicable diseases, risks for NCDs (eg. overweight) is on the rise

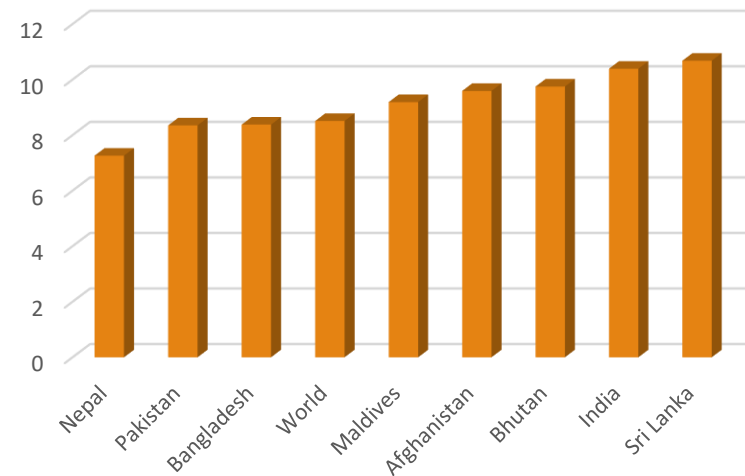
## CAUSE OF DEATH BY COMMUNICABLE DISEASES

Percentage of total



## DIABETES PREVALENCE

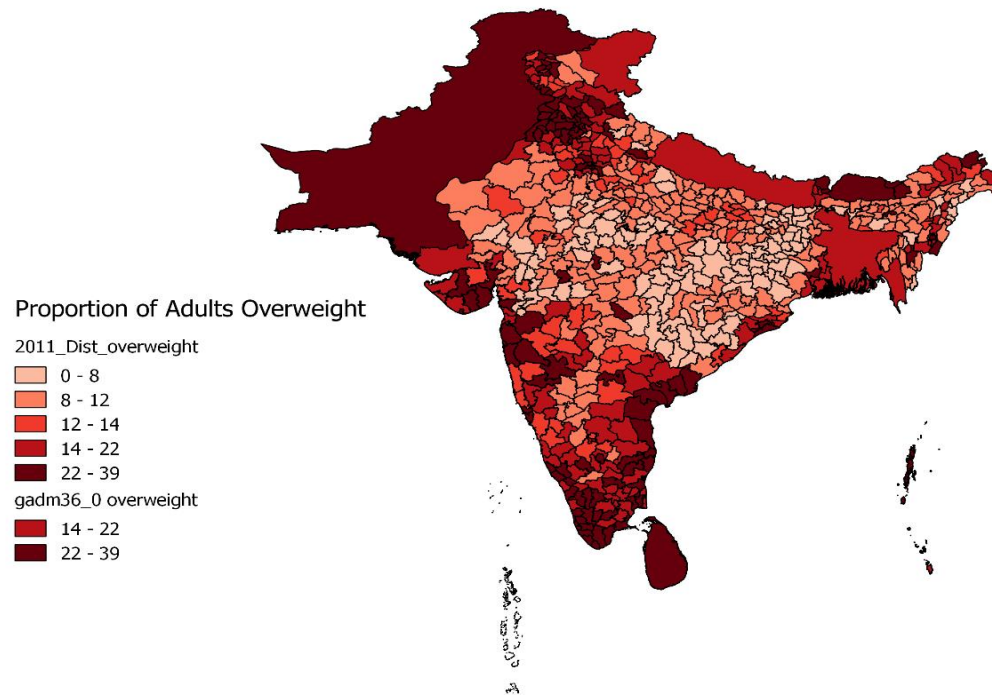
% of population ages 20 to 79



Based on Authors calculations from WDI Indicators, 2019

# Overweight prevalence is rising with income growth

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*Based on Authors calculations from WDI Indicators, 2019*

