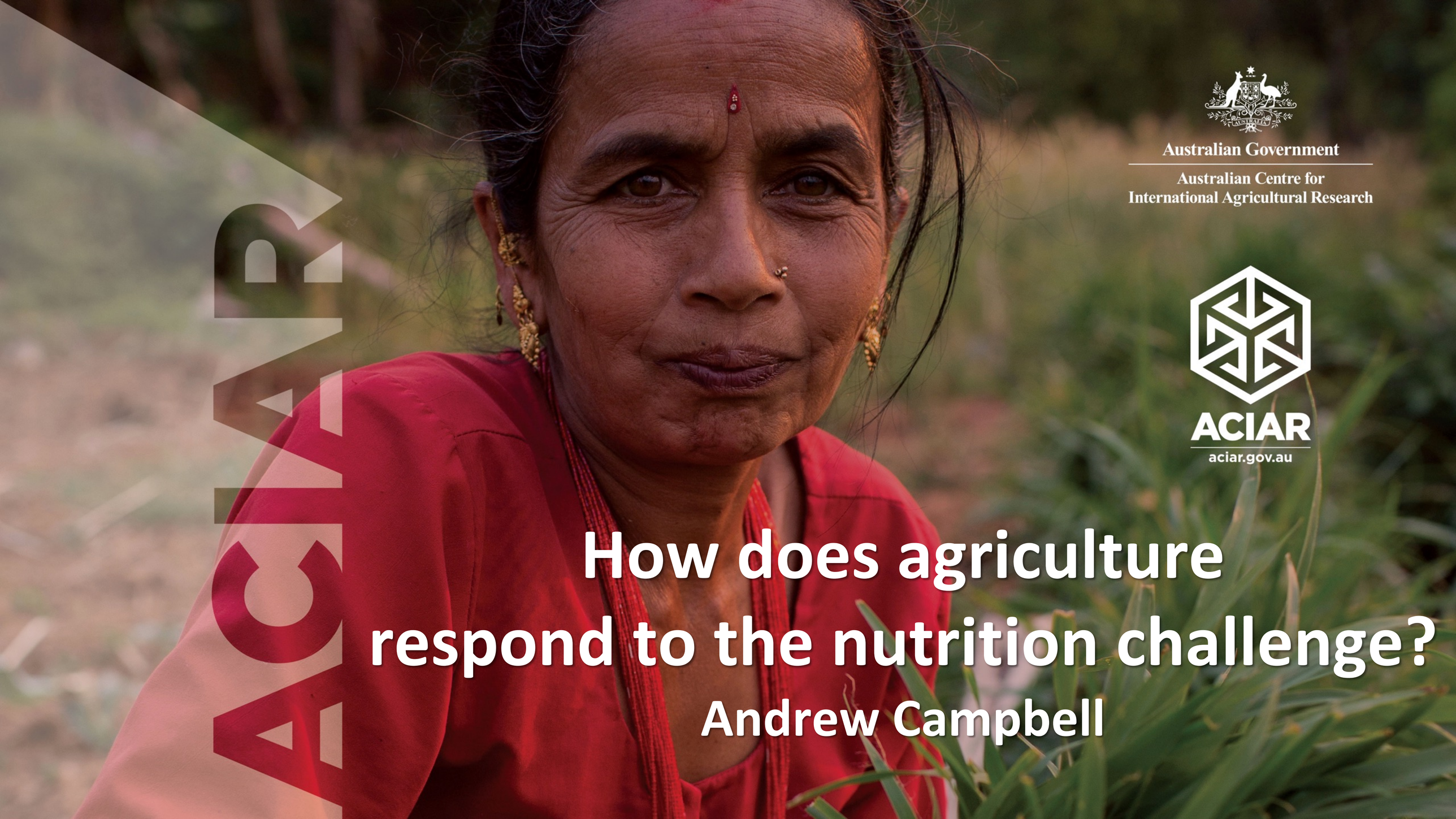

Australian Government

Australian Centre for International Agricultural Research

ACIAR

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How does agriculture respond to the nutrition challenge?

Andrew Campbell

How does agriculture respond to the nutrition challenge?

With difficulty!

