Linking Nutrition with Agriculture- Nutrition Values and Interventions from Seed to Table and Beyond

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12 October 2016




Outline

- Introduction and objectives of the day (10 min)
- Part 1: Nutrition values from seed to table and beyond
  - Lectures (60 min)
    - Food and nutrition
    - Nutrition values from seed to table and beyond
    - Case studies
  - Group discussion and presentation (110 min)
- **Part 2: Nutrition interventions from seed to table and beyond**
  - Lectures (60 min):
    - Public health nutrition
    - Linking nutrition with agriculture
    - Case studies
  - Group discussion and presentation (120 min)

Importance of vegetables in Human Nutrition

- Food and nutrition security
- Dietary needs and consumption patterns
- Enhancing nutrient supplies from farm to table

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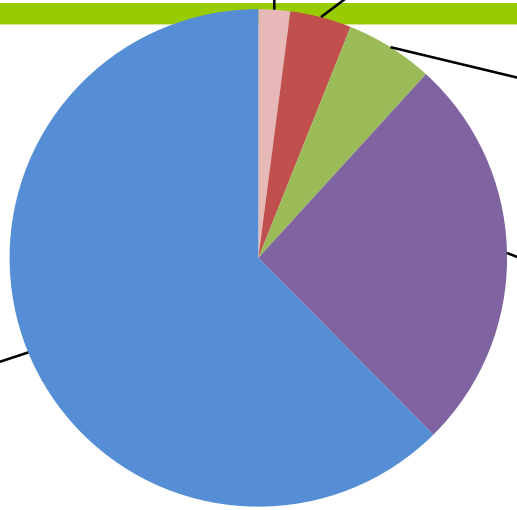
Food and nutrition security

- Sustainable and affordable diets and healthy life styles for all
- Food and nutrition security

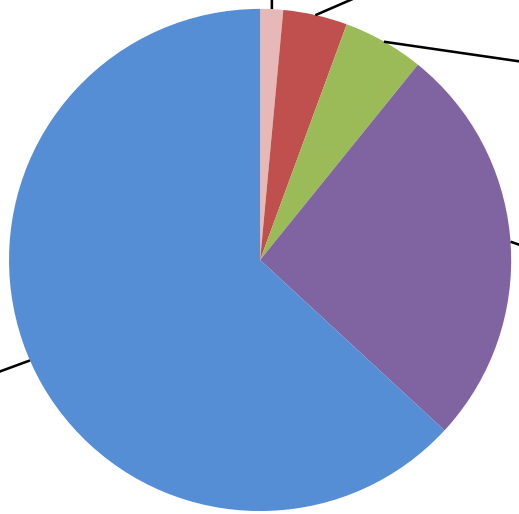
Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life (the Committee on World Food Security, 2012)

Food insecurity

Total in 2010 = 925 million



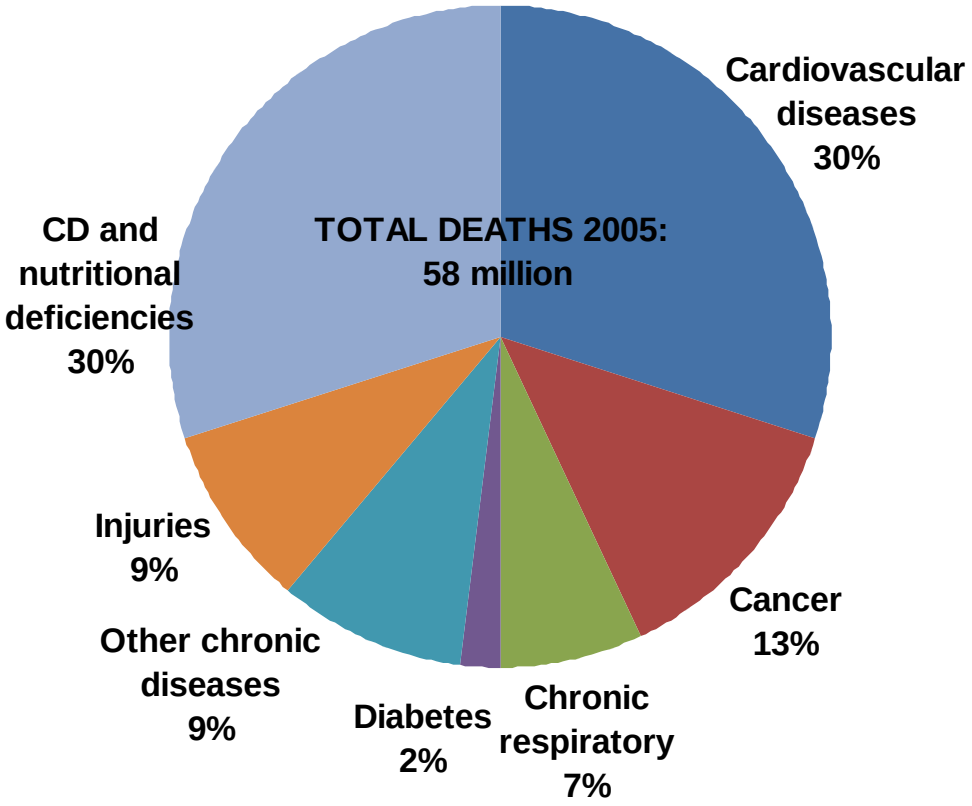
Total in 2009 = 1.02 billion



Malnutrition

Three forms

- Hunger (under nutrition)
  - Insufficient protein and energy
- Hidden hunger (micronutrient deficiencies)
  - Deficiencies in vitamin A, iron, zinc and iodine
- Overweight and obesity
  - Over consumption of high energy food



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Malnutrition

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The multiple burden of malnutrition

- A: child stunting
- B: Child micronutrient deficiencies
- C: Adult obesity
- D: No significant malnutrition problem

Multiple burden:

- AB, ABC, BC, B, C, D

Source: Food system for better nutrition, FAO 2013

Undernutrition in children

- Stunting: low height for age
  - Child's height is shorter than an average child his or her age due to malnutrition
- Underweight: low weight for age
  - Child's weight is less than an average child his or her age due to malnutrition
- Wasting: low weight for height
  - child's fat and muscles are wasting away, making them thin due to being hungry or starving recently

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Malnutrition in Children

	Children under five (2003-2008) in %				% Low birth weight
Countries	Underweight		Wasting	Stunting	<2500 g
	Moderate & Severe	Severe	Moderate & Severe	Moderate & Severe	
Bhutan	14	3	3	48	9.9
Burkina Faso	32	-	19	36	16.2
Indonesia	18	5	14	37	8.8
Nepal	39	11	13	49	21.2
Philippines	21	5	6	34	21.2
Thailand	7	1	5	16	6.6
Tanzania	17	4	4	44	9.5

-: no data available
Source: UNICEF State of the World's Children (2012); WHO NLiS (2008)

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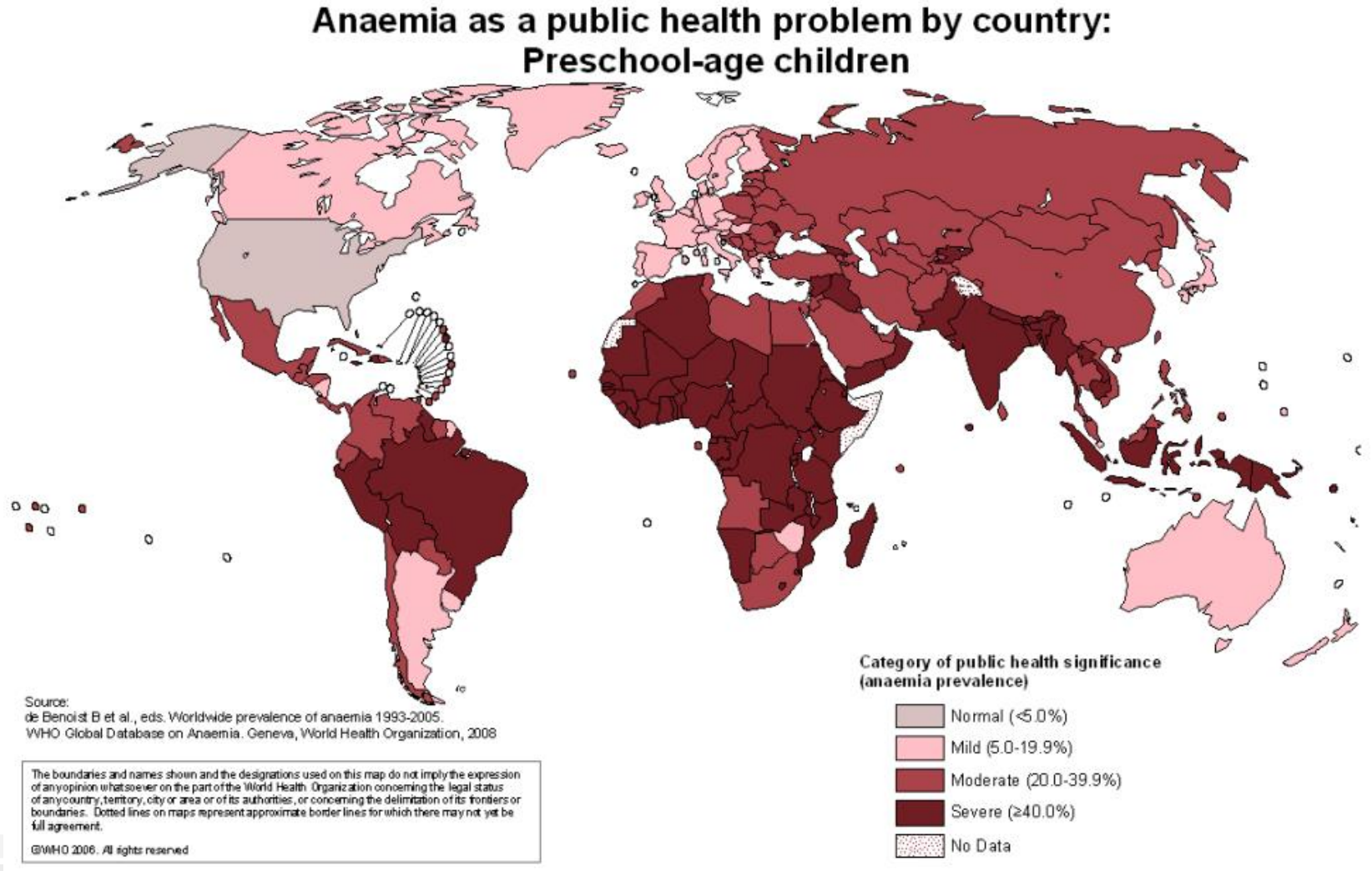
Iron Deficiency



Severe anemia: Burkina Faso, Tanzania, Nepal, Bhutan, Indonesia
Moderate anemia: Thailand, Philipines