# Food Systems for Better Nutrition & Health

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- Diversifying from staple grain focused agriculture towards a nutrition-sensitive food system can help address all dimensions of malnutrition
- Advances in genomics and molecular biology targeted towards enhancing nutritive value of crops, particularly for the less commonly researched crops
- International R&D could draw on advances in food technology being developed by advanced country public and private systems.
- Plant based meats and “clean meat” innovations

# South Asian regions have been identified as high climate risk

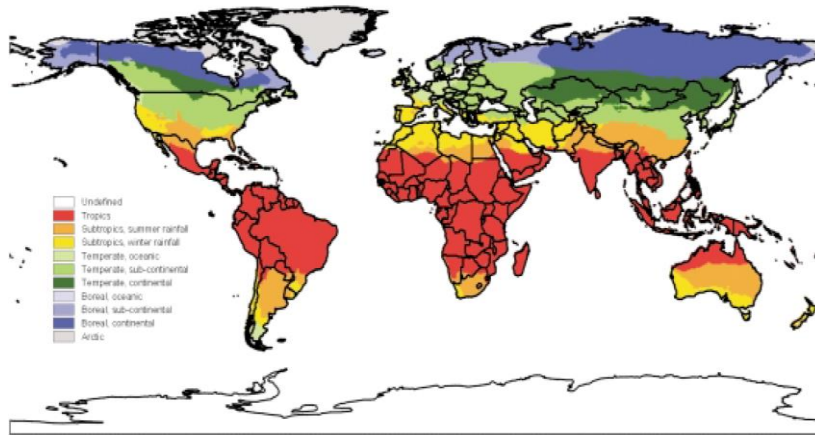


Plate 3.1. Thermal climates (reference climate, 1961–1990).

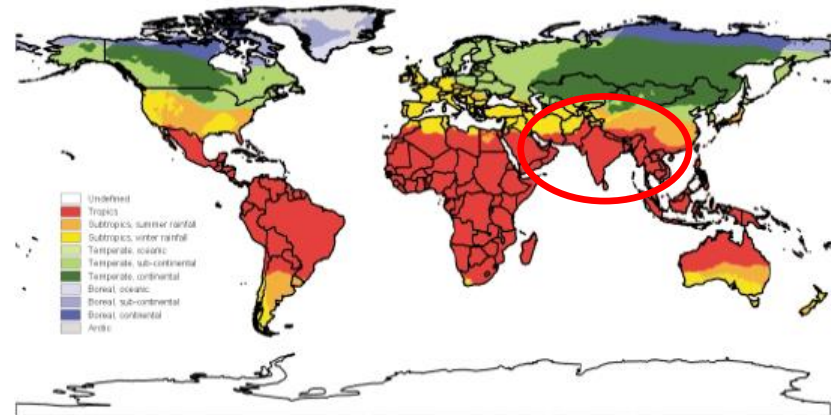
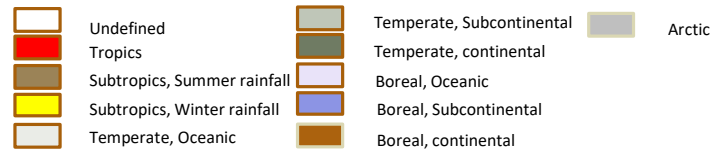


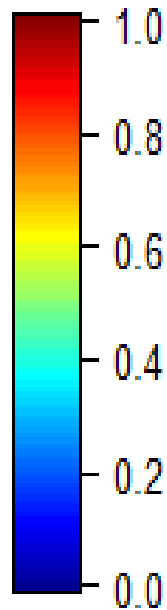
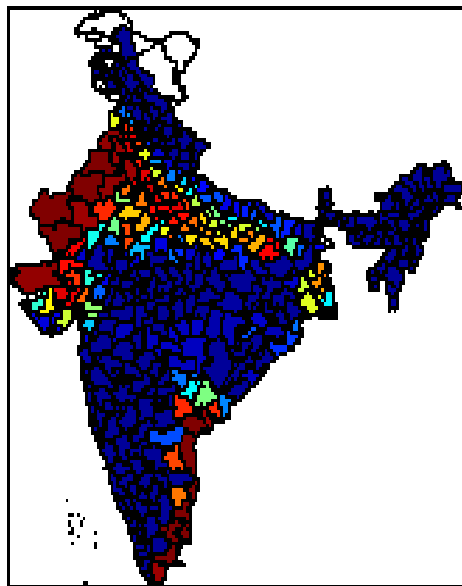
Plate 3.2. Thermal climates (HadCM3-A1F1, 2080s).