- The nutrition challenge
- The place and role of agriculture
- Implications for agricultural science
- Thoughts on governance

The Nutrition Challenge

- In production terms, agriculture has done well
  - Global population doubled from 1961 to 2003
  - Food production increased by 2.5 (to 2772 kcal/day)

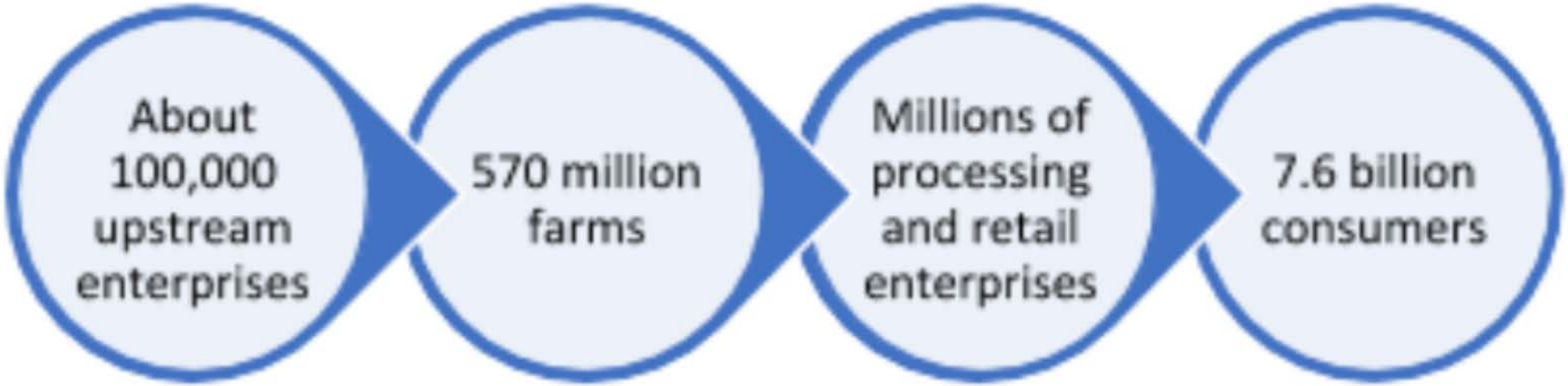
We've heard about the **triple burden** of food insecurity

- 816 million people suffering from acute hunger
- ~ 2 billion people with micronutrient deficiencies
- ~ 2 billion people consuming too many calories

Which leaves **less than 1/3 of all people on Earth eating a healthy diet**

- Agriculture now needs a new paradigm
  - A food systems perspective
  - Tailored to deliver against SDGs

The food system is large, complex, and has many actors



Source:

Juergen Voegele (2018). The Fourth Industrial Revolution is changing how we grow, buy and choose what we eat. https://www.weforum.org/agenda/2018/08/the-fourth-industrial-revolution-is-changing-how-we-grow-buy-and-choose-what-we-eat

The role of Agriculture

In the Anthropocene, agriculture is the biggest lever humans can pull

- Biggest employer of people
- Biggest water user (75% of diverted freshwater)
- 26% of global greenhouse emissions
  - on track to be the largest emitting sector
- Causes 78% of eutrophication
- Uses 87% of ice-free, non-desert land
- The main driver of deforestation

