



Future Smart Crops: The key to improving dietary diversity and fighting hunger and malnutrition

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Outline

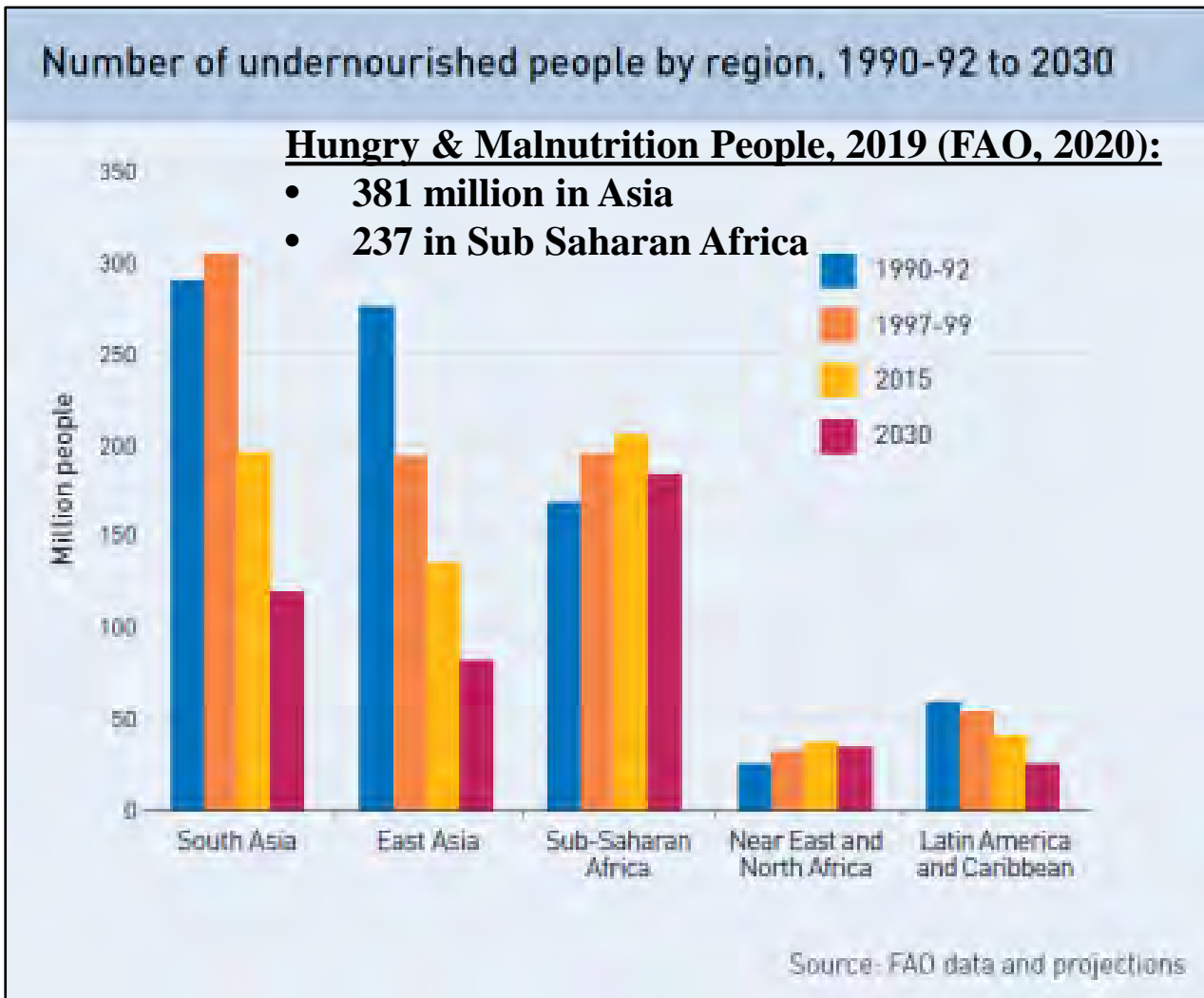
- Global Hunger and Malnutrition
- The Prevalence of Unhealthy Diets
- Challenges Facing Food Security and Nutrition
- Diversification of the Food System
- Conclusions & Recommendations



Hunger and malnutrition remain a global concern

State of Food Security and Nutrition in the World (FAO, 2020)

