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# Challenges and Opportunities for Nutrition Security in the 21st Century

## Climate Change and Economic Growth

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# Faculty Disclosure

No conflicts to disclose.

nature sustainability

ARTICLES

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# Income growth and climate change effects on global nutrition security to mid-century

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# Nutrition Security Today: Calories versus Nutrients

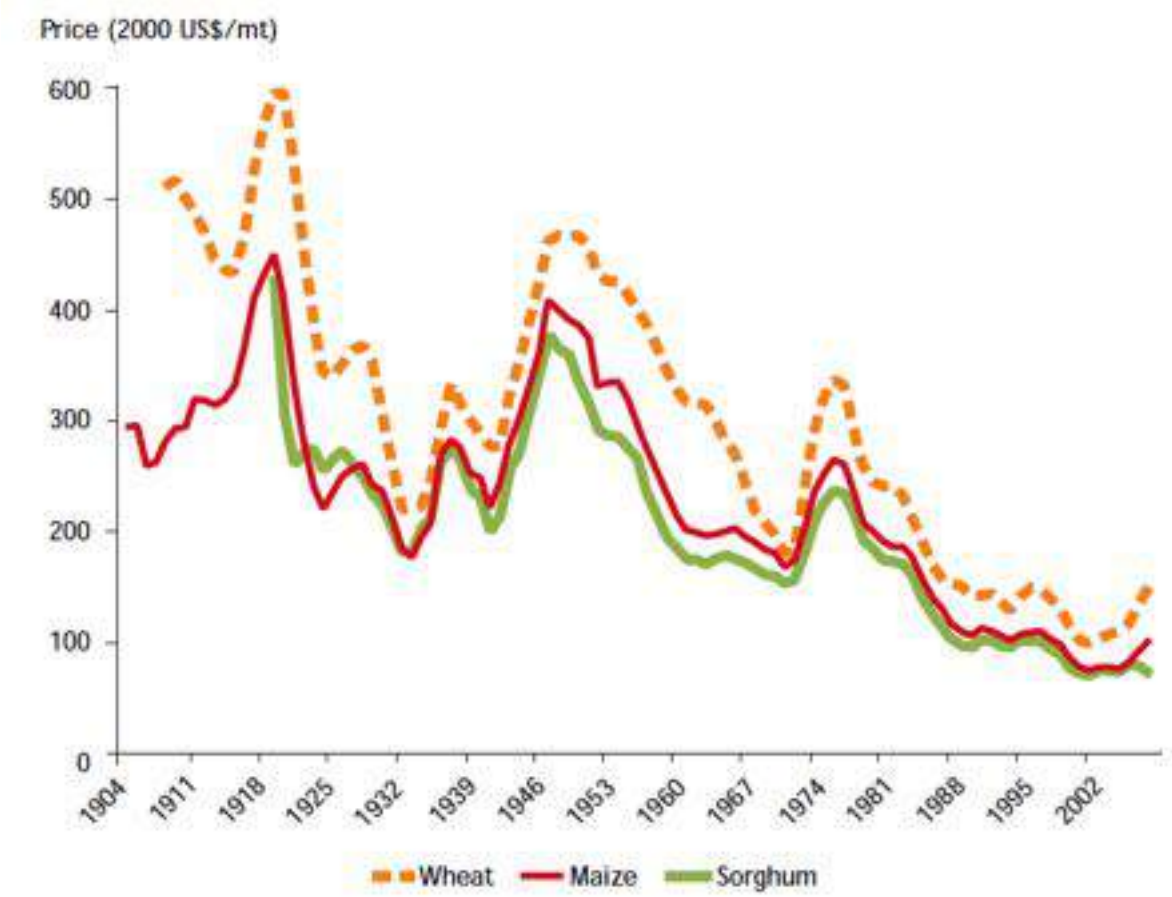
- 820 million people in the world suffer from undernourishment
- One in three women of reproductive age globally suffer from anemia
- Adult obesity is over 13 percent, or almost 700 million people
- Childhood overweight affects over 38 million children

**Source: FAO, IFAD, UNICEF, WFP and WHO. The State of Food Security and Nutrition in the World 2018.**

# Bennett's Law as a guide to nutritional security

- As income increases, a consumer spends a
  - *smaller* share on starchy staples with high energy content
  - *larger* share on tastier and more expensive food items (e.g., meat, fats and oils, fruits, and vegetables)
- Income growth makes nutritious food more affordable
- Changes in *relative* prices encourage shifts to *relatively* cheaper foods

# Agricultural research greatly lowered prices of ***staples*** in 20th century




Source: Nelson et al, 2010.