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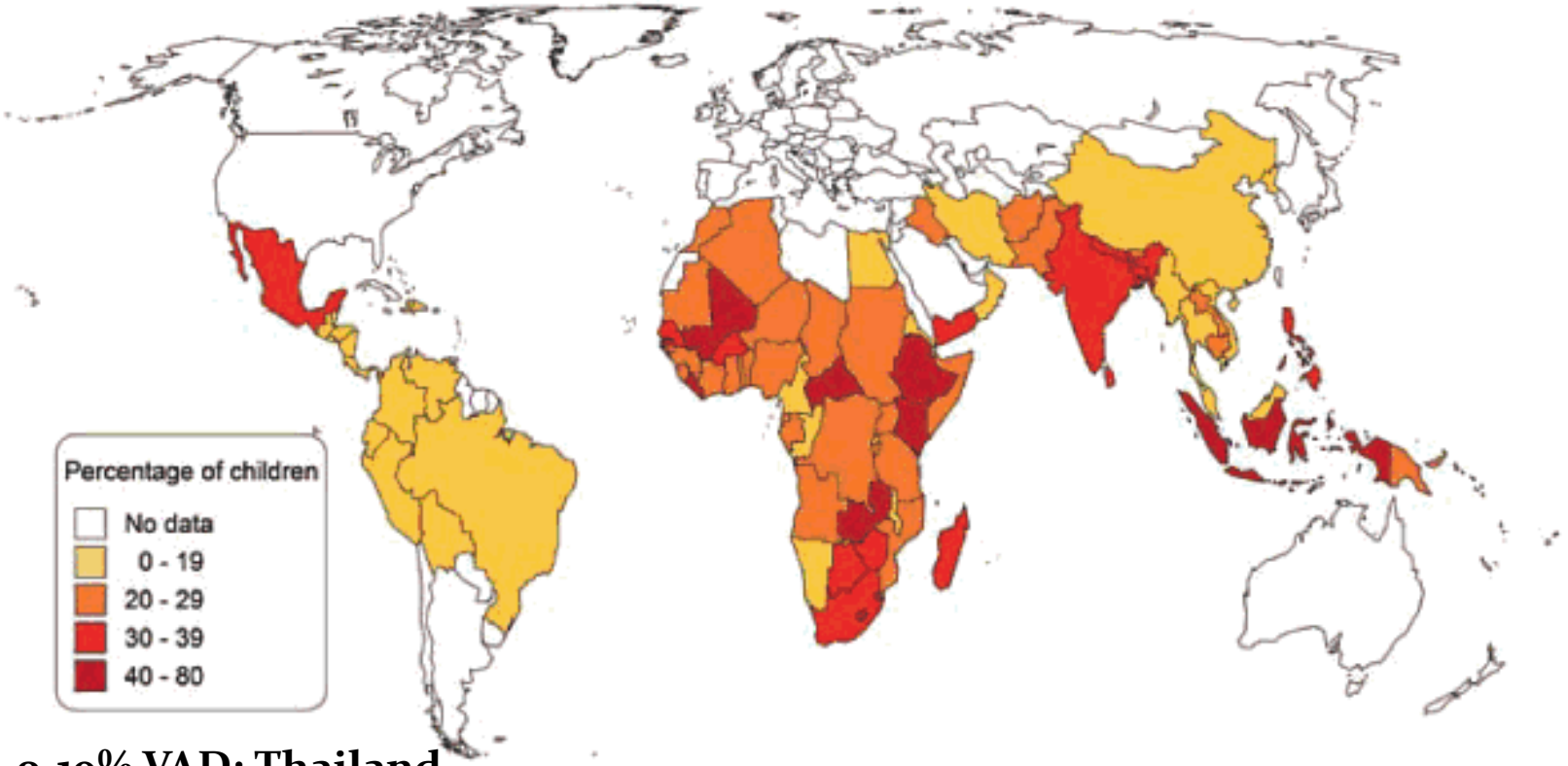
Vitamin A deficiency in preschool-aged children



<u>0-19% VAD:</u> Thailand
<u>20-29% VAD:</u> Tanzania
<u>30-39% VAD:</u> Burkina Faso, Nepal, Philippines
<u>40-80% VAD:</u> Indonesia, Bhutan

Source: The Atlas of World Hunger (2010)

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Malnutrition in Women

	Malnutrition in women based on BMI in %		
Countries	Underweight	Overweight	Obese
	<18.5 kg/m²	≥25 kg/m²	≥30 kg/m²
Bhutan	-	-	-
Burkina Faso	27.2	9.3	2.4
Indonesia	-	17.8	3.6
Nepal	24.4	8.6	0.9
Philippines	14.2	27.3	5.7
Thailand	6.6	37.1	10.2
Tanzania	22.6	17.7	4.4

-: No data available
Source: WHO NLiS (2008)

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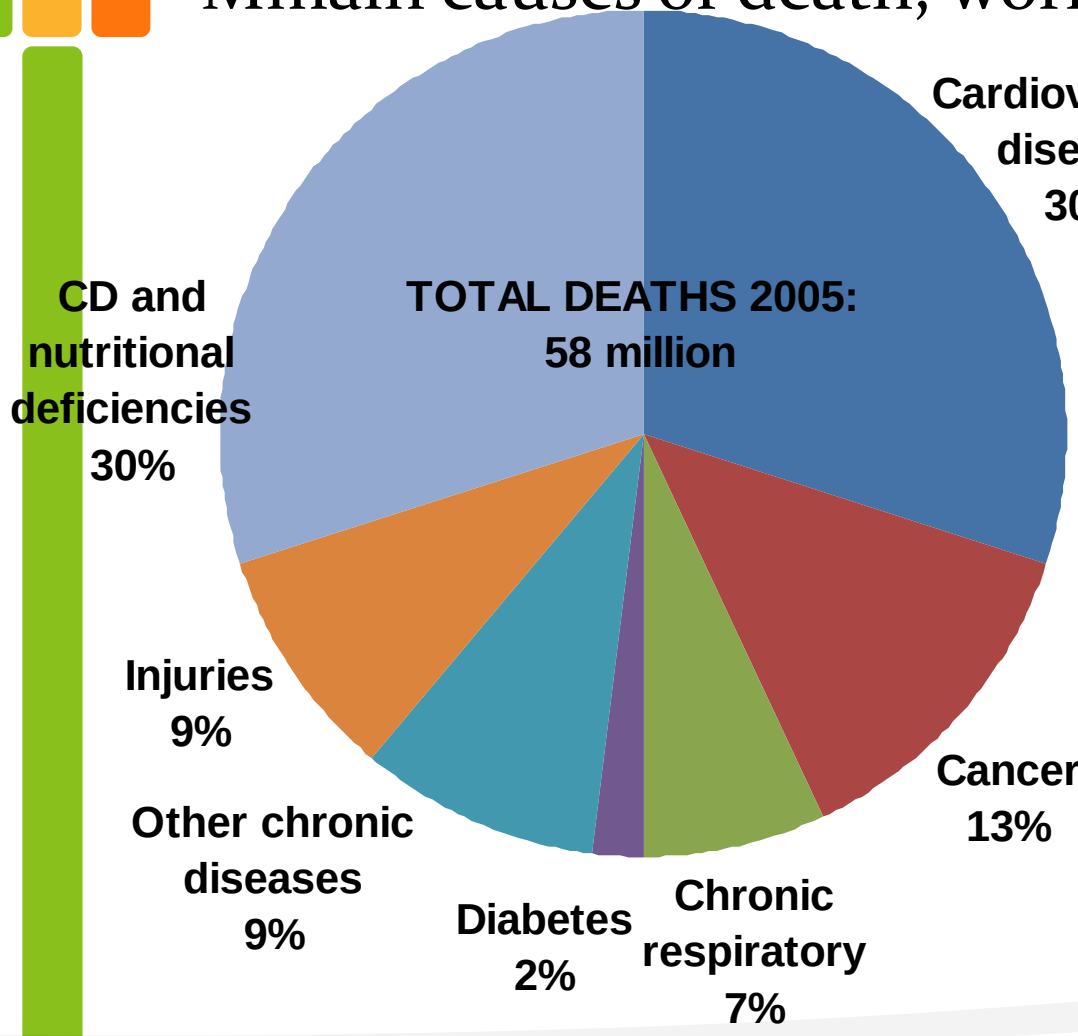
Mmain causes of death, worldwide, all ages, 2005



- 35 million people (61%) died of chronic diseases in 2005
- 23 million people (30%) died of communicable diseases and nutritional deficiencies
- 80% of chronic disease deaths occur in low & middle income countries

Source: WHO 2005

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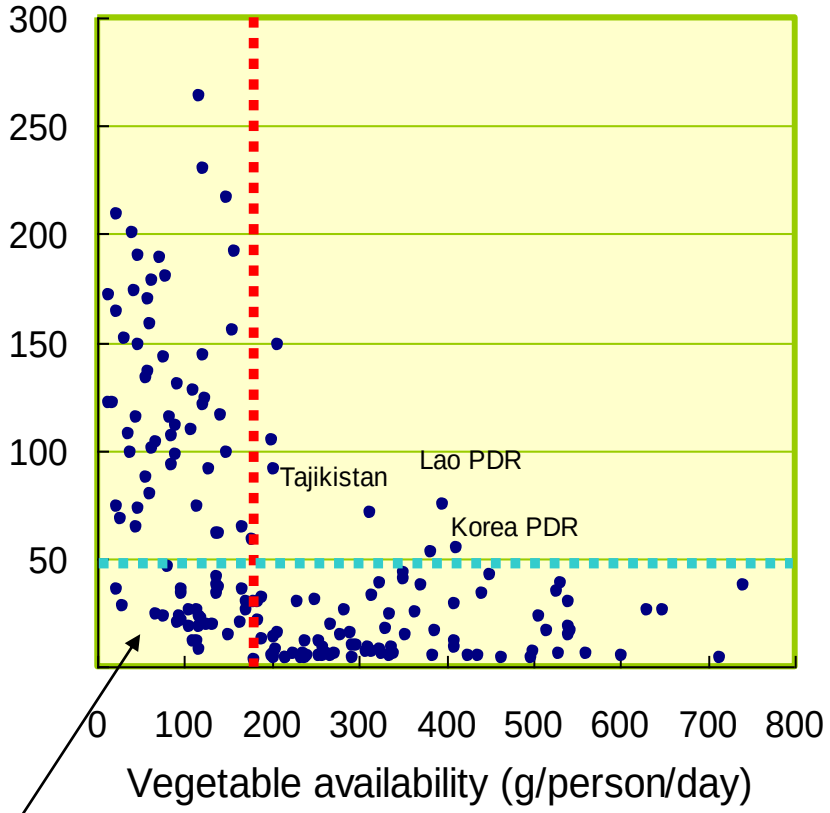
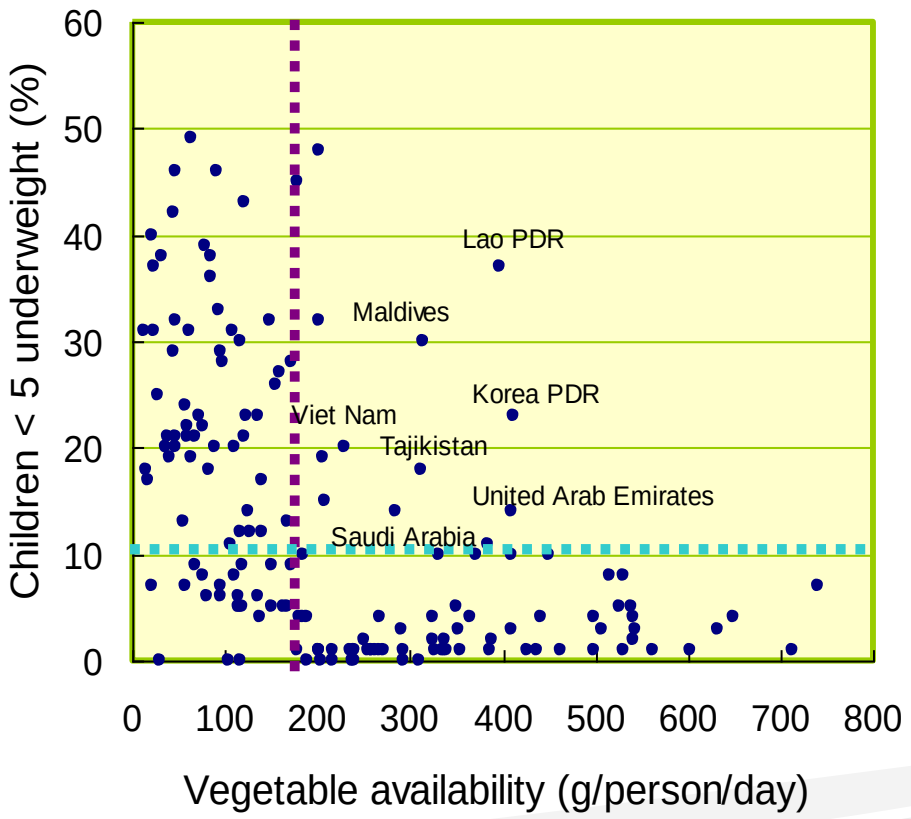
National vegetable availability vs. health/nutrition status