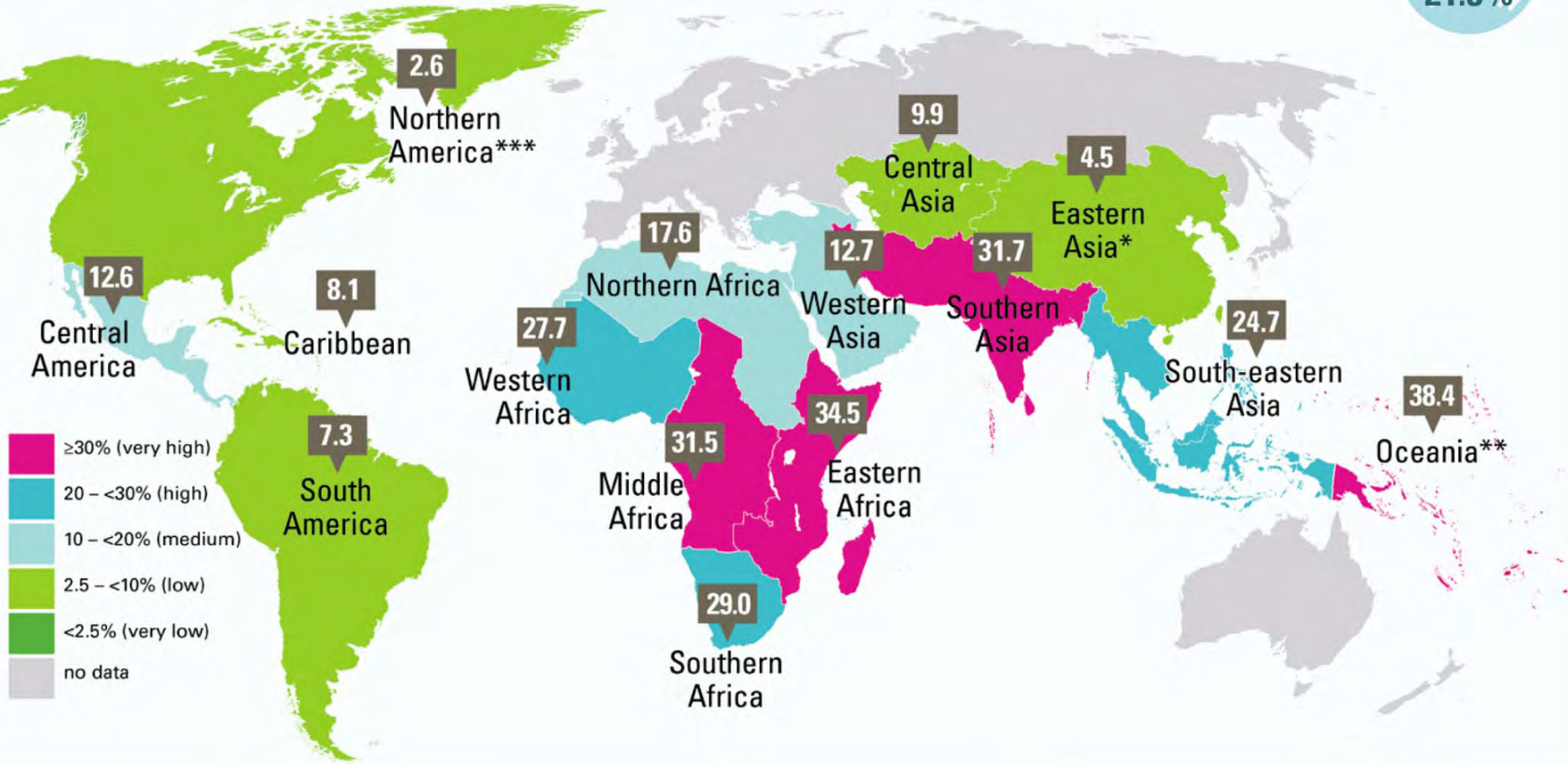
- Over 690 million people in the world still hungry in 2019; people affected by hunger on the rise slowly. If it continues at this rate, it'll exceed 840 million by 2030. (FAO 2020).
- Economic and social implications of Corona virus crisis adding >150 million to undernourished people in the world. Underscoring the immense challenge of achieving SDG2/Zero Hunger;
- Asia Pacific Region: hunger and malnutrition levels decreased over the last decade (381 m.) but continues to face high prevalence of malnutrition: 93 m. stunted children under 5 years old (30% of population);
- Sub Saharan Africa: 237 m. facing chronic malnutrition with 59 million stunted children under five years old.



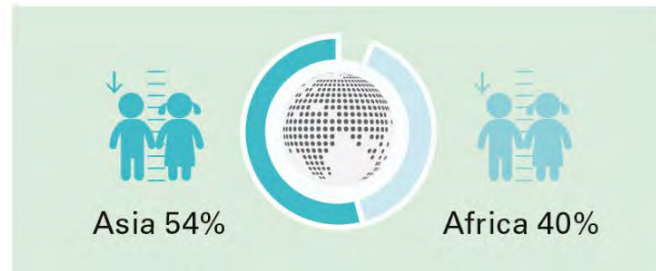
Seven sub-regions have a high or very high stunting prevalence

Percentage of stunted children under 5, by United Nations sub-region, 2019

GLOBAL
21.3%



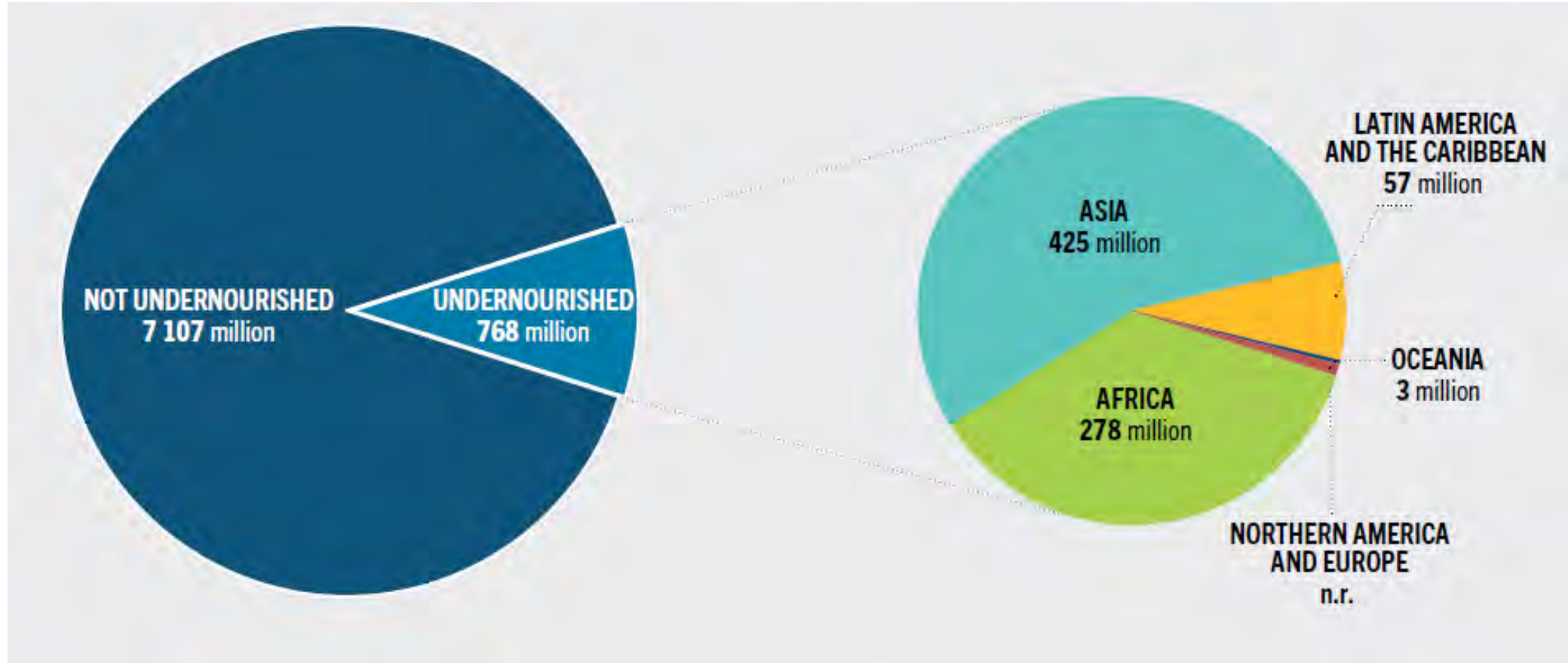
75%
of all wasted children live in lower-middle-income countries