*Fisher et al 2002*

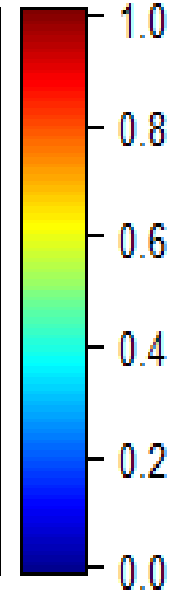
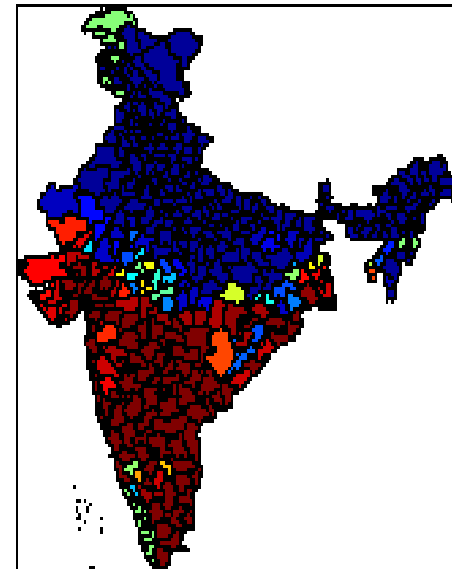
# Emerging Climate Risks to Agricultural Productivity

## KHARIF SEASON TEMPERATURE (T)



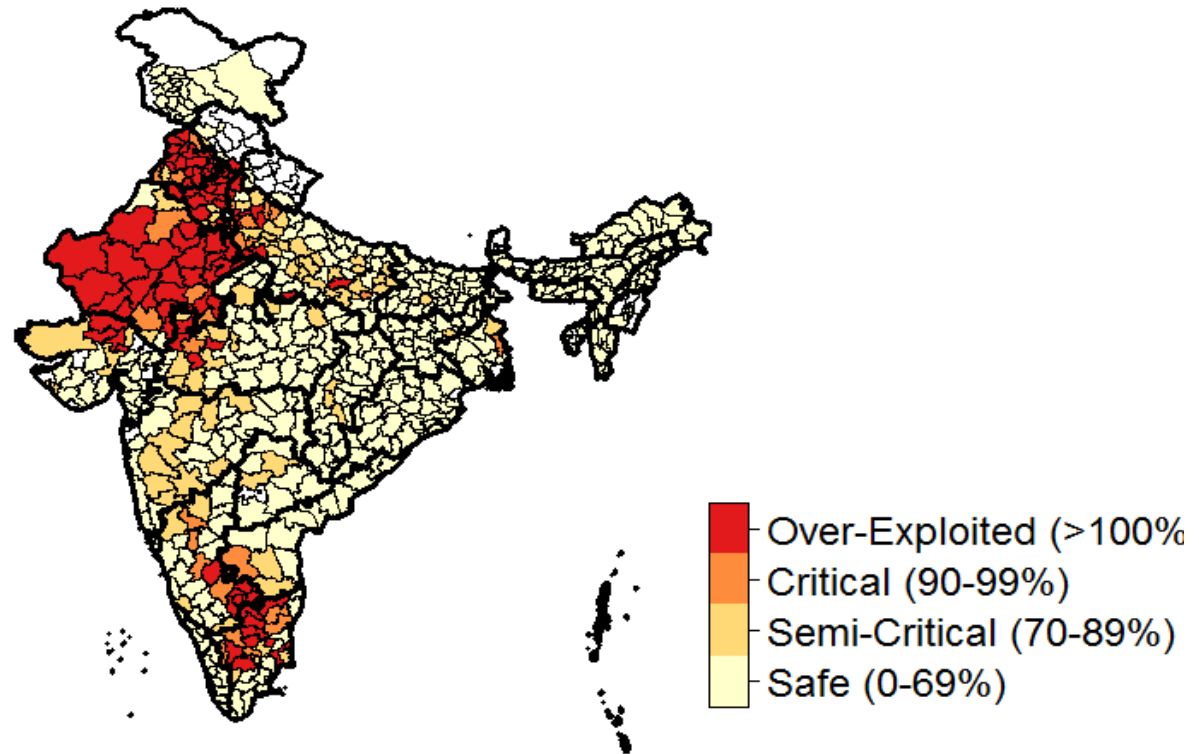
*Median  
future  
probability of  
T being  
higher than  
historical 90<sup>th</sup>  
percentile\**