Health status indicator:
Children under 5 mortality rate



Nutrition status indicator:
Children under 5 underweight



Iceland, Thai, Malaysia, Costa Rica, Fiji, Grenada, Columbia, Peru, Panama, Honduras, Nicaragua

Data source for the correlation test: FAOSTAT and WHO

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The strength of evidence for obesity, type 2 diabetes, cardiovascular disease (CDV), and cancer

	Obesity	Type 2 diabetes	CVD	Cancer
High intake of energy-dense foods	C↑			
High intake of NSP (dietary fibre)	C↓	P↓	P↓	
Wholegrain cereals			P↓	
Fruits and vegetables	C↓	P↓	C↓	P↓
Whole fresh fruits				
Sugars-sweetened soft drinks and fruit juices	P↑			
Overweight and obesity		C↑	C↑	C↑
Physical activity, regular	C↓	C↓	C↓	C↓
Heavy marketing of energy-dense foods, and fast-food outlets	P↑			

C↑: Convincing increasing risk; C↓: convincing decreasing risk; P↑: Probable increasing risk; P↓: Probable decreasing risk; P-NR: Probable, no relationship;

WHO Technical Report Series 916, 2003

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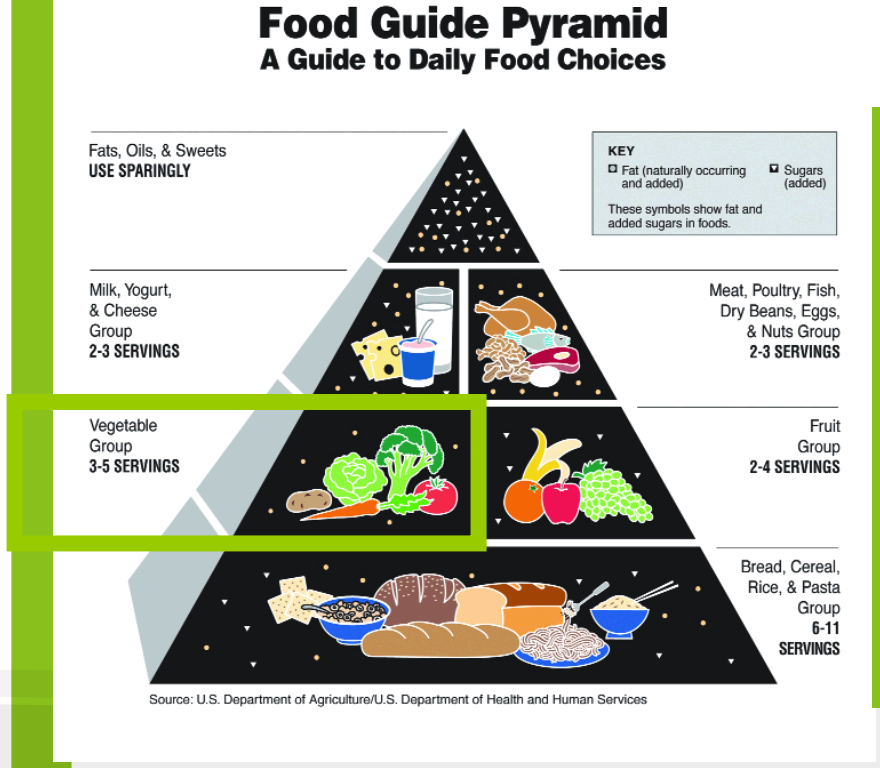


Vegetables

3-5 servings a day

Min. 200 g per day

Min. 73 kg per year

5 al día
Frutas y hortalizas frescas

5 A Day
Eat 5 to 9 Fruits and Vegetables for Better Health

fruits and vegetables
EAT 5 to 9 A DAY
for better health

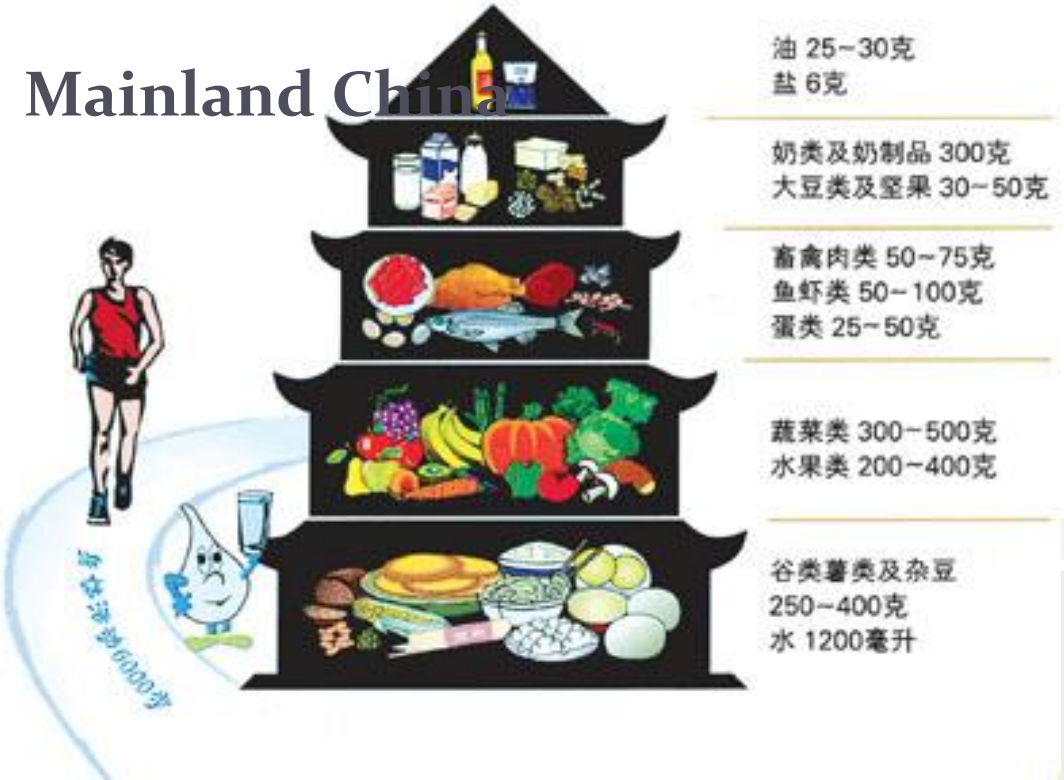
Source: USDA

National dietary guidelines

Hong Kong

Taiwan

Mainland China



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The Philippines

India

* Portion Size. ** No. of Portions

Extra Portions:

Pregnant women : Fat/Oil-2, Milk-2, Fruit-1, Green Leafy Vegetables-1/2.

Lactating women : Cereals-1, Pulses-2, Fat/Oil-2, Milk-2, Fruit-1, Green Leafy Vegetables-1/2

Between 6-12 months of lactation, diet intake should be gradually brought back to normal.

Elderly women : Fruit-1, reduce cereals and millets-2.

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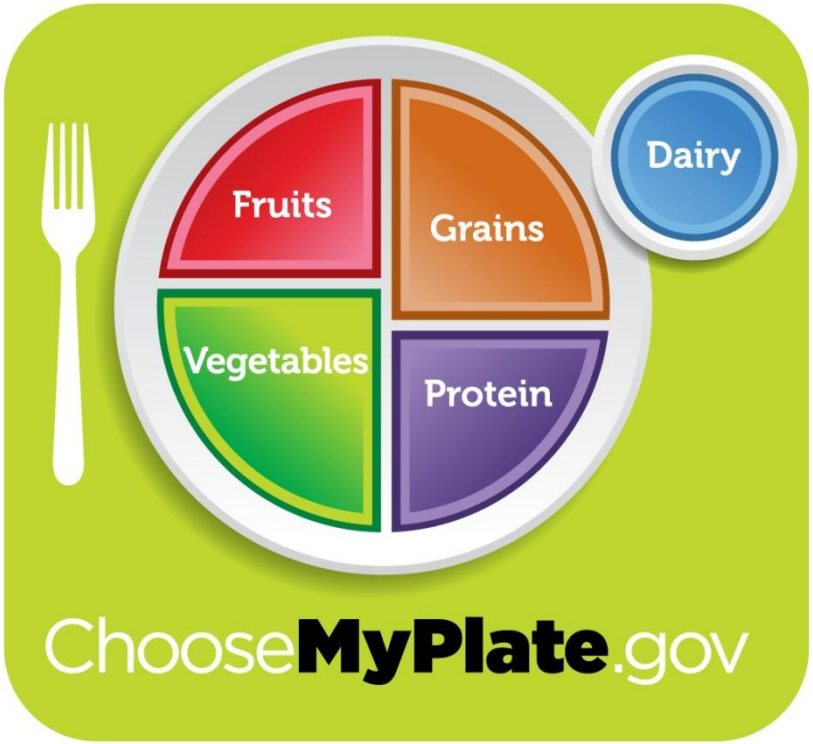
Health Canada Santé Canada