# How does climate change affect nutritional status

- Reduces yields
- Alters mix of crops/animals grown
- Alters nutrient content *(not included in the analysis)*
  - Known
    - Higher temps -> staples have less protein, more starch
  - Unknown – effects on
    - Fruits and veggies
    - Nutrients other than protein, starch [a bit of research on this now]
- Effects worsen over time -> Need for scenario analysis

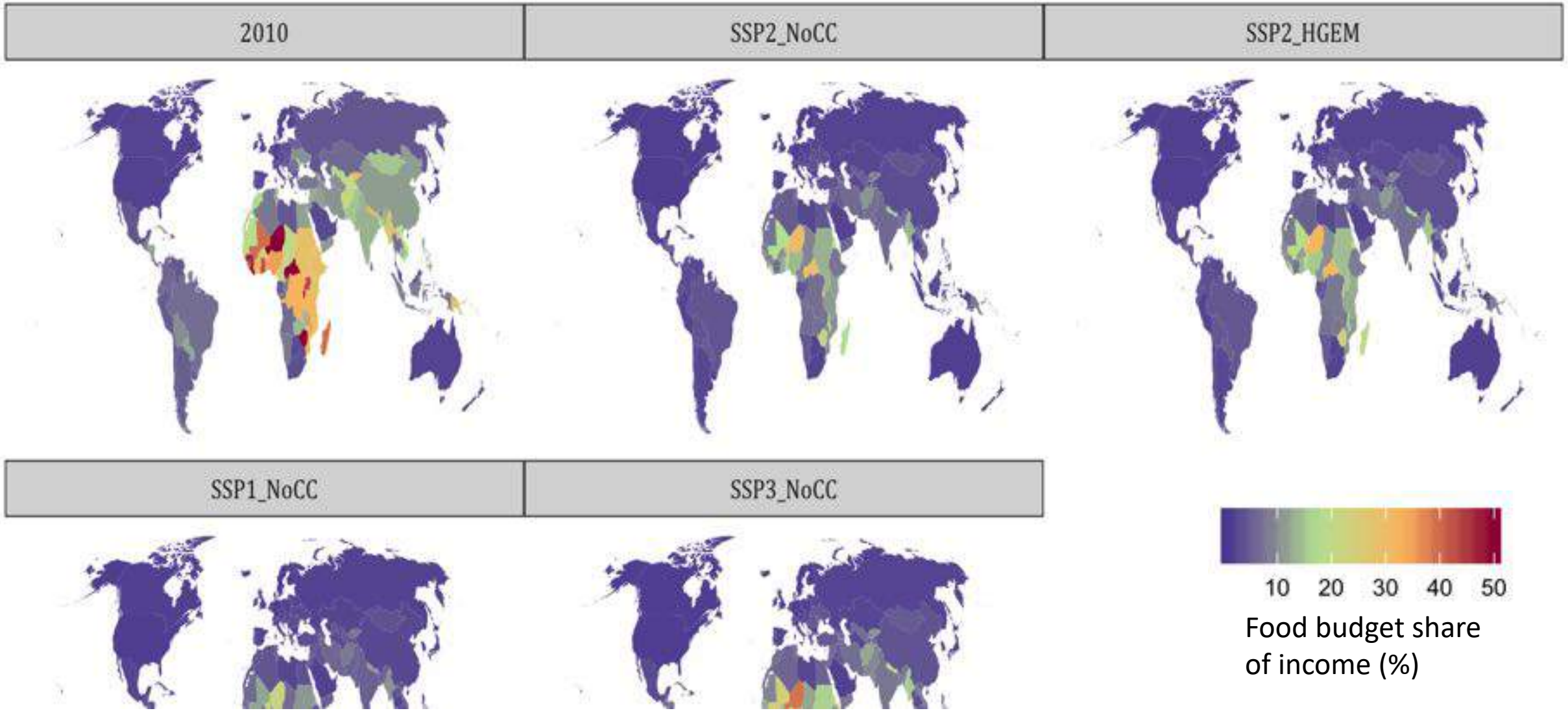
# Scenario inputs to determine nutrient outcomes