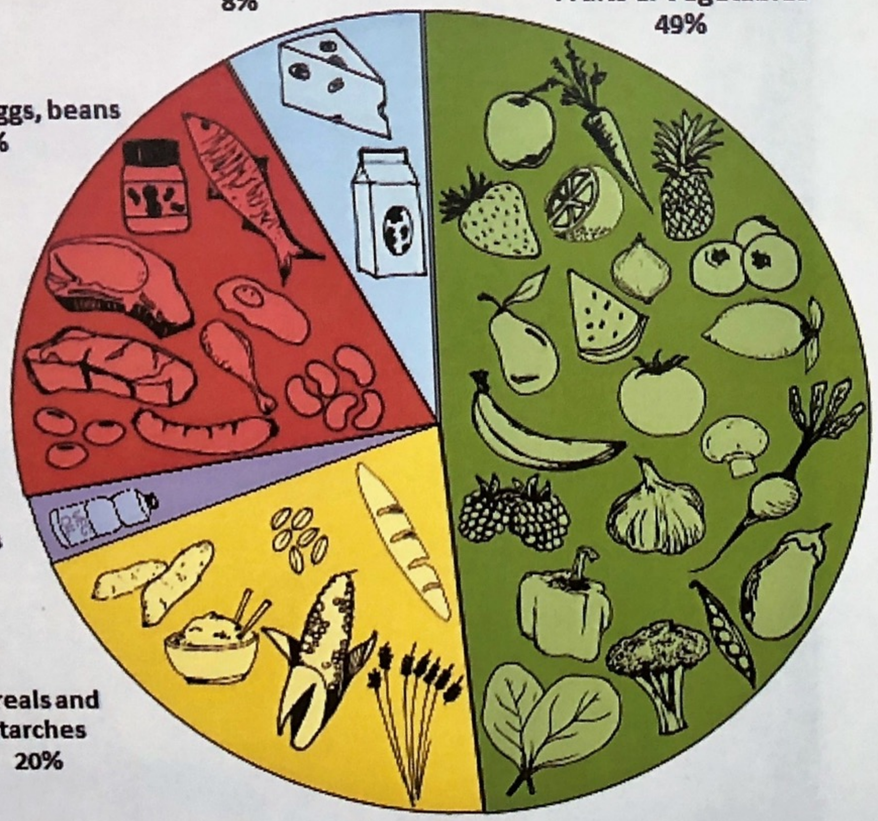
AND

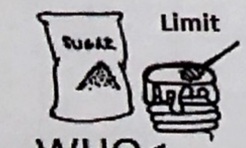
- **The most effective way to lift people from poverty**

Agriculture & Nutrition

- Three dimensions of food security:
  - Availability
  - Access
  - Utilisation
- Obviously Ag has a crucial role in **availability**
  - Ensuring diet diversity (leafy vegetables, protein, fruits, nuts, legumes etc)
  - Diversification & Biofortification of staples
  - Improving food safety & minimizing waste
- Ag also has a role in improving **access**
  - Especially for smallholder farmers & rural people
  - Peri-urban & urban are big opportunities
- Our role on the **demand** side is less obvious

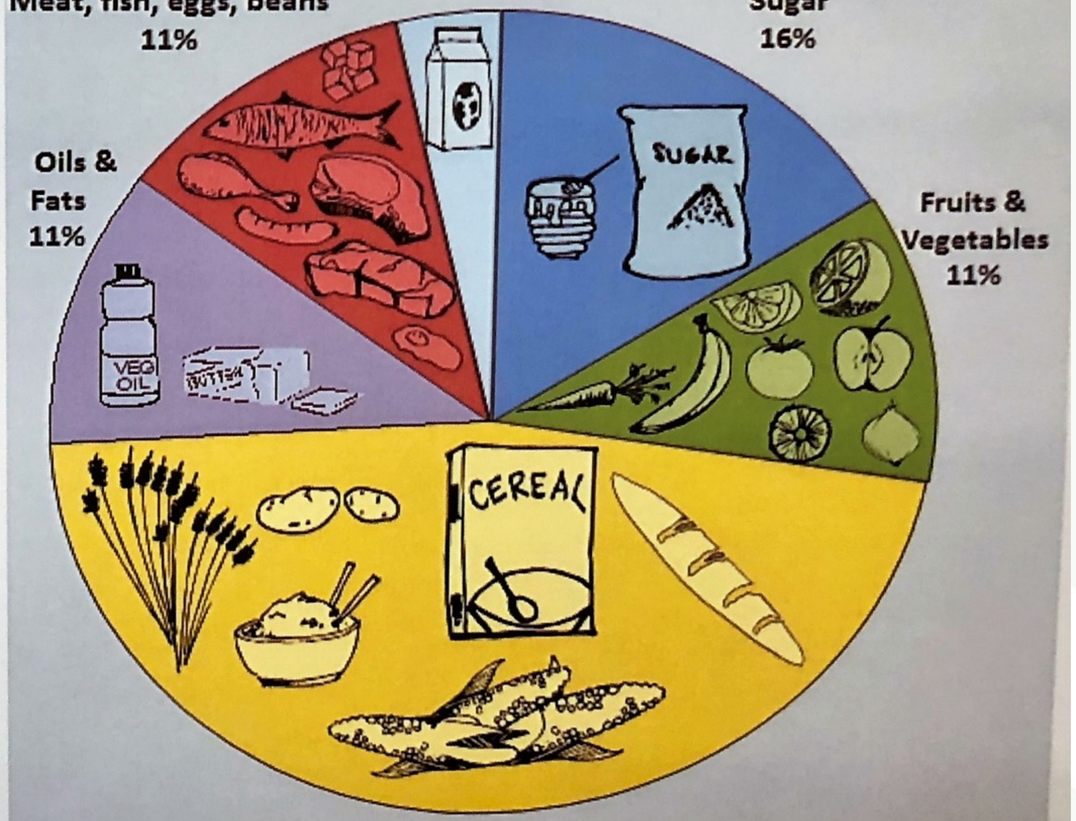
What we should be eating (Harvard's Healthy Eating Plate Model)