64%
of all stunted children live in lower-middle-income countries



Between 702 and 828 million people in the world faced hunger in 2021. **Considering the middle of the projected range (768 million), hunger affected 46 million more people in 2021 compared to 2020, and a total of 150 million more people since 2019, before the Covid-19 pandemic.**



More than half (425 million) of the people in the world affected by hunger in 2021 were in Asia and more than one-third (278 million) in Africa.

What is a food system?



*“A food system consists of all the **elements** (environment, people, inputs, processes, infrastructures, institutions) and activities that relate to the **production, processing, distribution and marketing, preparation and consumption of food, and the outcomes of these activities, namely nutrition and health status, socio-economic growth, equity and environmental sustainability**”.*



Today, global food supplies rely increasingly on just a few crops and few food commodities



WHEAT



RICE



MAIZE



POTATO

And more recent ones:



SOYBEAN



SUNFLOWER OIL



PALM OIL



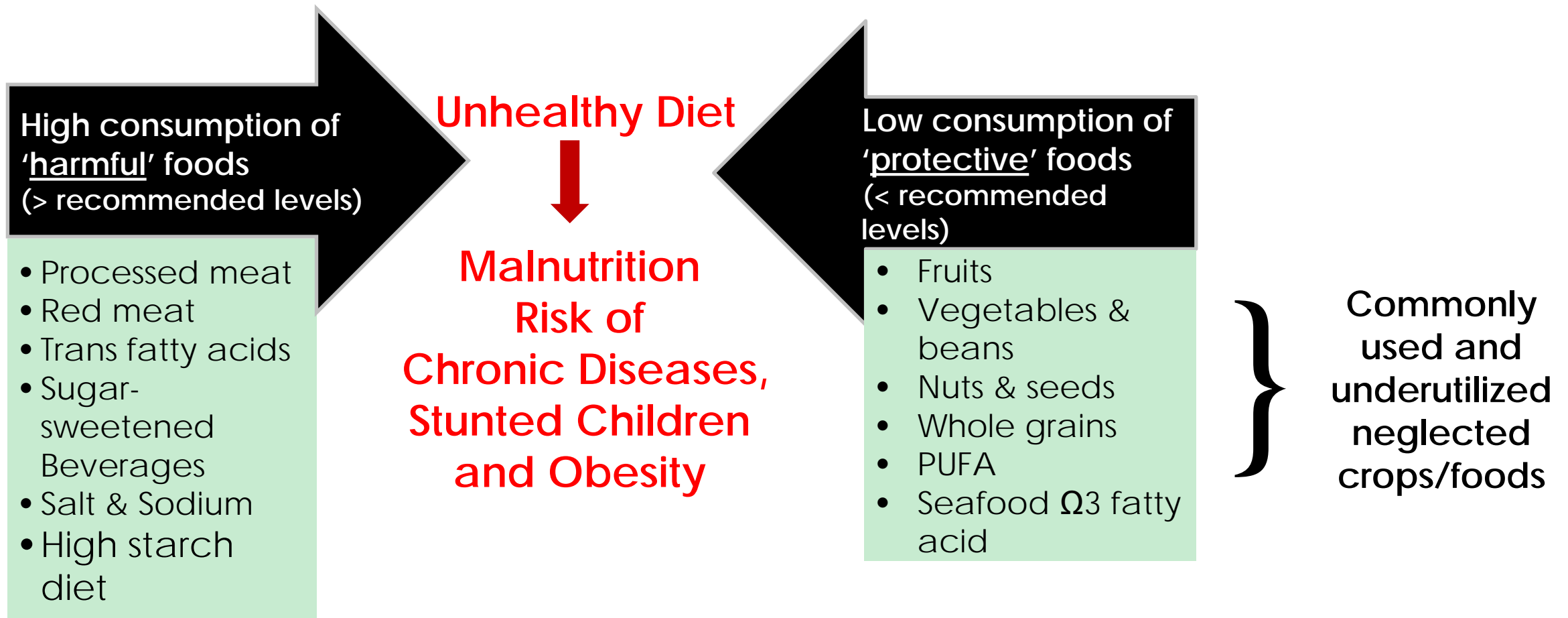
+ MEAT AND DAIRY



FISH



The unhealthy current food consumption patterns



Features of current agriculture and food systems

1. Agricultural production relies on a few staple crops with high input requirements, making farming more vulnerable to environmental shocks with negative consequences for ecosystems, food diversity and health;
2. Limited diversity in the food system including consumption leading to unbalanced diets and ultimately malnutrition.