Canada

USA



Food guide

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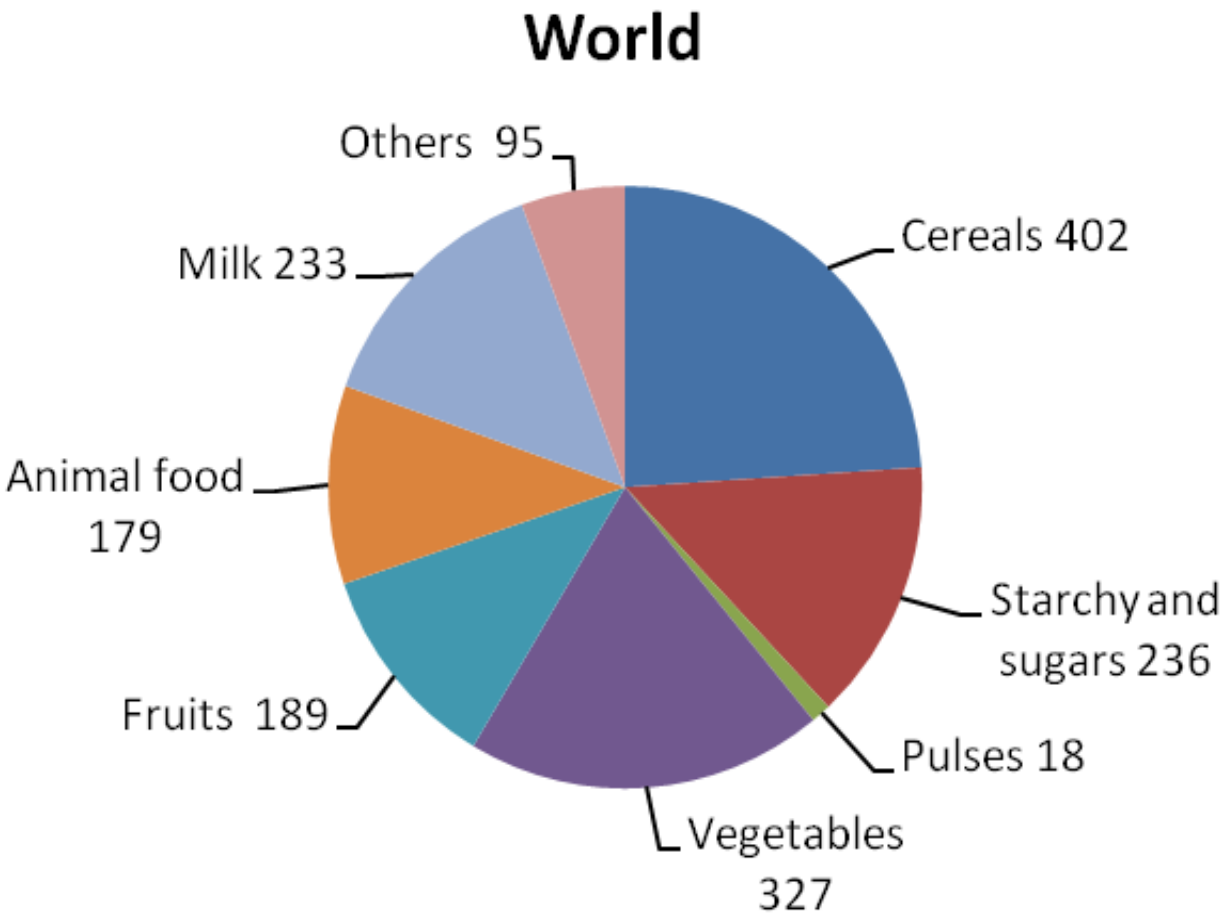
Food consumption patterns



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Comparison Among Countries

	Burkina Faso	Indonesia	Nepal	Philippines	Thailand	Tanzania
Cereals	627	512	473	422	421	287
Starchy Roots	27	159	189	84	57	443
Animal Foods	109	151	161	253	234	155
Pulses and Nuts	35	5	25	9	9	55
Vegetables	**37**	**108**	**243**	**170**	**129**	**94**
Oilcrops	52	103	23	27	63	50
Fruits	16	186	109	334	293	211
Others	14	48	113	77	114	27
Total	917	1272	1336	1376	1320	1322

Source: FAOSTATS (2012)

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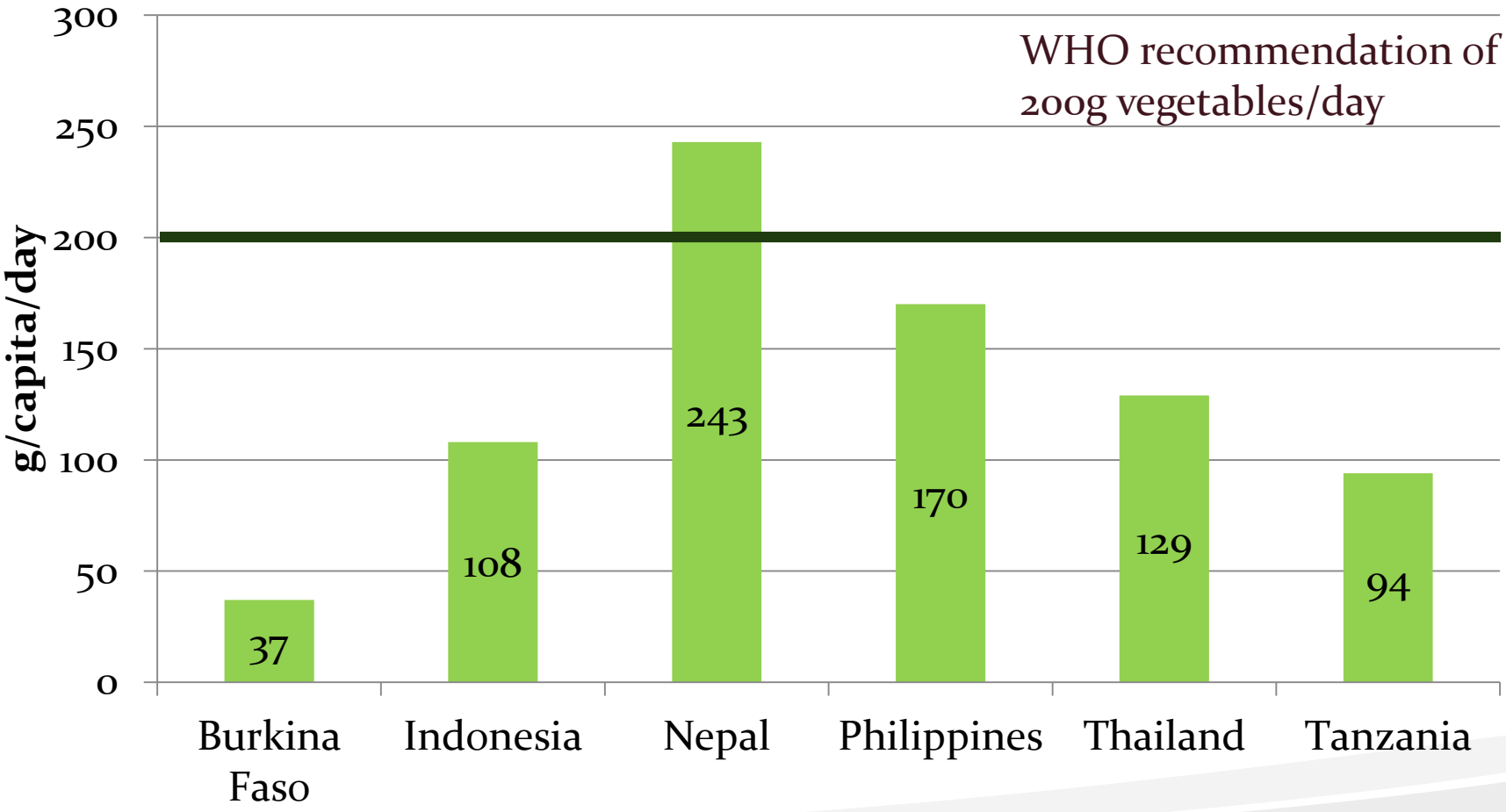
Vegetable Supply by Country



*No data for Bhutan

Source: FAOSTATS (2012)

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Contribution of vegetables to human nutrition and health

Consumption x **Nutrient density** x **Bio-availability**

- Increased access, availability, and consumption of vegetables
- Improved nutrient and bioactive phytochemical contents
- Enhanced nutrient retention and bioavailability

= **Nutrition and health outcome**

- Assessing the outcomes from the consumption of vegetables on nutrition, public health and overall economic development.

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Food flow from seed to fork, to human

Nutrition outcomes and impact

Seeds (genebank/breeding) → **Field** → **Market** → **Plate** → **Human**

Homestead Production

Gap

Gap

Gap

Gap

Gap

Nutritional value chain

What are the types and amounts of food and nutrients

- Produced by farmers
- Made available for dietary requirements
- Distributed
- Accessible and affordable by consumers
- Selected, purchased, used by consumers
- Consumed

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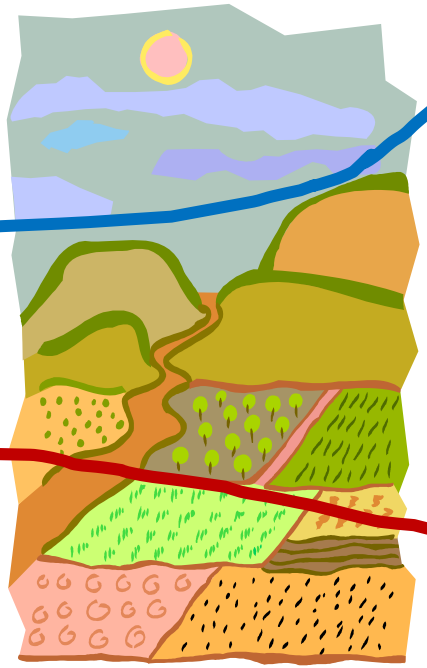
Nutritional Value Chain