- SSPs provide range of GDP and population futures
- IMPACT model generates
  - Average food availability for 61 food items
  - Country specific results
- Nutrient content from USDA Food Composition Tables
- Recommended Daily Allowances

**Adequacy ratio**

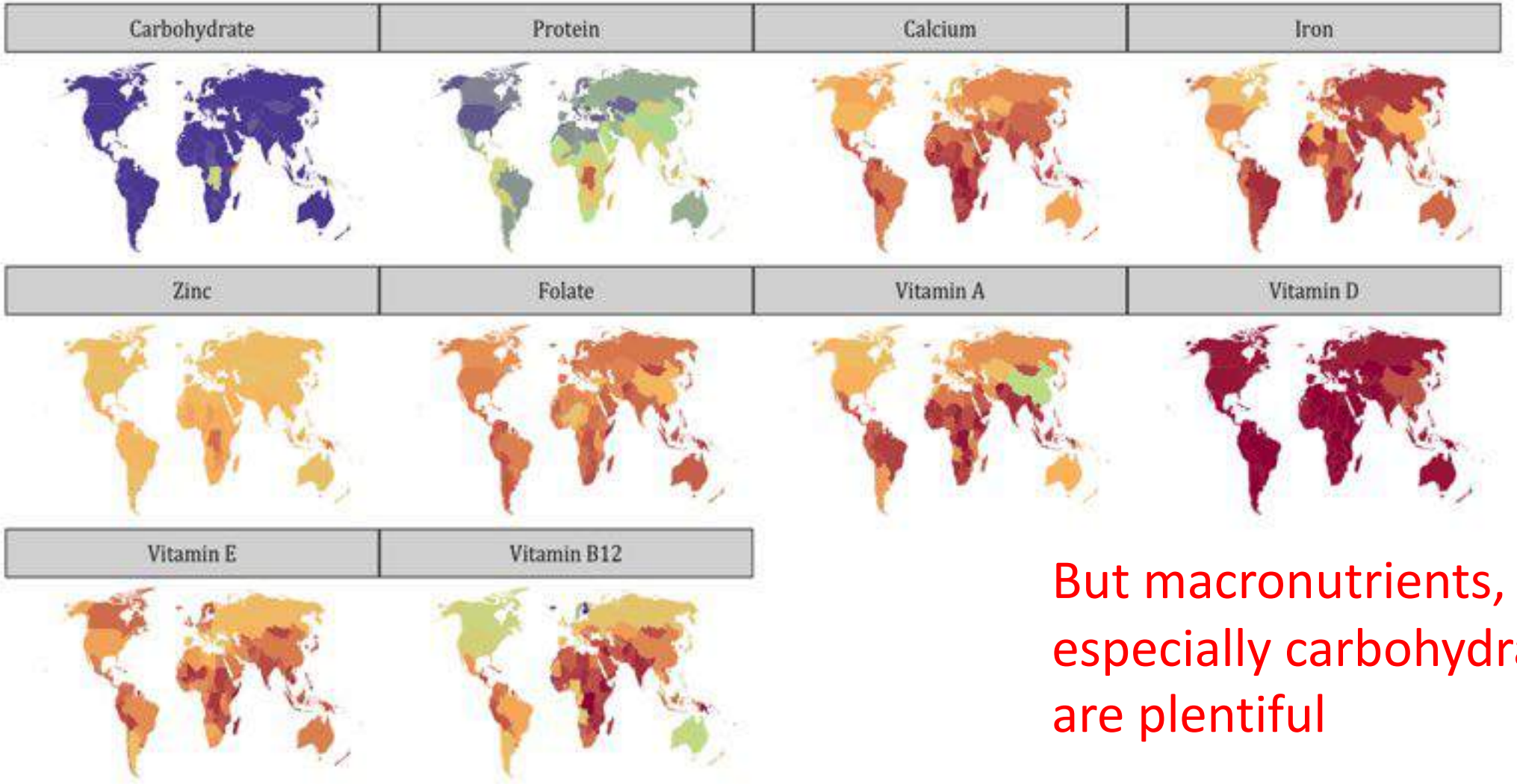
Ratio of average nutrient availability to the RDA for a representative consumer