Therefore, it is essential to diversify the food system for a balanced diet and enhance adaptation to climate change.



Major global challenges to enhance food security and nutrition

- Environmental degradation continues due to unsustainable use of already limited natural resources: water, land and biodiversity;
- Producing more food with less resources;
- Coping with serious climate change implications;
- Lack of economic and social development;
- High birth rate in developing countries (2.3% average for NENA region compared to an average of 1.9% in other developing countries);
- Political unrest, wars and civil conflicts which exacerbate these challenges and contribute to increased poverty, hunger and malnutrition.



Challenges facing food systems: limiting the capacity to address hunger and malnutrition

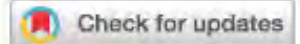


- **Bridging Production gap:** food production need to be increased by 70% to meet the needs of 9.7 billion people by 2050.
- **Limited yield potential of traditional major food crops:** unlikely to meet the increasing food demand despite considerable investments in their improvement. Annual increases in global yields of rice, maize and wheat have been slightly more than 1% only.
- **Nutrition gap:** increasing the production of staple crops like rice and wheat is not enough to accelerate reductions in malnutrition due to insufficient supply of nutrient-rich foods;
- **Diversification of Food Systems :** essential to diversify food systems for healthy diets to eliminate or reduce malnutrition.

PERSPECTIVE

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nature
plants



Rediscovering Asia's forgotten crops to fight chronic and hidden hunger

Kadambot H. M. Siddique ¹ , Xuan Li² and Karl Gruber¹

Asia has a rich variety of nutritious 'neglected crops', domesticated since ancient times but mostly forgotten or underutilized today. These crops, including cereals, roots, nuts, pulses, fruits and vegetables, are adapted to their land, resilient to environmental challenges and rich in micronutrients. Changing current agricultural practices from a near monoculture to a diverse cropping portfolio that uses these forgotten crops is a viable and promising approach to closing the current gaps in production and nutrition in Asia. Such an approach was proposed by the Food and Agriculture Organization's Zero Hunger initiative in Asia, which aims to end hunger by 2030. The Zero Hunger initiative is a promising approach to help increase access to nutritious food; however, it faces substantial challenges, such as the lack of farmer willingness to switch crops and adequate governmental support for implementation. Countries such as Nepal have started using these neglected crops, implementing various approaches to overcome challenges and start a new agricultural pathway.

Potential Future Smart Food

Cereals	Roots and tubers	Pulses	Fruits and vegetables	Nuts, seeds and spices
<ul style="list-style-type: none"> • Sorghum • Pearl millet • Finger millet • Teff • African rice 	<ul style="list-style-type: none"> • Cassava • Yams • Sweet potatoes • Taro 	<ul style="list-style-type: none"> • Cowpea • Lablab Beans • Pigeon Peas • Chick pea 	<ul style="list-style-type: none"> • Guava • Loquarts • Baobab • Amarula • Nightshades • Spider Plant • Amaranth • Pumpkin • Moringa 	<ul style="list-style-type: none"> • Macadamia • Cashews, • Bambara nuts • Cumin • Saffron • Rosemary • Ginger • Nutmeg

Examples of neglected and underutilized crops



a, Foxtail millet (Kaon) (*Setaria italica*; also known as *Panicum italicum*). **b**, Drumstick (*Moringa oleifera*). **c**, Elephant foot yam (*Amorphophallus paeoniifolius*). **d**, Taro (*Colocasia esculenta*).

Nutritional value of already utilized vegetables and fruit

- Rich in macro and micro-nutrient including minerals like iron, mg, zinc, selenium and calcium;
- Rich also in many vitamins like carotenoids, Vitamin B complex, C, K and others; antioxidants and fibers essential to healthy diets;
- Considering their nutritional importance, the UN General Assembly declared 2021 as the **International Year of Fruits and Vegetables (IYFV)**.



International Year of Quinoa 2013

Based on FAO recommendation considering quinoa's exceptional nutritional value and health benefits, the United Nations General Assembly declared 2013 as the '**International Year of Quinoa**', in recognition of ancestral practices of the Andean people, who have managed to preserve quinoa in its natural state as food for both present and future generations.



The Amazing Health Benefits of... **Quinoa**



- ✓ Source of complete protein
- ✓ Contains minerals including iron, calcium & magnesium
- ✓ Naturally gluten-free product - suitable for coeliacs
- ✓ Provides balanced energy for active lifestyles
- ✓ Weight management - keeps you fuller for longer
- ✓ High in heart healthy fats
- ✓ High in complex carbohydrates
- ✓ Rich in fibre to promote healthy bowels & digestion
- ✓ Promotes healthy blood sugar levels
- ✓ High in lysine to protect against cold sores



Pronounced 'KEEN-WAH' this seed originates in South America & was the food of the Incas for power & stamina. Available in organic/non organic as a seed or flakes, this versatile food can be eaten hot or cold. Ideal for soups or salads, it can also be used as a substitute for rice/pasta.