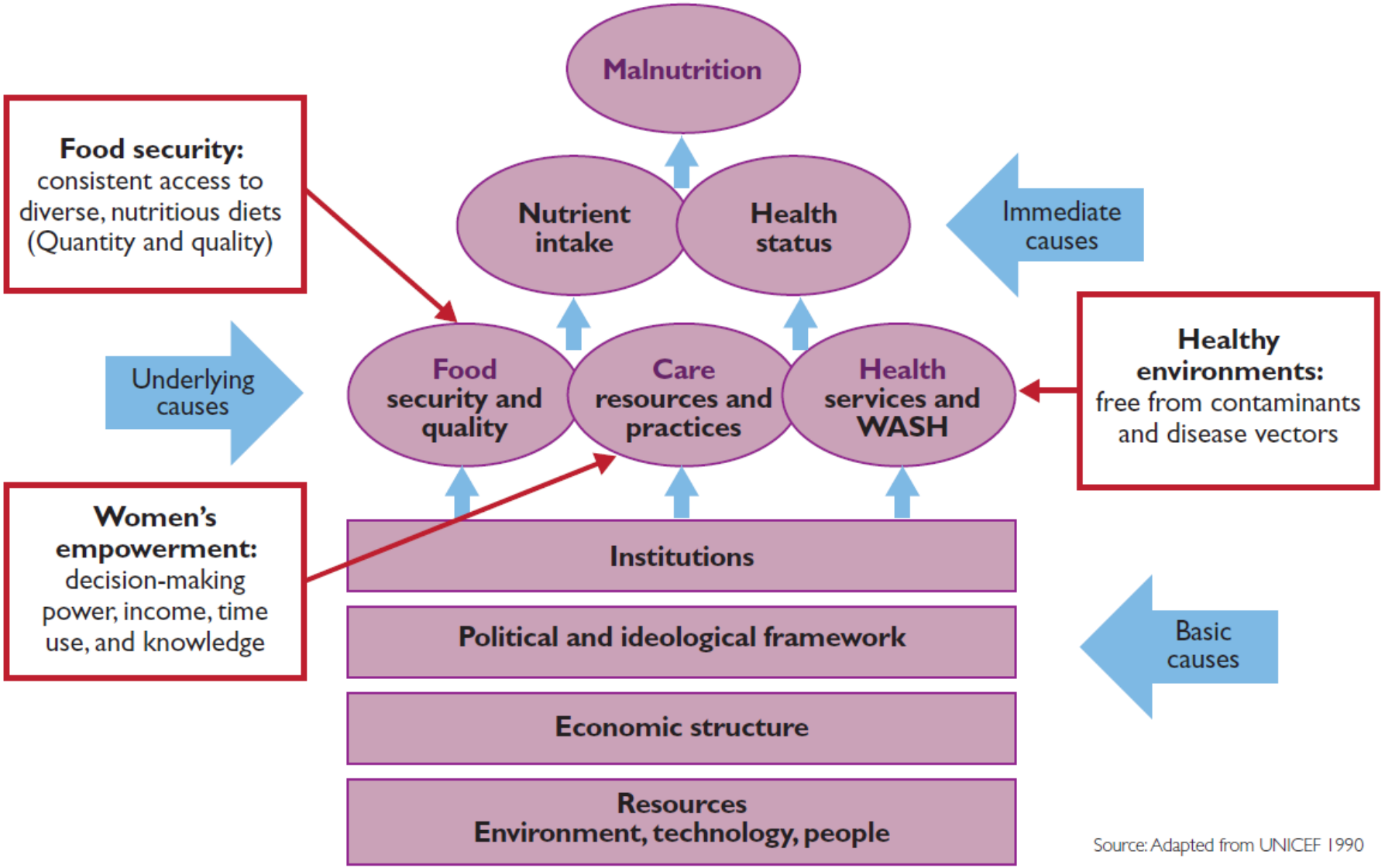
Nutrition outcomes and impact



Seeds (genebank/breeding) → **Field** → **Market** → **Plate** → **Human**

Homestead Production

UNICEF framework for malnutrition



Source: Adapted from UNICEF 1990

Linking agriculture and nutrition

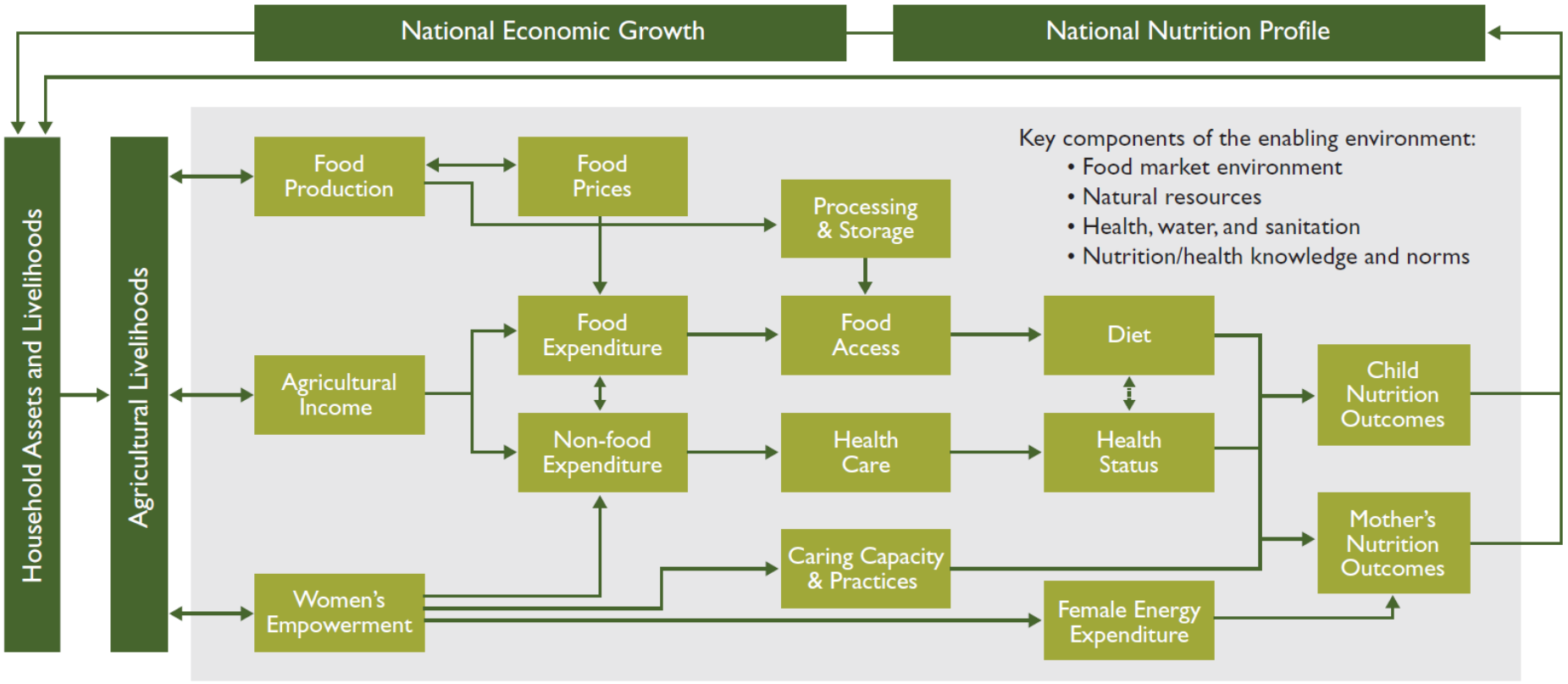
- Agriculture and food system affect nutrition
- Needs for multisectoral approaches
- The strong evidence base that link the use of maternal, infant, and young child feeding and care practices to reductions in chronic malnutrition
- Integrating nutrition and social behavior change (SBC) into agriculture development activities

Linking agriculture and nutrition

- The food and agriculture sector is essential to human nutrition, but food and agriculture interventions do not always contribute to positive nutritional outcomes.
- Specific attention is required to make agriculture “nutrition-sensitive”.
- What does this mean in practice?

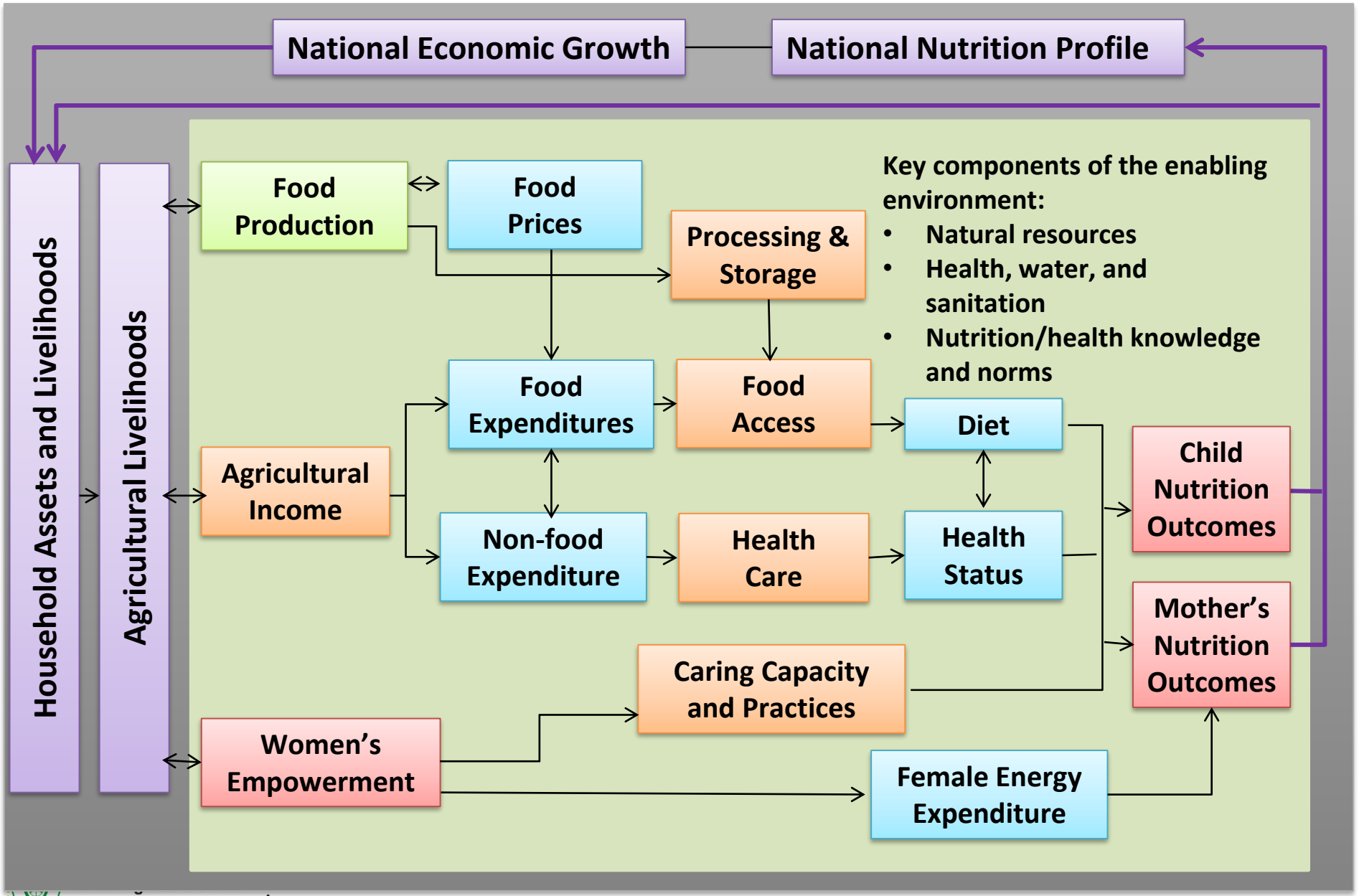

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative
LINKING AGRICULTURE & NUTRITION
PATHWAYS | PRINCIPLES | PRACTICE
IMPROVING NUTRITION THROUGH AGRICULTURE TECHNICAL BRIEF SERIES
Understanding and Applying Primary Pathways and Principles
MARCH 2014
BRIEF 1
USAID
FROM THE AMERICAN PEOPLE
SPRING
Strengthening Partnerships, Results, and Innovations in Nutrition Globally

Conceptual pathways between agriculture and nutrition



Adapted for Feed the Future by Anna Herforth, Jody Harris, and SPRING, from Gillespie, Harris, and Kadiyala (2012) and Headey, Chiu, and Kadiyala (2011).