# In 2050, food budget share is much smaller in poorer countries, in all scenarios



# Nutrition Status Today

# Deficiencies of some *micronutrients* are a problem everywhere today




red is low
green to blue is high

But macronutrients, especially carbohydrates, are plentiful

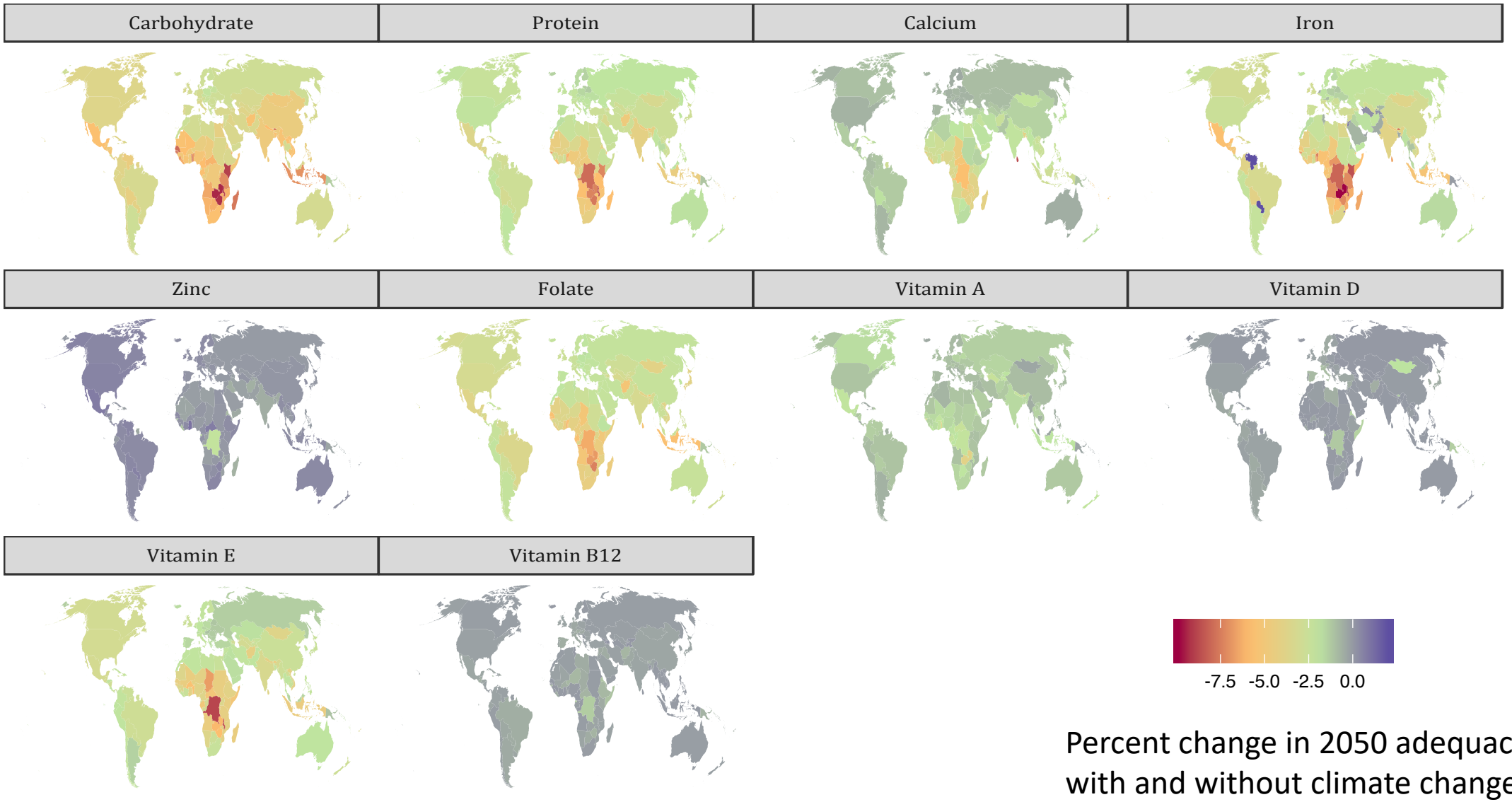
Adequacy: Ratio of average nutrient availability to (RDA-based) requirement for representative consumer

# Building scenarios to 2050: Choose drivers to capture range from worst to best plausible future

- Climate change – None (NoCC) to highest in IPCC (HGEM - RCP 8.5)
- Income growth – low to high (SSP3, SSP2, SSP1)
- Population growth – high to low (SSP1, SSP2, SSP3)