International Year of Pulse 2016



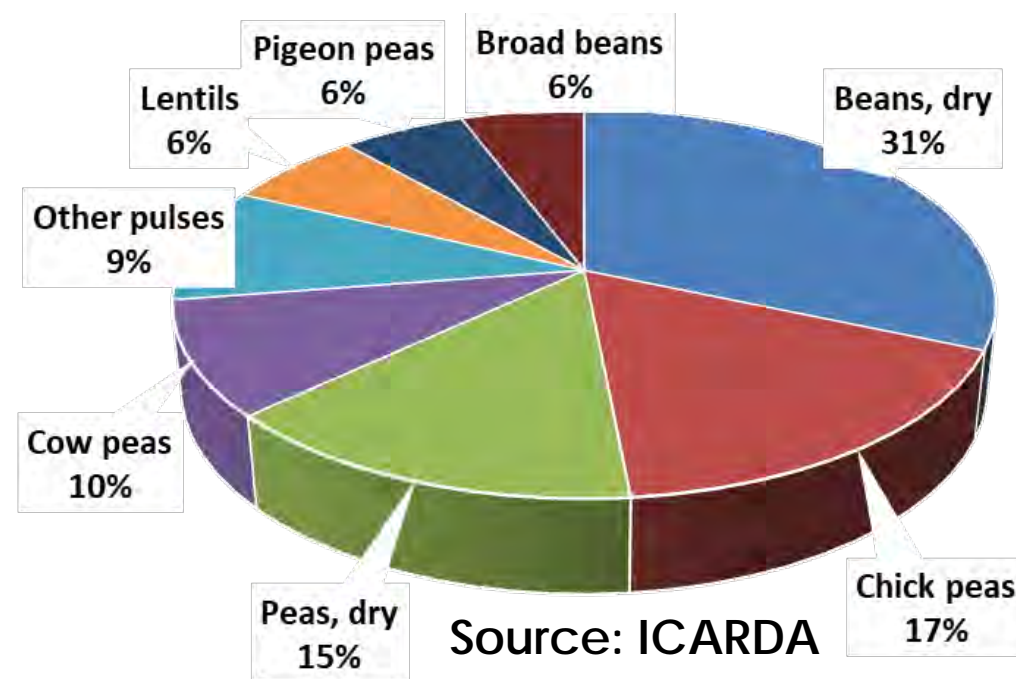
2016 was declared as the **International Year of Pulses (IYP 2016)** by the 68th session of the United Nations General Assembly based on FAO recommendation.

The IYP 2016 aims to raise public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition. The Year should facilitate cooperation within food production systems to use [protein](#) in pulses much better. Also the Year should promote production and consumption of pulses worldwide, improve crop rotation and improve trade in pulses.

Pulses offer many nutritional benefits

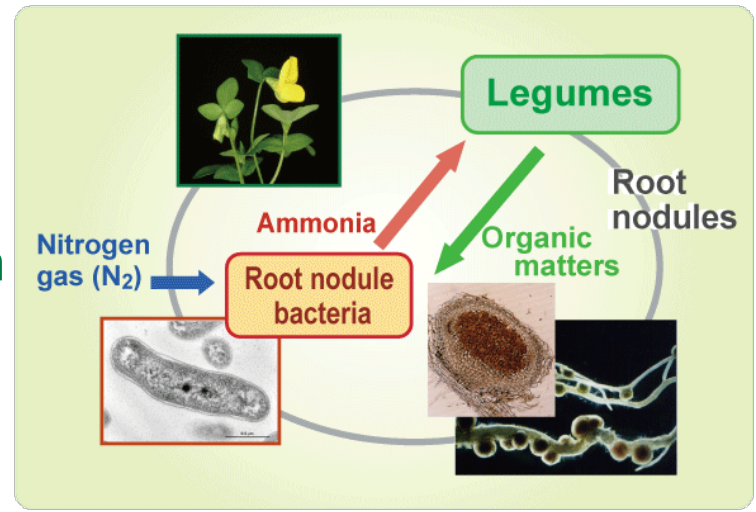
'Poor man's meat' at affordable prices

- Pulses are three times richer in low fat protein (20 – 36%) as compared to cereals including rice and wheat (7 – 9%);
- Pulses have complementary Amino acid profile with cereals;
- High in Lysine;
- Micro-nutrient rich grains (Fe, Zn, Mg and Ca);
- Good quality carbohydrates make pulses great functional food;
- High in dietary fiber.

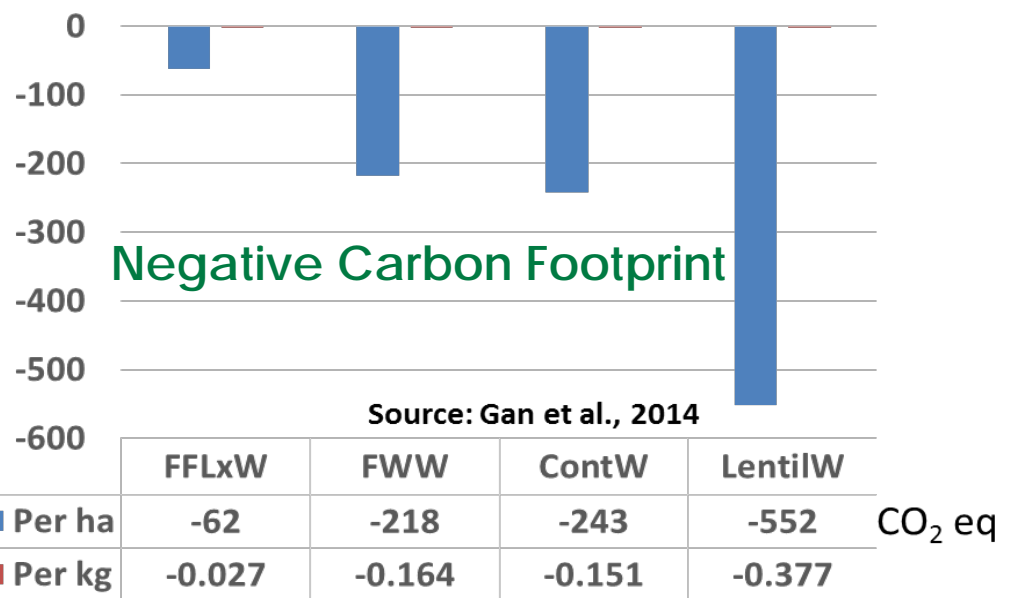
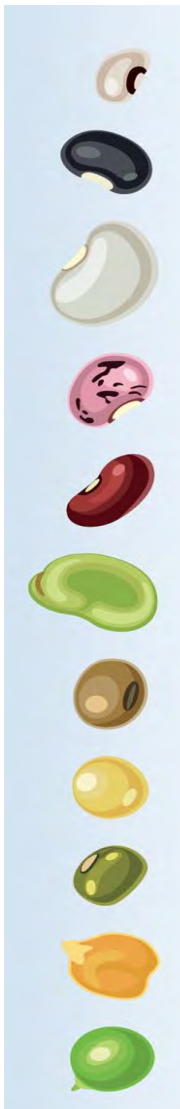