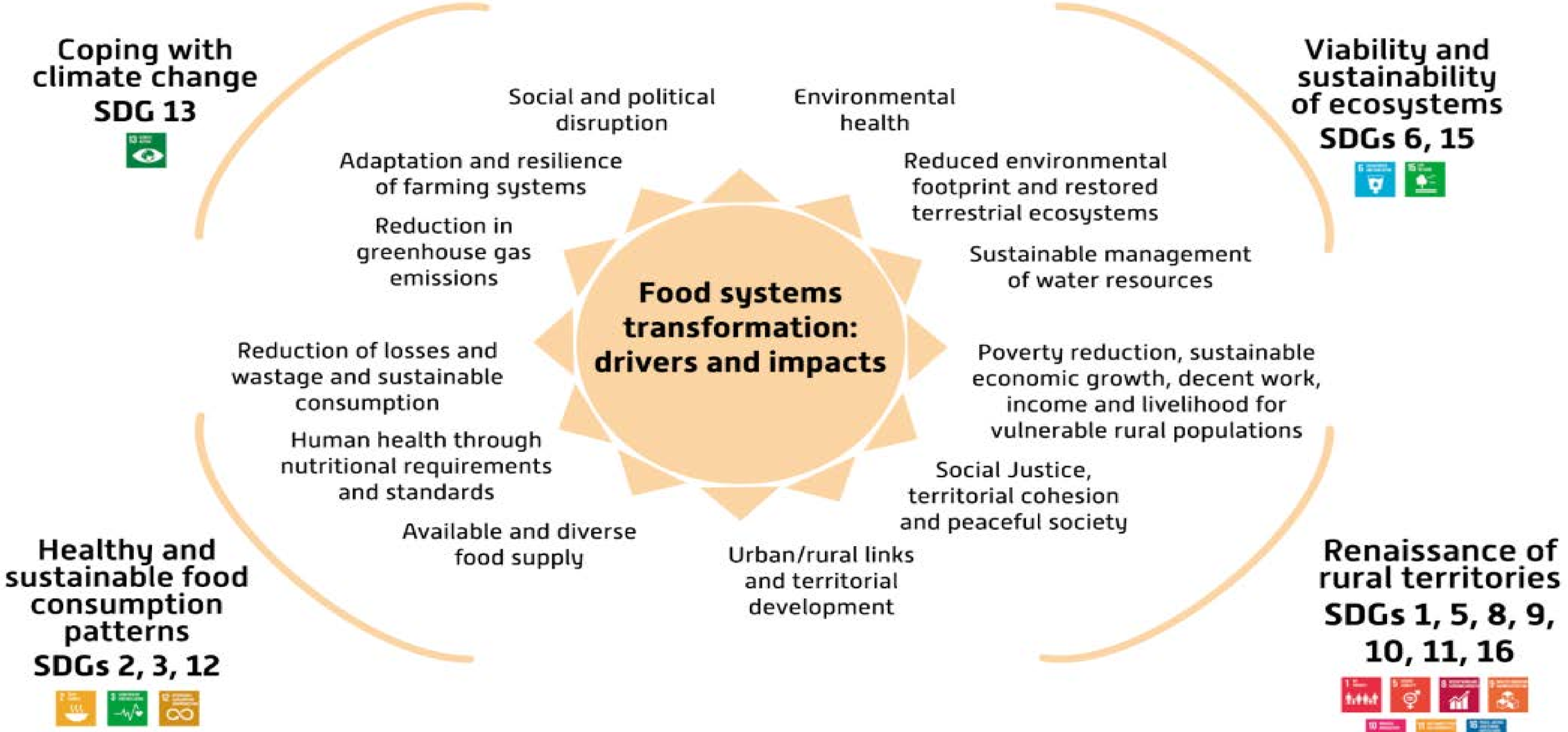
WHO<
5%

What we are actually producing (According to 2011 FAO)



Evan Fraser, Guelph, FBS analysis, 2015

Food Systems are central to meeting SDGs



Source:

Caron, Patrick et al (2018). Food systems for sustainable development: proposals for a profound four-part transformation. *Agronomy for Sustainable Development* 38:41 https://doi.org/10.1007/s13593-018-0519-1

The Fourth Industrial Revolution

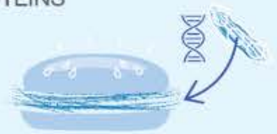
High-tech silver bullets for healthy, efficient and sustainable food systems?

