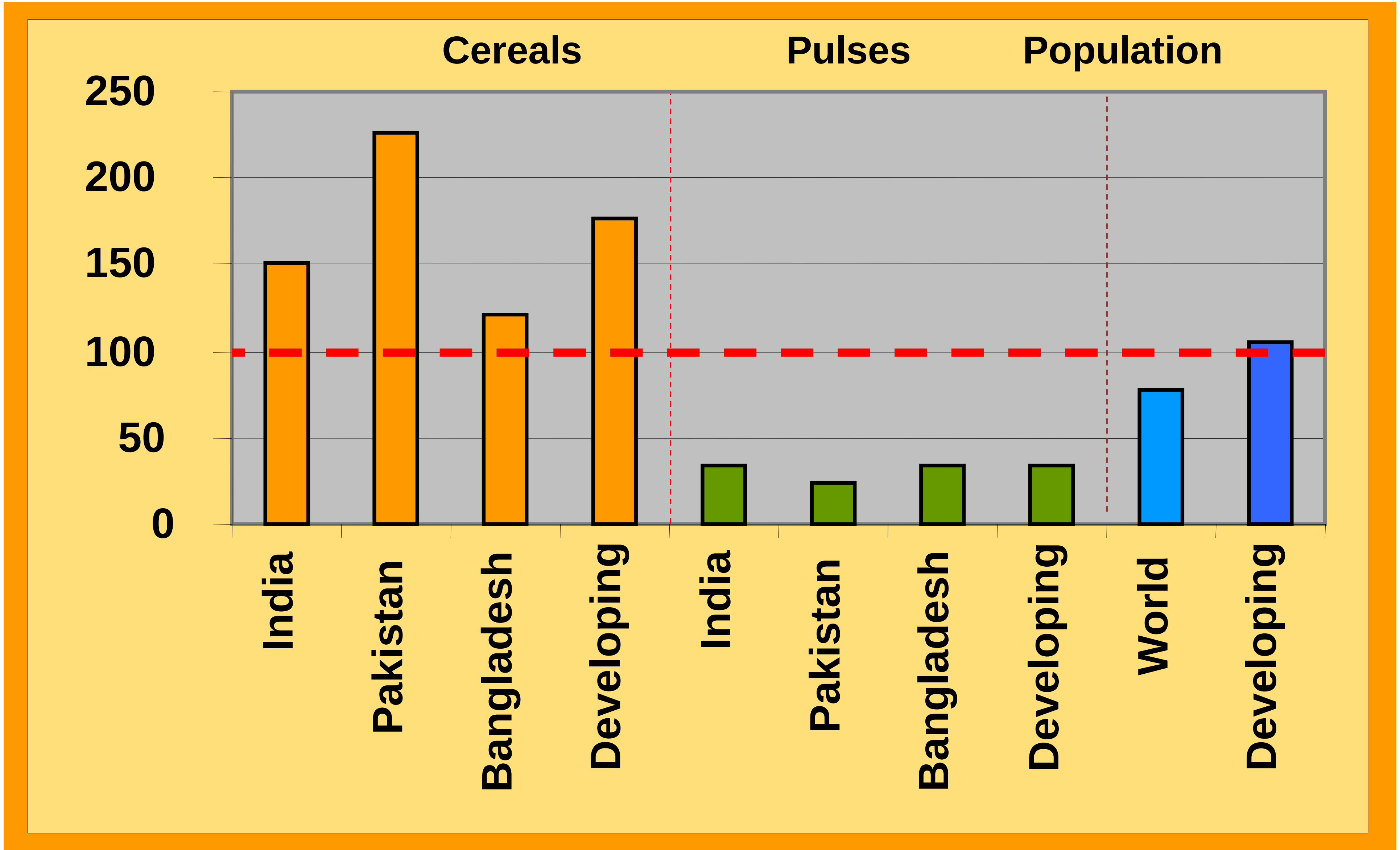
Agricultural Strategies For Improving Dietary Quality

Howarth Bouis
Founding Director, HarvestPlus
December 10, 2019

HarvestPlus c/o IFPRI
2033 K Street, NW • Washington, DC 20006-1002 USA
Tel: 202-862-5600 • Fax: 202-467-4439
HarvestPlus@cgiar.org • www.HarvestPlus.org