Legumes-essential for sustainable agriculture & soil health

Soil Health



- Legumes can fix 70-210 kg/ha N;
- **BNF is 20-22 million tons N/year;**
- High water use efficiency;
- **Residue of pulses has a lower C:N ratio (17) compared with oilseed (41) and wheat (32).**



Source: ICARDA

Global investment in pulse R,D&E is too low compared with cereal crops:
(US \$ 175 million per annum in 13 pulse crops)



nature
plants

PERSPECTIVE

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Neglecting legumes has compromised human health and sustainable food production

Christine H. Foyer^{1,2*}, Hon-Ming Lam³, Henry T. Nguyen⁴, Kadambot H. M. Siddique⁵, Rajeev Varshney⁶, Timothy D. Colmer^{2,5}, Wallace Cowling⁵, Helen Bramley⁷, Trevor A. Mori⁸, Jonathan M. Hodgson⁸, James W. Cooper¹, Anthony J. Miller⁹, Karl Kunert¹⁰, Juan Vorster¹⁰, Christopher Cullis¹¹, Jocelyn A. Ozga¹², Mark L. Wahlqvist^{13,14}, Yan Liang¹⁵, Huixia Shou¹⁶, Kai Shi¹⁷, Jingquan Yu¹⁷, Nandor Fodor¹, Brent N. Kaiser¹⁸, Fuk-Ling Wong³, Babu Valliyodan⁵ and Michael J. Considine^{2,5,19}

Why Millets?

- Provide nutritious food, feed and fodder
- Less water consuming than other cereals
- Grow faster & putting less stress on environment
- Low insects, pests and diseases problem
- Can grow on marginal lands
- Complete food and nutritional security
- Will supplement the existing income of the farmers
 - ✓ reducing groundwater extraction,
 - ✓ combating desertification and
 - ✓ increasing farmer resilience to droughts brought on by climate change



Millets



Sorghum



Pearl Millet



Finger Millet



Foxtail Millet



Little Millet



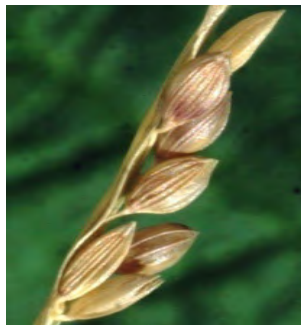
Barnyard Millet



Kodo Millet



Proso Millet



Fonio



Browntop
Millet



Crab finger
Millet



Teff

International Year of Millets (IYoM)-2023

- Government of India had proposed to United Nations for declaring 2023 as International Year of Millets (IYOM). The proposal of India was supported by 72 countries and United Nation's General Assembly (UNGA) declared 2023 as International Year of Millets on 5th March, 2021
- Government of India is celebrating IYOM, 2023 to make it peoples' movement so that the Indian millets, recipes, value added products are accepted globally



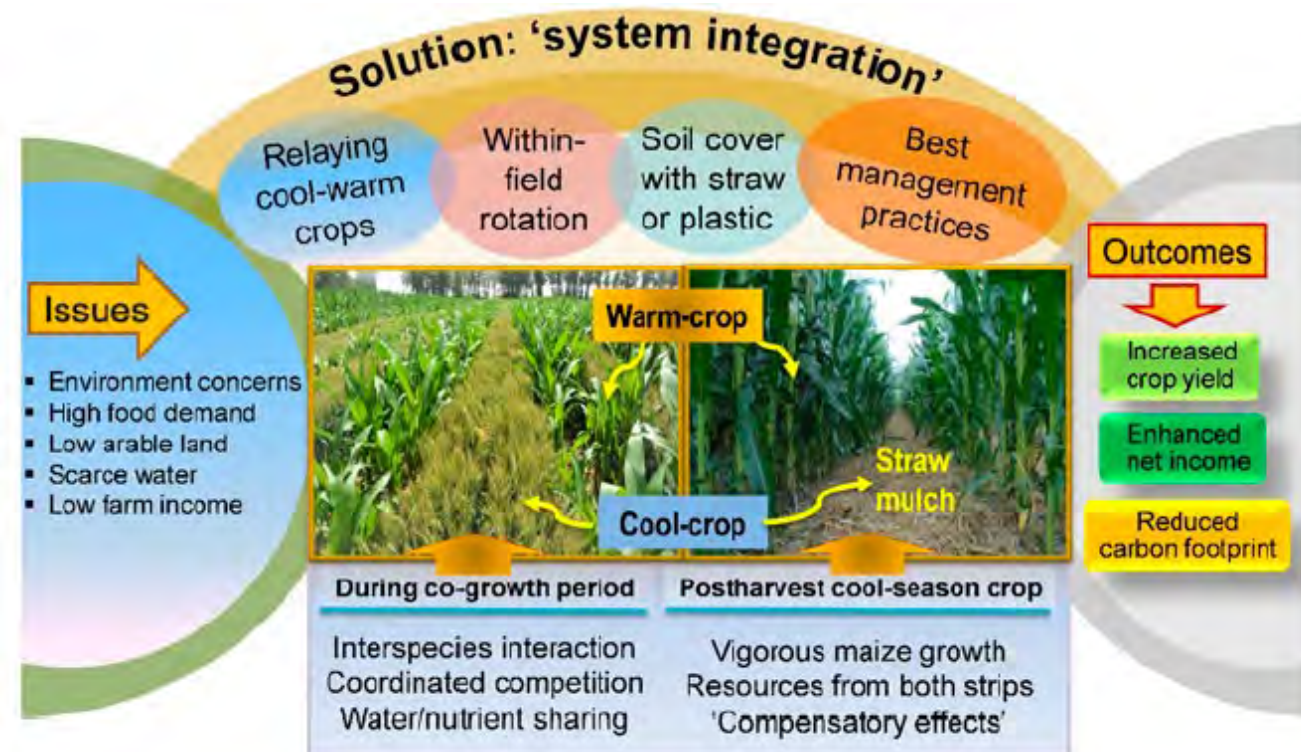
Integrated farming with intercropping increases food production while reducing environmental footprint