## RABI SEASON TEMPERATURE (T)



# Water is running out in some of the most productive areas of the country

## Stage of Groundwater Development (Total Draft/Total Available)

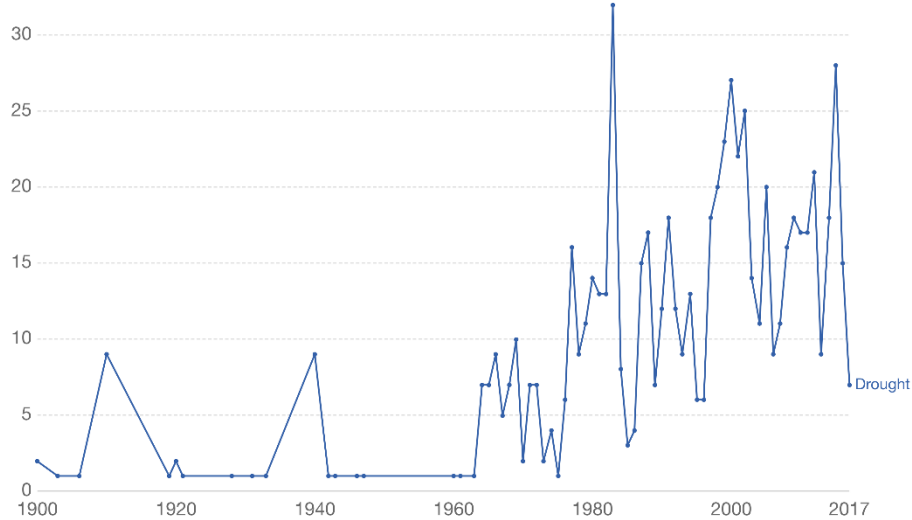


Data source: Central Groundwater Board, 2013.