Source:
World Economic Forum (2018). Innovation with a Purpose: the role of technology innovation in accelerating food systems transformation

Figure 1: The 'Transformative Twelve' could deliver significant impacts to food systems by 2030

Changing the shape of demand

ALTERNATIVE PROTEINS



- Reduce GhG emissions by up to 950 megatonnes of CO_2 eq.
- Reduce freshwater withdrawals by up to 400 billion cubic metres
- Liberate up to 400 million hectares of land

FOOD SENSING TECHNOLOGIES FOR FOOD SAFETY, QUALITY, AND TRACEABILITY

- Reduce food waste by up to 20 million tonnes

NUTRIGENETICS FOR PERSONALIZED NUTRITION

- Reduce the number of overweight by up to 55 million

Promoting value-chain linkages

MOBILE SERVICE DELIVERY

- Generate up to $200 billion of income for farmers
- Reduce GhG emissions by up to 100 megatonnes of CO_2 eq.
- Reduce freshwater withdrawals by up to 100 billion cubic metres

BIG DATA AND ADVANCED ANALYTICS FOR INSURANCE

- Generate up to $70 billion of income for farmers
- Increase production by up to 150 million tonnes

IOT FOR REAL-TIME SUPPLY CHAIN TRANSPARENCY AND TRACEABILITY

- Reduce food loss by up to 35 million tonnes

BLOCKCHAIN-ENABLED TRACEABILITY

- Reduce food loss by up to 30 million tonnes

The Fourth Industrial Revolution (2)

High-tech silver bullets for healthy, efficient and sustainable food systems?

Creating effective production systems

PRECISION AGRICULTURE FOR INPUT AND WATER USE OPTIMIZATION

- Reduce farmers' costs by up to $100 billion
- Increase production by up to 300 million tonnes
- Reduce freshwater withdrawals by up to 180 billion cubic metres

BIOLOGICAL-BASED CROP PROTECTION AND MICRONUTRIENTS FOR SOIL MANAGEMENT

- Increase production by up to 50 million tonnes
- Reduce GhG emissions by up to 5 megatonnes of CO_2 eq.

GENE-EDITING FOR MULTI-TRAIT SEED IMPROVEMENTS

- Generate up to $100 billion in additional farmer income
- Increase production by up to 400 million tonnes
- Reduce the number of micronutrient deficient by up to $100 million

OFF-GRID RENEWABLE ENERGY GENERATION AND STORAGE FOR ACCESS TO ELECTRICITY

- Generate up to $100 billion in additional farmer income
- Increase production by up to 530 million tonnes
- Reduce freshwater withdrawals by up to 250 billion cubic metres

MICROBIOME TECHNOLOGIES TO ENHANCE CROP RESILIENCE

- Generate up to $100 billion in additional farmer income
- Increase production by up to 250 million tonnes
- Reduce GhG emissions by up to 30 megatonnes of CO_2 eq.

Source:
World Economic Forum (2018). Innovation with a Purpose: the role of technology innovation in accelerating food systems transformation

Implications for Agricultural Science

- **Multidisciplinarity**
- **Transdisciplinarity**
- **Brokering new collaborations**
  (e.g. with public health, nutrition, ICT, finance)
- **Developing critical mass**
  - 5% Global GDP – (primary production)
  - 30% Global GDP – (whole food system)
  - **5% Global R&D – USD $70B (0.9B in CGIAR)**
- **New coalitions of investors**

Governance for the Anthropocene

- Humans are now changing the basic biogeochemical cycles of the planet
- Exceeding some planetary boundaries already
- On-going environmental change will challenge governments, industries and communities
- Many responses need to be designed or interpreted at regional and local levels
- Durable implementation depends on community support and engagement
- Policy convergence in food, nutrition, water and health systems (risks amplified by climate change) requires integrated planning & delivery, & decentralised leadership and decision-making
- Resilience theory warns us to look at scales above & below – need to equate the local & the global

Nutrition, along with climate change,
is the meta challenge for agriculture,
and agricultural and food systems research,
this century

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