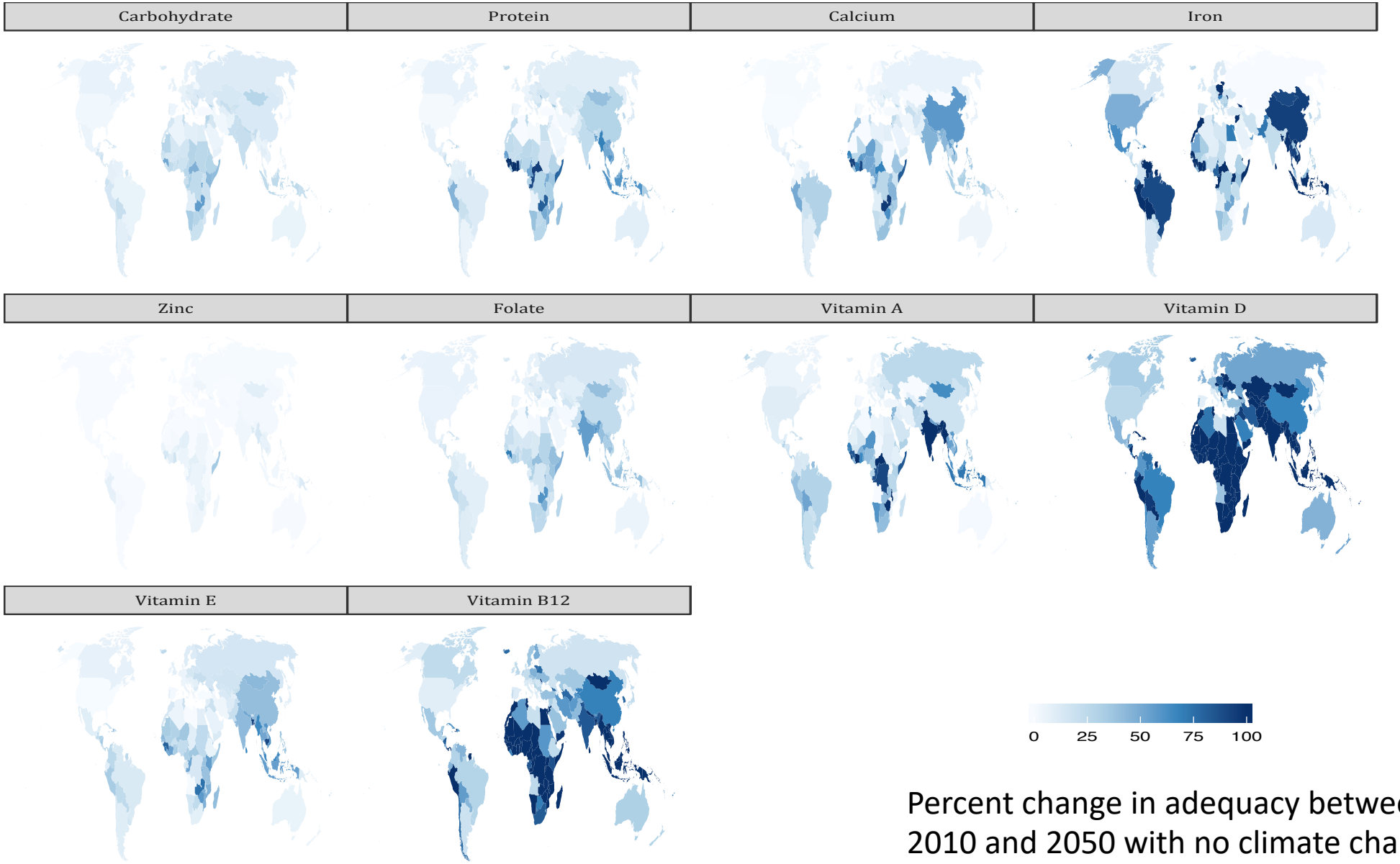
# Compare effects of climate change and income growth on adequacy in 2050