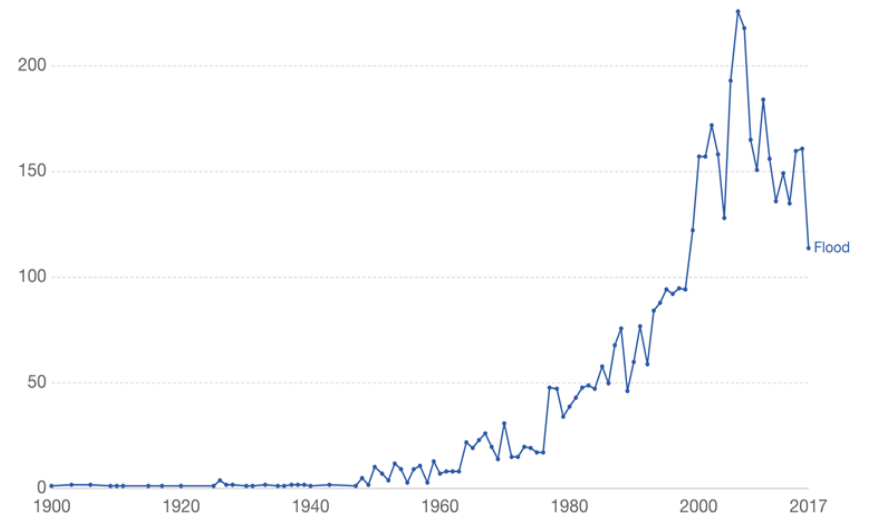


# Increase in Climatic Uncertainties

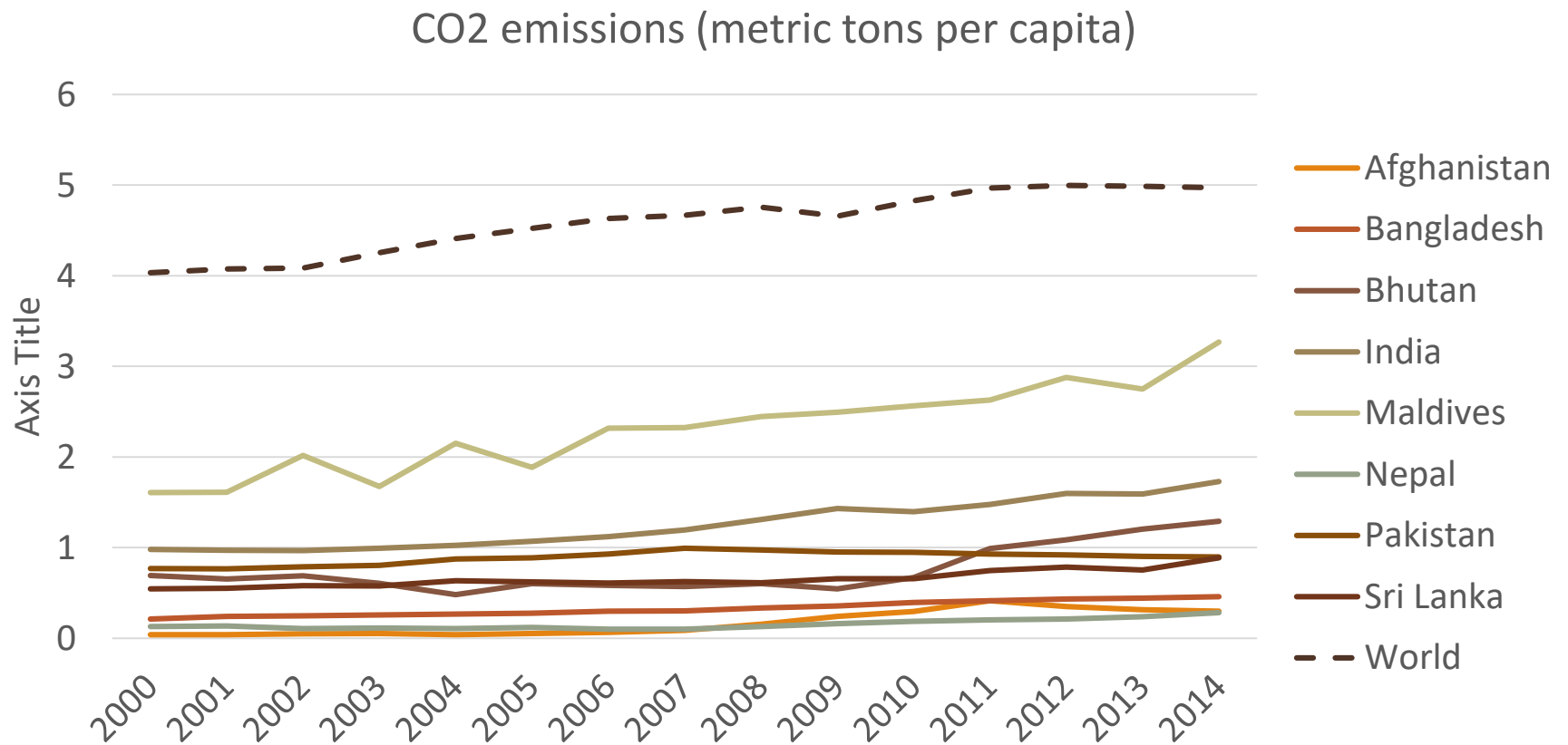
## Frequency of Droughts Globally



## Frequency of Floods Globally



# Reducing per capita carbon emissions from South Asia



Based on Authors calculations from WDI Indicators, 2019

# Food Security Impacts of Climate Change

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- **Increased cost of production** – disease ecology change in plants and animals
- **Income losses** due to yield reduction and post harvest losses
- Even crops suited for warmer climates will see a drop in yields
- **Food price fluctuations** especially higher value nutritious crops
- Diversification can have both +ve and –ve green house gas effects
- International trade can buffer domestic supplies and prices

# Towards Sustainable Intensification

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- Role of modern science and technology with “big data” tools, ICT and precision agriculture
- Advances in renewable energy sources could contribute to efficiency of energy use and sustainable resource use
- Adaptation to smaller scales is a major challenge for research and technology design

# Evolving Organization of the R&D System

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- Growing number of non-traditional players in the food and agriculture innovation space.
- Continued amalgamation of bioscience companies and food industry can hamper technology access for the poor.
- Can the CGIAR continue to be a conduit for technology access, adaptation and delivery to small farm systems?

# Small farm success also depends on the other SDGs

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## Small producer agriculture