Qiang Chai^{a,1}, Thomas Nemecek^b, Chang Liang^c, Cai Zhao^a, Aizhong Yu^a, Jeffrey A. Coulter^d, Yifan Wang^a, Falong Hu^a, Li Wang^{a,1}, Kadambot H. M. Siddique^e, and Yantai Gan^{f,1,2}

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Food security has been a significant issue for the livelihood of smallholder family farms in highly populated regions and countries. Industrialized farming in more developed countries has increased global food supply to meet the demand, but the excessive use of synthetic fertilizers and pesticides has negative environmental impacts. Finding sustainable ways to grow more food with a smaller environmental footprint is critical. We developed an integrated cropping system that incorporates four key components: 1) intensified cropping through relay planting or intercropping, 2) within-field strip rotation, 3) soil mulching with available means, such as crop straw, and 4) no-till or reduced tillage. Sixteen field experiments, conducted with a wide range of crop inputs over 12 consecutive years (2006 to 2017), showed that the integrated system with intercropping generates significant synergies—increasing annual crop yields by 15.6 to 49.9% and farm net returns by 39.2% and decreasing the environmental footprint by 17.3%—when compared with traditional monoculture cropping. We conclude that smallholder farmers can achieve the dual goals of growing more food and lowering the environmental footprint by adopting integrated farming systems.





The Future Smart Food Initiative - edited by Dr Xuan Li & Professor Kadambot H.M Siddique



Food and Agriculture Organization of the United Nations

SUSTAINABLE DEVELOPMENT GOALS



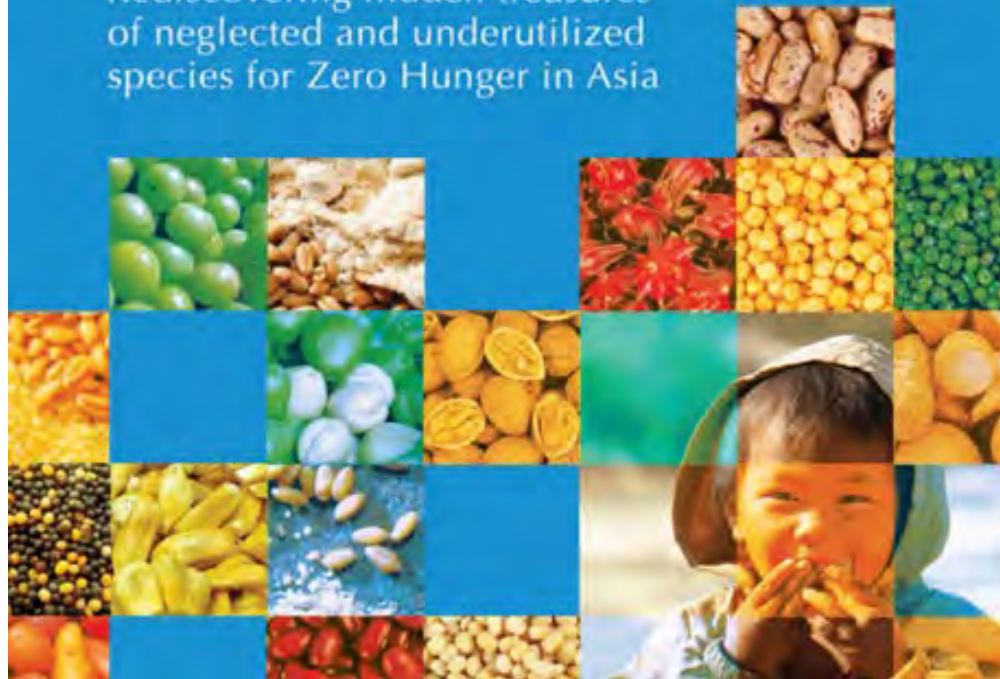
working for Zero Hunger

FUTURE SMART FOOD

Rediscovering hidden treasures of neglected and underutilized species for Zero Hunger in Asia

FAO RAP's Regional Initiative on Zero Hunger is taking a leading role in harnessing the hidden treasures embodied in neglected and underutilized species, which we like to call 'Future Smart Food'. These foods are smart because they can bolster dietary diversification, improve micronutrient intake, enhance soil health, require fewer inputs such as chemical fertilizers and often prove resilient to climate change and adverse farming conditions..How to create an enabling environment across value chains – to promote their sustainable production, processing, marketing and consumption of Future Smart Food – is essential to achieving Zero Hunger.