Conceptual pathways between agriculture and nutrition



Pathway through food production

- **Household food production** for consumption
- **Growing nutritious and variety** of food (crops and livestock)
- **Nutrition knowledge and SBC** (social and behavior change): essential to informing the range of decisions that farmers make about what they grow to consume, what they grow to sell, and what they decide to purchase with their income.
- **Processing and storage** can affect the shelf life, safety, and nutrient content of foods in positive or negative ways for nutrition and health.

Pathway through agriculture income

- The effect of income on nutrition is not direct or easily predictable; it is always modified by what is available, affordable, and convenient to purchase; who decides what is purchased; and the myriad factors that drive that decision
- Establishing **successful small farming businesses** that ensure livelihoods: Keys to reducing poverty in rural areas
- Ensure that **nutritious, diverse foods are available and affordable** in **local markets**
- **Market and transportation systems** must enable year-round and/or seasonal supplies based on **consumer preferences** and **purchasing power**.
- **Nutrition SBC**: Household investments in health and nutritious food

Pathway through women's empowerment

- Women's decision-making affects what is produced on the farm
- Women's control of income and assets can affect productivity based on their spending decisions and on the social networks and cultural norms that influence those decisions
- Training female and male farmers in farm management and business skills can optimize the income earned with the available time, labor, assets, and capital

Pathway through women's empowerment

- Activities that influence the amount of time or labor women spend on agriculture-related tasks can affect their own health and energy expenditure, and in turn their capacity to feed and care for infants, young children, and themselves.
- A vital step in improving nutrition in a household with an agricultural livelihood requires that farming business decisions give attention to how women are involved in agriculture activities.

The enabling environments

- Food market environment
- Natural resources environment
- Health, water and sanitation environment
- Nutrition/ health knowledge and norms

Nutrition-sensitive agriculture - Programing principles

1. Incorporate explicit nutrition objectives and indicators into design.
2. Assess the local context.
3. Target the vulnerable and improve equity.
4. Collaborate and coordinate with other sectors.
5. Maintain or improve the natural resource base, particularly water resources.

Nutrition-sensitive agriculture - Programing principles

6. Empower women.
7. Facilitate production diversification, and increase production of nutrient-dense crops and livestock.
8. Improve processing, storage, and preservation of food.
9. Expand market access for vulnerable groups, and expand markets for nutritious foods.
10. Incorporate nutrition promotion and education that builds on local knowledge.

Making agriculture work for nutrition – Synthesis of guiding principles (FAO)

Planning for nutrition

1. **Incorporate explicit nutrition objectives** in agricultural policy and programme design.
2. **Assess the context** and causes of malnutrition at the local level**,** to maximize effectiveness and reduce negative side effects.
3. **Do no harm**. Identify potential harms, develop a mitigation plan, and set in place a well-functioning monitoring system.
4. **Measure nutritional impact through programme monitoring and evaluation.**
5. Maximize opportunities through **multisectoral coordination**.
6. **Maximize impact of household income** on nutrition, such as through increasing women's discretionary income.
7. **Increase equitable access to productive resources** (e.g. land, water, credit).
8. **Target** the most vulnerable groups, including smallholder farmers, women, and poor/food insecure households

Source: FAO, www.fao.org/fileadmin/user_upload/wa_workshop/docs/Synthesis_of_Ag-Nutr_Guidance_FAO_IssuePaper_Draft.pdf

Making agriculture work for nutrition – Synthesis of guiding principles (FAO)

Taking Actions: All approaches should:

9. **Empower women**, the primary caretakers in households, through: income; access to extension services and information; avoiding harm to their ability to care for children; labor and time-saving technologies; and support for rights to land, education, and employment.

10. **Incorporate nutrition education** to improve consumption and nutrition effects of interventions. Employ agricultural extension agents to communicate on nutrition as feasible.

11. **Manage natural resources** for improved productivity, resilience to shocks, adaptation to climate change, increased equitable access to resources through soil, water, and biodiversity conservation.

Source: FAO, www.fao.org/fileadmin/user_upload/wa_workshop/docs/Synthesis_of_Ag-Nutr_Guidance_FAO_IssuePaper_Draft.pdf

Making agriculture work for nutrition – Synthesis of guiding principles (FAO)

These can be combined with approaches to:

12. **Diversify production and livelihoods** for improved food access and dietary diversification, natural resource management, risk reduction, and improved income.

13. **Increase production of nutrient-dense foods**, particularly locally-adapted varieties rich in micronutrients and protein, chosen based on local nutrition issues and available solutions.

- **Horticultural crops** are highly recommended, to improve year-round micronutrient intakes and healthy diet patterns, and to increase income (especially women's).
- Produce **animal-source foods on a small scale**, including fish and livestock, to improve intakes of micronutrients, protein, and fat; keep production small-scale to avoid harms to the natural resource base.
- Harness the potential of nutritious **underutilized foods** (e.g. indigenous crops), which often have high nutrient content, low input requirements, and can generate income.
- Increase **legume** production for their nutritional value and their attribute of nitrogen fixation, which can improve soil fertility and yields and reduce inputs.
- Invest in **biofortification** as a complement to other approaches.
- Staple crop production may be necessary but insufficient for addressing undernutrition.
- Cash crops are unlikely to improve nutrition on their own.

Source: FAO
www.fao.org/fileadmin/user_upload/wa_workshop/docs/Synthesis_of_Ag-Nutr_Guidance_FAO_IssuePaper_Draft.pdf

Making agriculture work for nutrition – Synthesis of guiding principles (FAO)

These can be combined with approaches to:

14. **Reduce post-harvest losses and improve processing**

15. **Increase market access and opportunities**, especially for nutritious foods that smallholders may have a comparative advantage in producing

16. **Reduce seasonality of food insecurity** through **diversification throughout the year, improved storage and preservation, and other approaches**

Source: FAO, www.fao.org/fileadmin/user_upload/wa_workshop/docs/Synthesis_of_Ag-Nutr_Guidance_FAO_IssuePaper_Draft.pdf

AVRDC Approaches to Improved Nutrition

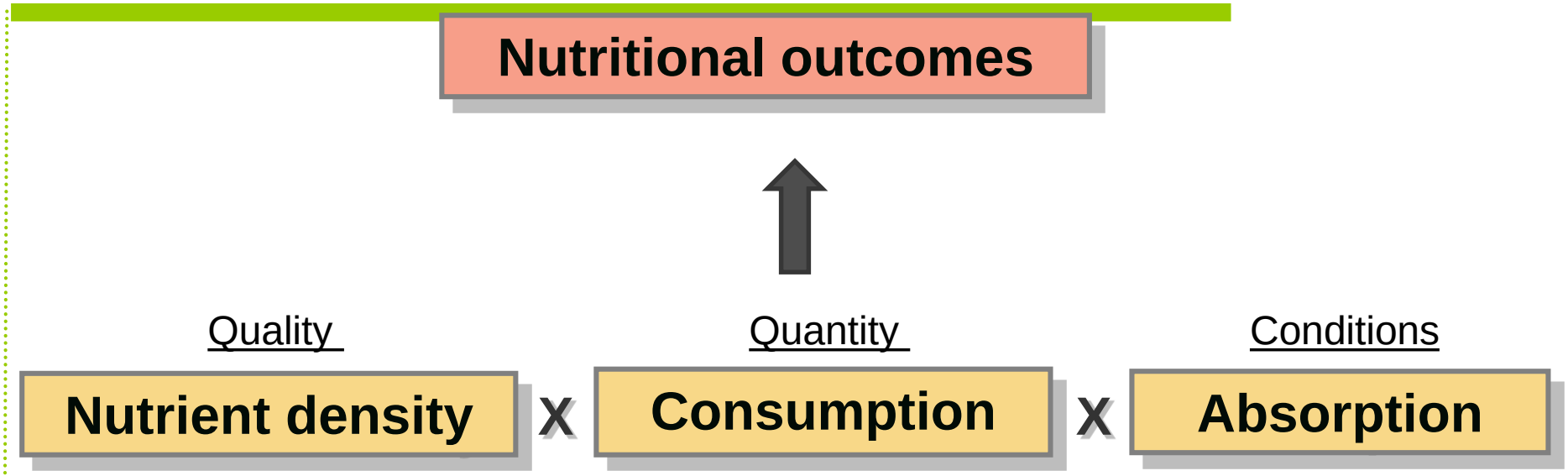
Achievements, challenges and perspectives

Ray-Yu Yang
AVRDC – The World Vegetable Center, Taiwan

AVRDC Approaches to Improved Nutrition

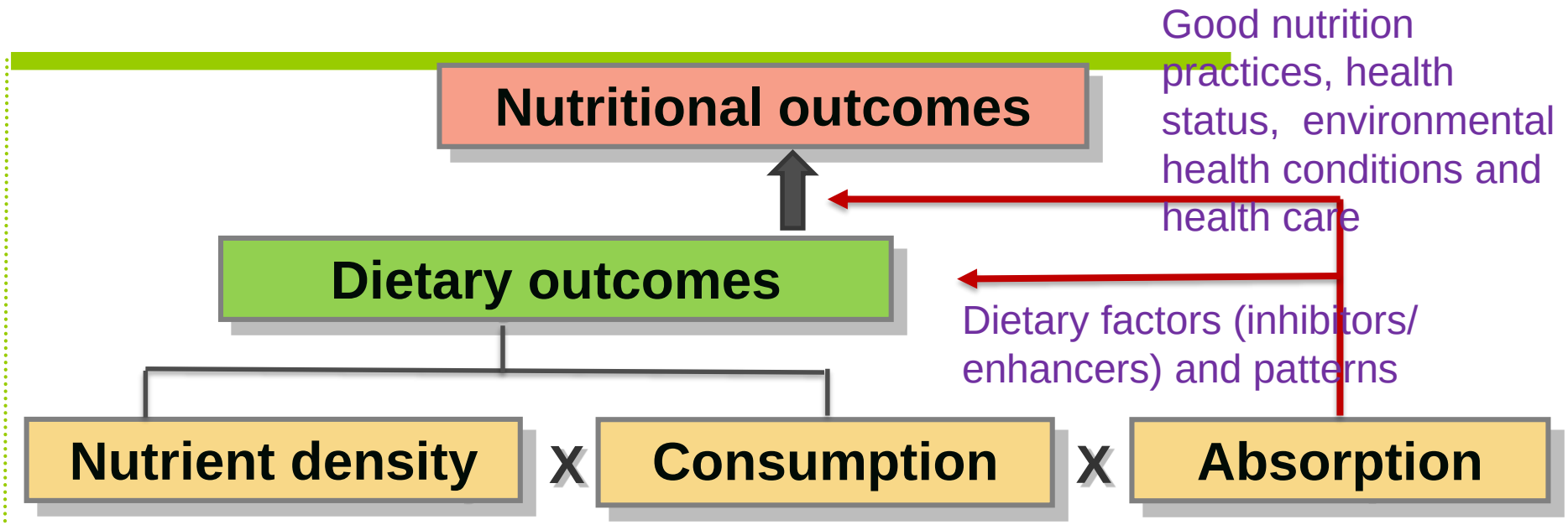
Achievements, challenges and perspectives