### Poverty goals

**Goal 1:**

**No poverty**

**Goal 8:**

**Decent work and economic growth**

### Nutrition goals

**Goal 2:**

**Zero hunger**

**Goal 3:**

**Good health and wellbeing**

### Social goals

**Goal 5:**

**Gender equality**

**Goal 10:**

**Reduce inequality within and among countries**

### Environmental goals

**Goal 12:**

**Responsible production and consumption**

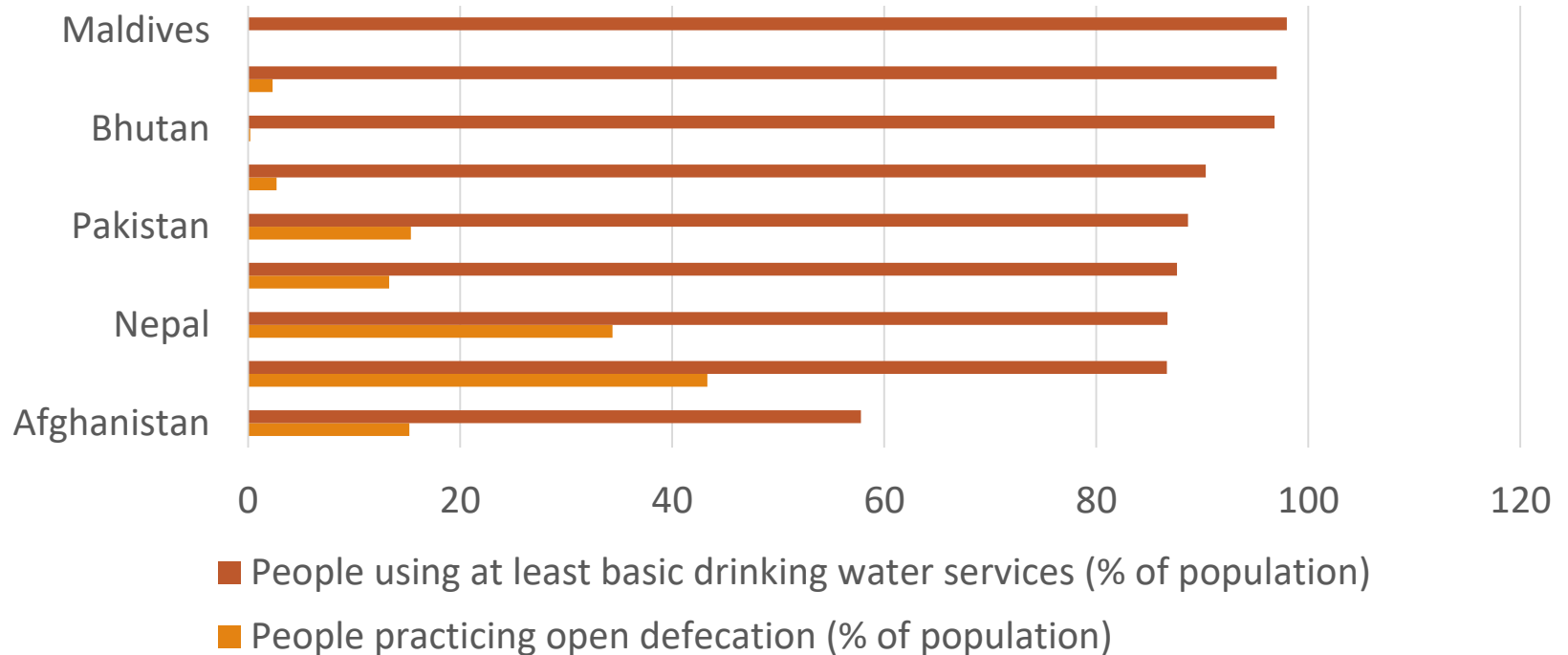
**Goal 13:**

**Climate action**

**Goal 15:**

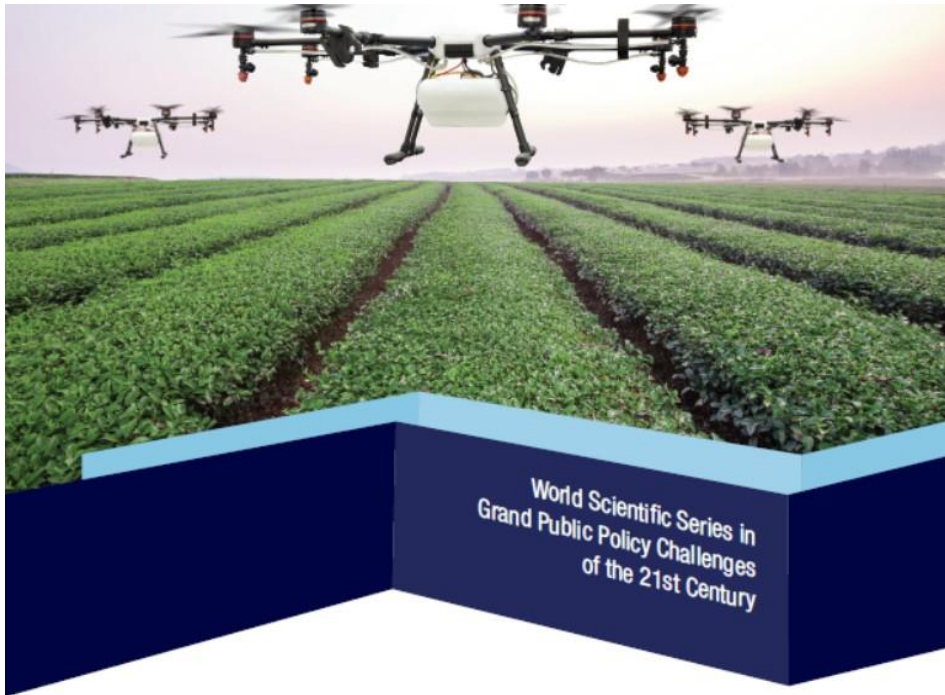
**Life on land**

# Access to toilet & drinking water infrastructure is still limited across the region leading to reduced progress on health and nutrition indicators



*Based on Authors calculations from WDI Indicators, 2019*





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