# Climate change has only small effect on adequacy in 2050



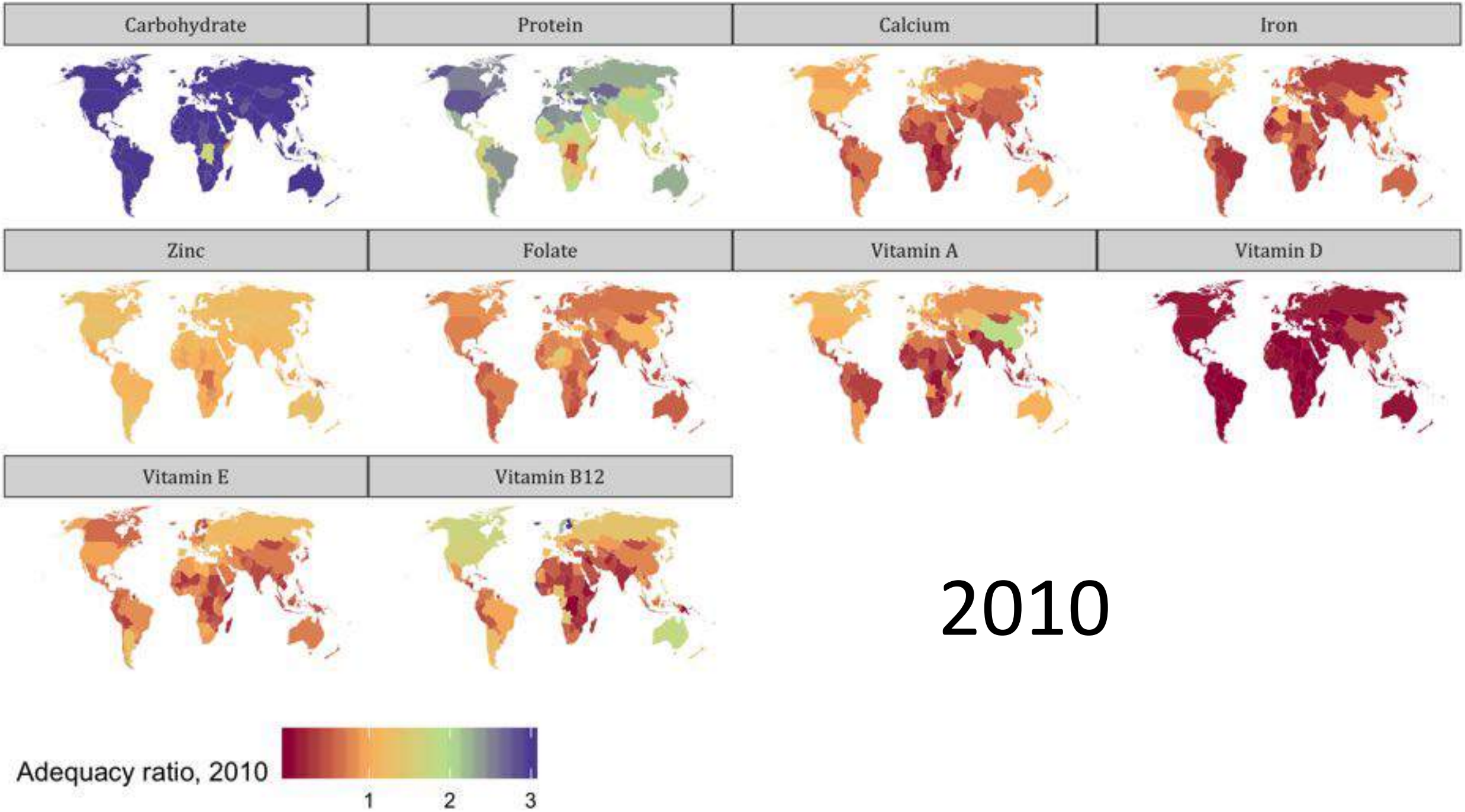

Percent change in 2050 adequacy with and without climate change

# Income growth improves adequacy for some micronutrients

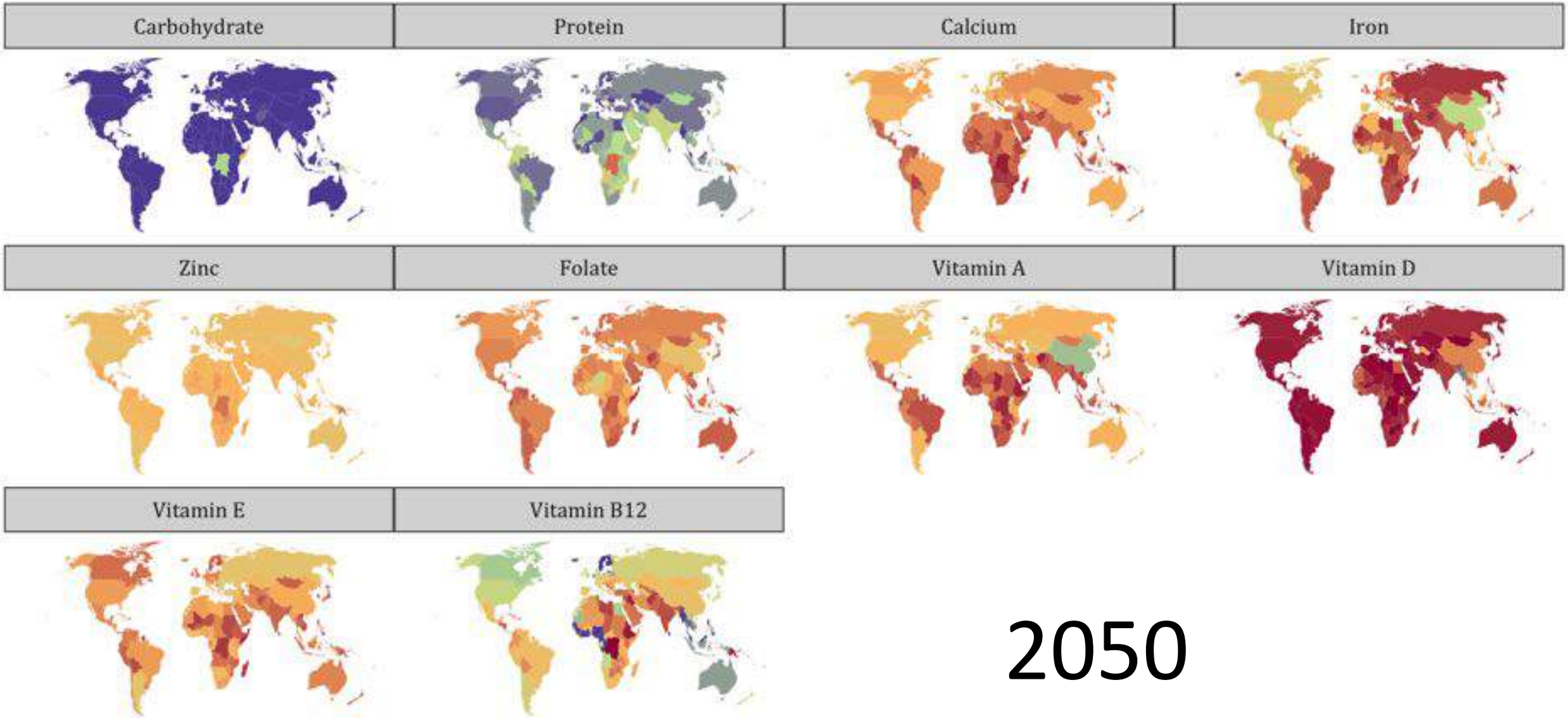



Percent change in adequacy between 2010 and 2050 with no climate change

# But micronutrient deficiencies remain


Carbohydrate
Protein
Calcium
Iron
Zinc
Folate
Vitamin A
Vitamin D
Vitamin E
Vitamin B12
Adequacy ratio, 2010
1
2
3

2010


Carbohydrate
Protein
Calcium
Iron
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Folate
Vitamin A
Vitamin D
Vitamin E
Vitamin B12
Adequacy ratio, 2050, with climate change
1
2
3

2050

# Some results with global perspective

- Average *macronutrient* availability is more than adequate now and to 2050
- Low availability of some micronutrients is widespread and likely to remain so
- Benefits of even slow economic growth are much stronger than negative effects of climate change, to 2050
- Some nutrients with *negative* health effects are likely to become more available

# Implications for agricultural research policies

- Assess climate change effects beyond temperature and precipitation on many crops (and animals)
- Prepare for worsening climate change effects on all foods
- Reorient public sector agricultural research expenditures and policy
  - More productivity funding for micronutrient dense foods (e.g. fruits and veggies)
  - Biofortification
  - Food additives

# Country level analysis is essential

- https://impactnutrients.ifpri.org/nutrientModeling/

# Address the known unknowns

The models don't include effects of

- Increasing ozone
- Increasing extreme events and more weather variability
- Increasing pest and disease pressure
- Effects on nutritional content

These effect could be much larger than than those already modeled, even over the next 35 years to 2050.

… and it's likely to get much worse *after* 2050

# Thanks!