Contribution of vegetables to human nutrition



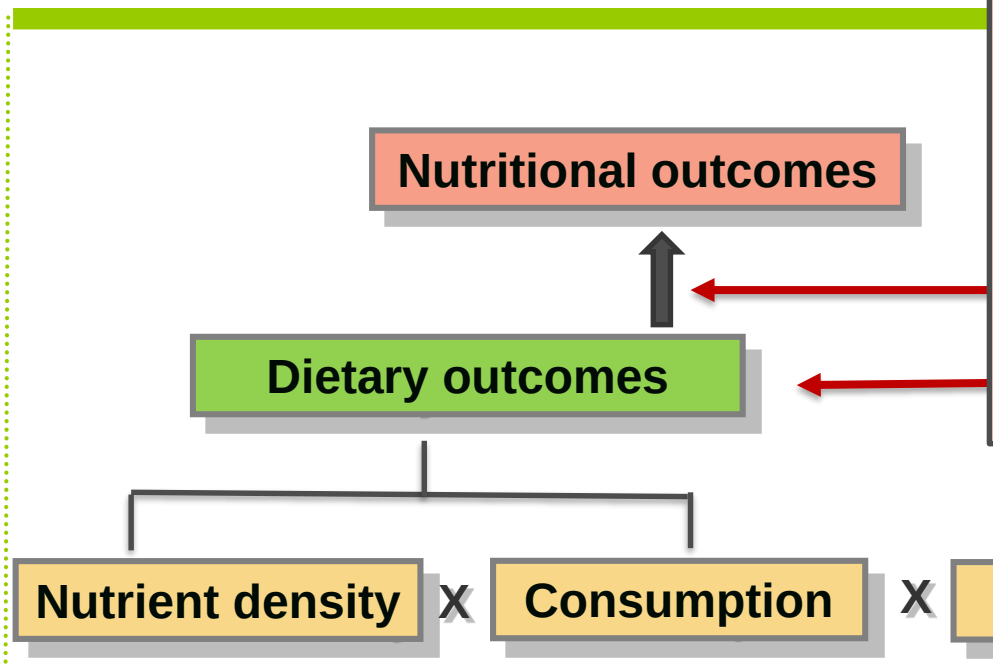
- Improved phytonutrient content, retention and bioavailability of raw, processed, and cooked vegetables
- Increased availability, accessibility and consumption of vegetables
- Conditions favoring nutrient absorption

Contribution of vegetables to human nutrition



- Improved phytonutrient content, retention and bioavailability of fresh and processed vegetables
- Increased productivity, availability, accessibility and consumption of vegetables
- Enhanced conditions favoring nutrient absorption

Dietary and nutrition indictors



Indicators for nutritional outcomes:

- Anthropometric measurements: Weight and height (stunting, wasting, underweight for children and BMI)
- Biochemical measurements: body retinol and iron concentration
- Clinical signs: blindness

Indicators for dietary outcomes:

- Nutrient intakes from all food items consumed
- Dietary diversity score of major food groups consumed
- Amount/ frequency of selected food groups consumed

Dietary diversity scores

Household dietary diversity score (0-12)

Numbers	Food groups
1	Cereals
2	White tubers and roots
3	**Vegetables** (1.vitamin A rich veg and tubers; 2. dark green leafy; 3. other veg)
4	Fruits (1. vit A rich; 2. others)
5	Meat (1. organ; 2. flesh)
6	Eggs
7	Fish and other seafood
8	Legumes, nuts and seeds
9	Milk and milk products
10	Oils and fats
11	Sweets
12	Spices, condiments and beverages

Women dietary diversity score (0-9)

Numbers	Food groups
1	Starchy staples
2	Dark green leafy vegetables
3	Other vitamin A rich fruits and vegetables
4	Other fruit and vegetables
5	Organ meat
6	Meat and fish
7	Eggs
8	Legumes, nuts and seeds
9	Milk and milk products

FAO 2013

Food flow from seed to fork, to human

Nutrition outcomes and impact

Seeds (genebank/breeding) → Field → Market → Plate → Human

Homestead Production

Gap

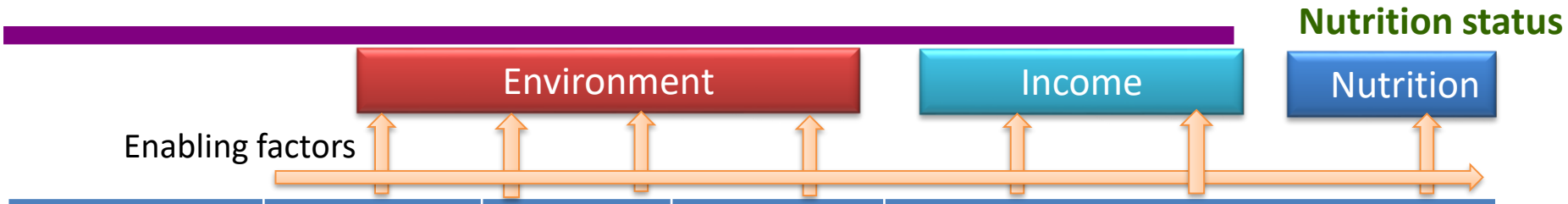
Gap

Gap

Gap

Gap

Set targets toward dietary and nutritional outcomes



	Germplasm	Breeding	Production	Consumption		
				Postharvest /processing	Market	Nutrition
Nutrition targets	Nutrient content	Nutrient yield	Nutrient supply	Nutrient retention	Cost of diet ?	Dietary intakes
Data						
Content	X	X	X	X		
Yield		X	X			
Area			X			
Loss (?)				X		
Market reach/price (?)					X	
Consumption						X

AVRDC HQ Nutrition- Involved Projects

Project	Target country/ study site
1. USAID-Horticulture project	Bangladesh
2. SDC-Vegetables Go to Schools	Nepal, Bhutan, Indonesia, Burkina Faso
3. CRP-Humidtropics: Crosscutting nutrition	Vietnam, Kenya
4. SDC-CHAIN Project	Cambodia
5. A4NH Seed Grant	Bangladesh
6. Others: postharvest, CoA, ..	Taiwan….

HQ Nutrition Approaches

Situation/ baseline analysis of diet and nutrition





Seeds → **Field** → **Market** → **Plate** → **Human**

Homestead Production

Home garden and nutrition education

Nutrition message delivery system and promotion

Nutrient database and nutritional and quality evaluation for Breeding and Germplasm program

Linking school garden with education, feeding and WASH

HQ Nutrition Activities

Project	Target countries	Intervention/ study	Expected diet/nutrition outcomes
USAID-Horticulture Project (2011-2015)	Bangladesh (S)	• Home garden (HG+N)	• Increased access to and consumption of vegetables
		• Promotion through school garden	• Increased awareness of vegetables and healthy diets
		• Nutrition education through Community Nutrition Scholars	• Improved nutrition KAP (knowledge, attitude and practice) and maternal, infant and young child nutrition
		• Training in food processing, product registration and linking processors to markets	• Increased vegetable utilization and preservation
SDC-Vegetables Go to	Indonesia, Nepal, Bhutan	• Linking school gardens with education, promotion	• Increased nutrition KAP related to vegetable and healthy diets

HQ Nutrition Activities (cont)

Project	Target countries	Interventions/ study	Expected diet/nutrition outcomes
CRP-Humidtropics: Crosscutting-Nutrition (2014-2016)	Vietnam (NW)	• Food and nutrition survey • Home gardens • Nutrition impact pathways • Nutrition innovation platform	• Increased production, consumption of vegetables • Enhanced nutrition KAP • Improved diets
	Kenya (W)	• Nutrition impact pathway • Nutrition innovation platform	• Improved diets (quantity and quality)
SDC- CHAIN Project (2015-2018)	Cambodia (N)	• Home garden and nutrition (HG+N) joint training materials • Capacity building of government trainers in HG+N	• Enhanced training delivery mechanisms and sustainable HG seed • Enhanced nutrition practices and utilization of vegetables

HQ Nutrition Activities (cont)

Project	Target countries	Interventions/ study	Expected diet/nutrition outcomes
A4NH Seed Grant (2014-2015)	Bangladesh (S)	• Nutrition messages integrated with agricultural extension through seed company	• Enhanced nutrition message delivery system • Increased awareness of healthy diets and nutrition among famers
Proposal: GIZ-small grant Nutrition Sensitive Promotion	Kenya (W)	• Test for effective nutrition messages	• Enhanced nutrition message delivery system

HQ Nutrition Activities (cont)

Project	Study site	Interventions/ study	Expected diet/nutrition outcomes
COA and others	Taiwan	• Nutrient database • Interactive and user-friendly web page design • Nutritional evaluation of cowpea leaves and pods, Malabar spinach, tomato, chili, amaranth seeds, moringa, ……..	Nutrition information • Promotion messages • Nutrient contents
USAID-postharvest		• Lectures in Cambodia and Thailand • Support training of food processing in Bangladesh in collaboration with USAID-Horticulture Project	

Achievements 2015

USAID-Horticulture Project: Shahabuddin, Peter, Razu, Ray-Yu et al. and partners

Number of beneficiaries in Bangladesh who received nutrition related interventions

	Y1		Y2		Y3		Y4 (2015)		Total	
	M	F	M	F	M	F	M	F	M	F
Home Gardeners		301	-	3595	-	6000	-	3000	-	12,896
School children	-	-	2932	2780	4,090	3,879	3,874	4,149	10,896	10,808
Food Processors	-	-	-	-	-	-	67	83	67	83
Total									10,963 (32%)	23,787 (68%)
Grand Total									34,750	