José Graziano da Silva
FAO Director-General



Original partners to FAO's Future Smart Food Initiative



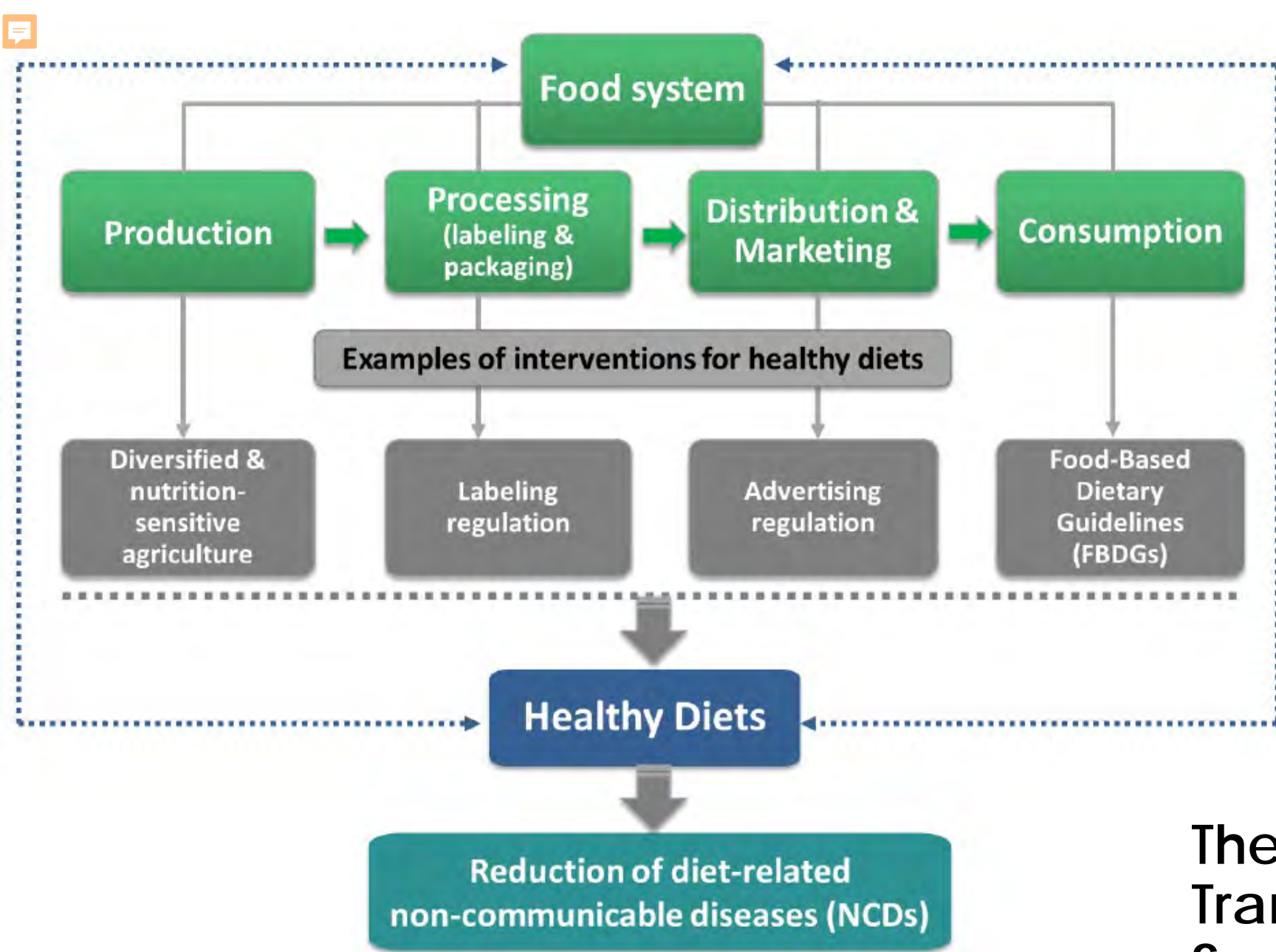


Neglected and Underutilized Crops

Future Smart Food

Edited by
Muhammad Farooq and Kadambot H.M. Siddique





The Approach for
Transformation of Food
System for Healthy Diet

Multi-dimensional benefits of traditional underutilized local crops

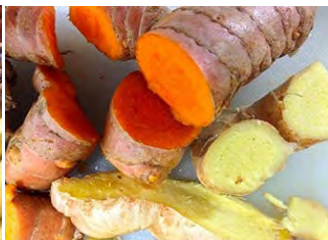




Conclusions and recommendations



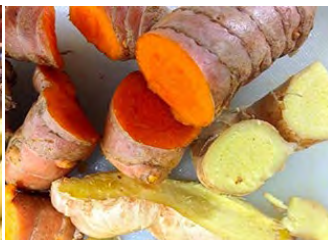
- **Current food system need to be transformed to be diversified** by incorporating Asia's (and Africa's) crops/foods to achieve healthy diets, reduce malnutrition and contribute to food security and nutrition.
- **Healthy diets will certainly provide more protein, macro and micro-nutrients and vitamins to reduce or eliminate malnutrition, hidden hunger, stunted children and obesity.**
- Targeted traditional underutilized local crops deserves special attention to diversify food systems considering not only their nutritional and health benefits but also **their adaptation to harsh environments, marginal land, low input agriculture and resilience to climate change.**





Conclusions and recommendations (cont'd)

- **Enhancing awareness of policy makers on the importance of diversified food system** to enhance food security and nutrition, increase income of small farmers, coping with climate change implications and producing more food with less resources;
- Incorporating diversification of food systems in **national food security and nutrition strategies and policies**;
- Encouraging and **investing in scientific research by public and private sectors** to improve traditional underutilized local crops to be integrated in agriculture and food systems
- **Increasing awareness of producers and consumers** about the nutritional, health, economic and environmental benefits of diversified food systems;



Conclusions and recommendations (cont'd)

- **Enhancing coordination and capacity development** of stakeholders involved in the food systems components including production, processing, marketing and consumptions and disposal;
- **Developing innovative platforms to allow greater access to information and technology transfer to all stakeholders involved in all components of food systems and value chain.**