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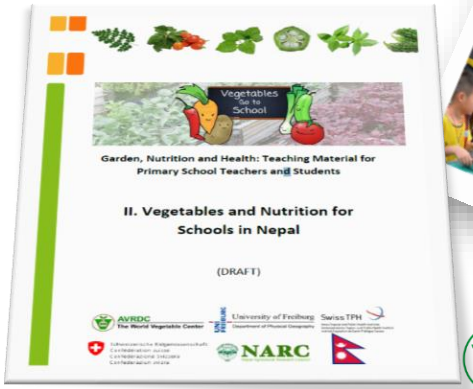
Achievements 2015

SDC-Vegetables Go to School: Ray-Yu, Pepijn, Maureen, Greg, Caroline, Jean-Baptiste

- **Project outcome assessment**
- **Technical support** to country teams: provide trainings, reference materials and consultation to country teams to implement the following programs:
  - School gardens
  - Education
  - Promotion
  - Linking with other feeding and WASH initiatives
- **Rapid assessment** of project operations at schools



Achievements 2015

SDC-Vegetables Go to School: Ray-Yu, Pepijn, Maureen, Greg, Caroline, Jean-Baptiste

- Rapid assessments of project interventions at schools and operations in four countries were accomplished

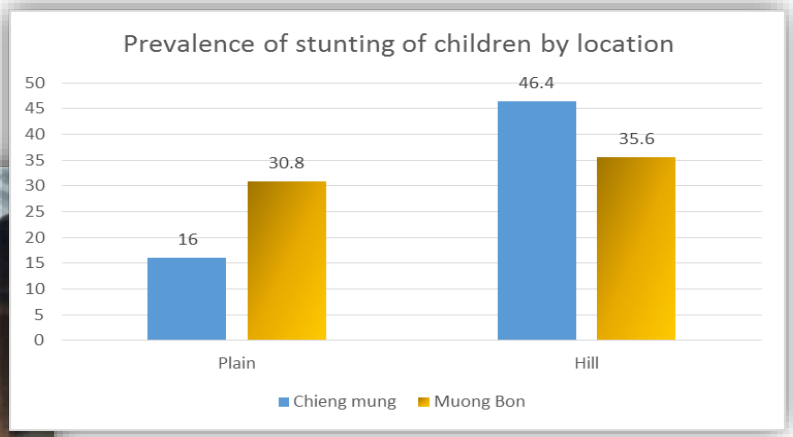
	Interventions at schools			
Country	**Garden**	**Education**	**Promotion**	**Linking feeding and WASH**
Bhutan	• Linked with national agriculture, nutrition and health programs	• Weekly lesson • Revising curricula	• Active	• Vegetables for school meals • Moringa and bean sprout supplements
Nepal	• Actively linked with home garden	• Weekly lesson	• Less active	• No school feeding/ health programs • Suggested to link with home garden and community nutrition
Indonesia	• Linked with women's groups and vegetable nurseries	• Weekly lesson	• Less active	• Weekly feeding program to demonstrate healthy diet planned
Burkina Faso				

Achievements 2015

Humidtropics-Crosscutting nutrition: Ray-Yu, Ha, Pepijn, Victor et al.

Food and nutrition assessments in target areas of Vietnam and Ethiopia

- Nutrition KAP (knowledge, attitude and practice)
- Consumption: food frequency, 24 hour recall, dietary diversity score
- Food security related parameters



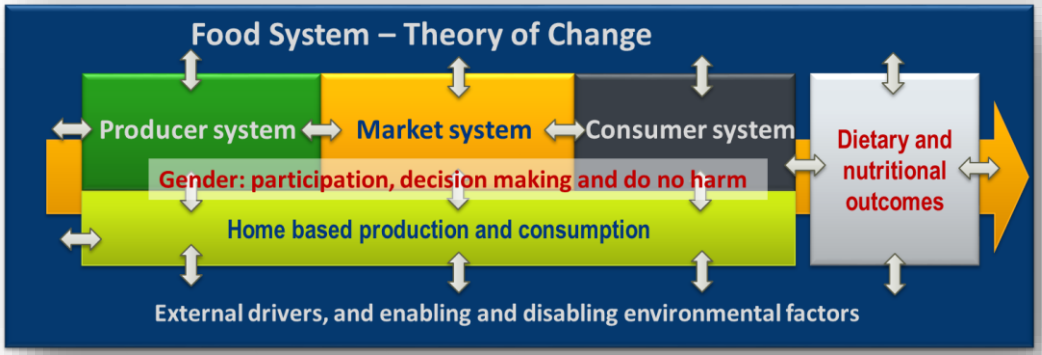
Foods	Chieng Mung (n=100)		Muong Bon (n=100)	
	% HH	N of m^2	% HH	N of m^2
vegetable garden	81	243.6	87	410.3
fish pond	39	612.0	59	387.3
agriculture land	84	2609.3	90	24053.3
non-agri-land	73	9671.3	59	7342.9

Achievements 2015

Humidtropics-Crosscutting nutrition: Ray-Yu, Ha, Peter, Greg, et al

- Potential impact pathways from production to market and consumption systems in NW Vietnam mapped in Hanoi Stakeholder Meeting

Nutrition Impact Pathway of Humidtropics in NW Vietnam	Humidtropics	XCutting nutrition
Consumer system Theory of Change Consumers (food choice decision-makers) purchase more products from markets Lower income consumers frequently buy higher quantities of diverse and affordable products Middle and higher income consumers frequently buy higher quantities of diverse products Diverse and higher quantities of products at affordable prices available for lower income consumers Diverse and higher quantities and quality of products available at affordable prices Product grading by quality and price Local markets in rural areas and small towns Urban markets and local markets in cities Assumptions/ Risks	Nutrition and social science studies and interventions	Comprehensive food and nutrition assessment tools **Questions to be addressed:** (5) Types and amounts of food and nutrients are selected/purchased/used (6) Types and amounts of food and nutrients are consumed
Market system Theory of Change Affordable and higher quality and quantity of diverse agricultural products in the markets year round Local markets- flexible product quality standards Hanoi Markets- wide range of market types and quality standards Direct producer marketing or simple marketing chain Multi-layer marketing system Producers transport produce to the local markets Producers sell produce to collectors Producers have market linkages and price information Appropriate postharvest handling and sorting by quality Flexible quality production from small scale producers Higher quality products from input intensive production Assumptions/ Risks	Market/ value chain studies and interventions	Food and distribution mapping (3) Types and amounts of and how food and nutrients are distributed (4) Types and amounts of food and nutrients are accessible by the target population
Producer system Theory of Change Producers supply increased quantities of safe and higher quality products in NW Vietnam year round Increased sustainable intensification of agricultural production in NW Vietnam Producers have the capacity, incentives and opportunities to integrate diverse agri production into major farming systems Producers know and effectively use inputs Inputs such as land, water, varieties, fertilizer, credit available to producers Key agricultural inputs are improved Assumptions/ Risks	Agricultural studies and interventions	Farm system model (and landscape) for nutrition (1) Types and amounts of food and nutrients are produced (2) Types and amounts of food and nutrients are available for the target population



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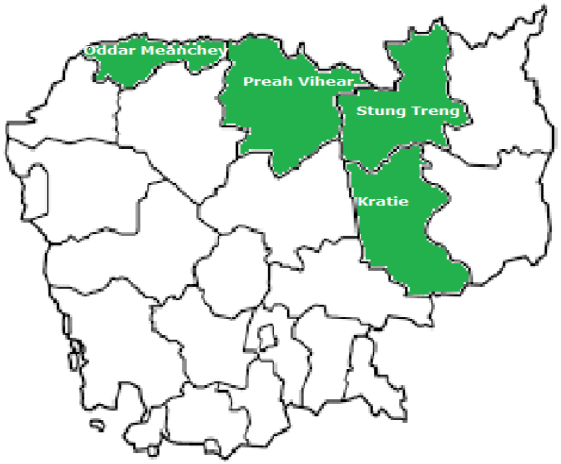
Achievements 2015

SDC-CHAIN Project: Ray-Yu, Peter, Sereyrith, Srini, et al.

- Scoping study – home garden, nutrition and seeds in north Cambodia
- Training program development in progress
  - Master trainers from GDA (General Directorate of Agriculture) and MoH-NNP (Minister of Health-National Nutrition Program)
  - Trainers: agriculture extension staff from PDA (Provincial Department of Agriculture) and food/nutrition extension staff from PDOWA (Provincial Department of Women's Affairs)
- Training material development in progress
  - Collect existing materials in English and Khmer
  - Identify key topics and training schedules
  - Develop customized materials



Problems:

- Too much water
- Too little water

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Part 1: Nutrition values from seed to table and beyond

- Essential nutrients and phytochemicals
- Daily requirement and health benefits
- Nutrient database
- Nutrient values along the food flow
  - Nutrient content
  - Nutrient supply
  - Nutrient cost
  - Nutrient retention
  - Nutrient bioavailability
  - Nutrient intake
  - Nutrient requirement

Food flow from seed to fork, to human

Nutrition outcomes and impact

Seeds (genebank/breeding) → Field → Market → Plate → Human

Homestead Production

Gap

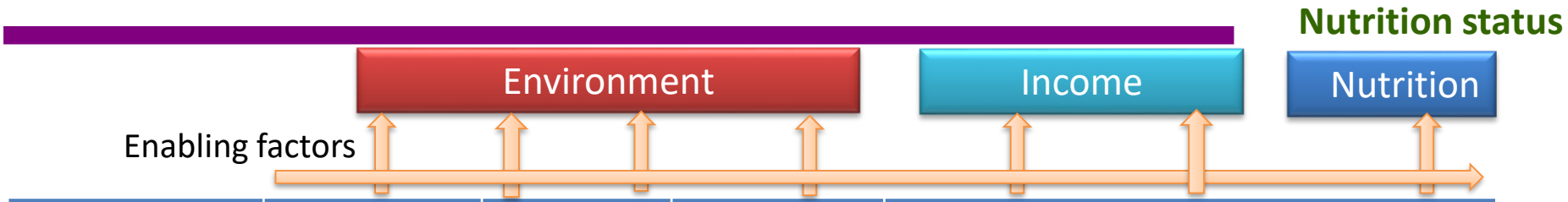
Gap

Gap

Gap

Gap

Nutritional values from seed to table, to outcomes



	Germplasm	Breeding	Production	Consumption		
				Postharvest /processing	Market	Nutrition
Nutrition targets	Nutrient content	Nutrient yield	Nutrient supply	Nutrient retention	Cost of diet ?	Dietary intakes
Data						
Content	X	X	X	X		
Yield		X	X			
Area			X			
Loss (?)				X		
Market reach/price (?)					X	
Consumption						X

Part 2: Nutrition interventions from seed to table and beyond

- Discussion:
  - Improve nutrition of consumers
    - Research topic, problems, objectives, approaches, partnerships, expected results