Percent Changes in Cereal and Pulse Production and in Population Between 1965 and 1999



Indices of Inflation-Adjusted Prices for Bangladesh
1973-75 = 100

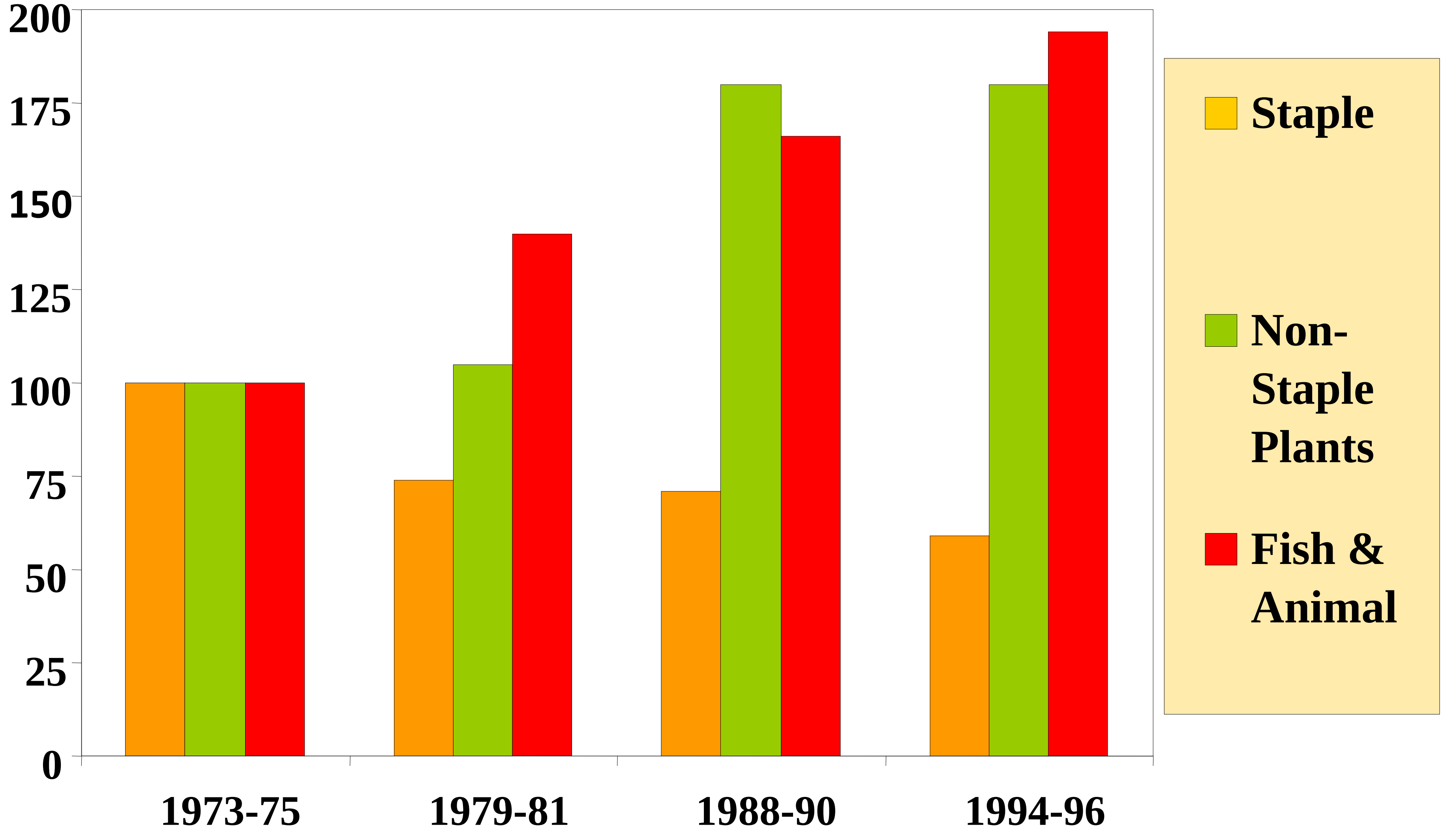
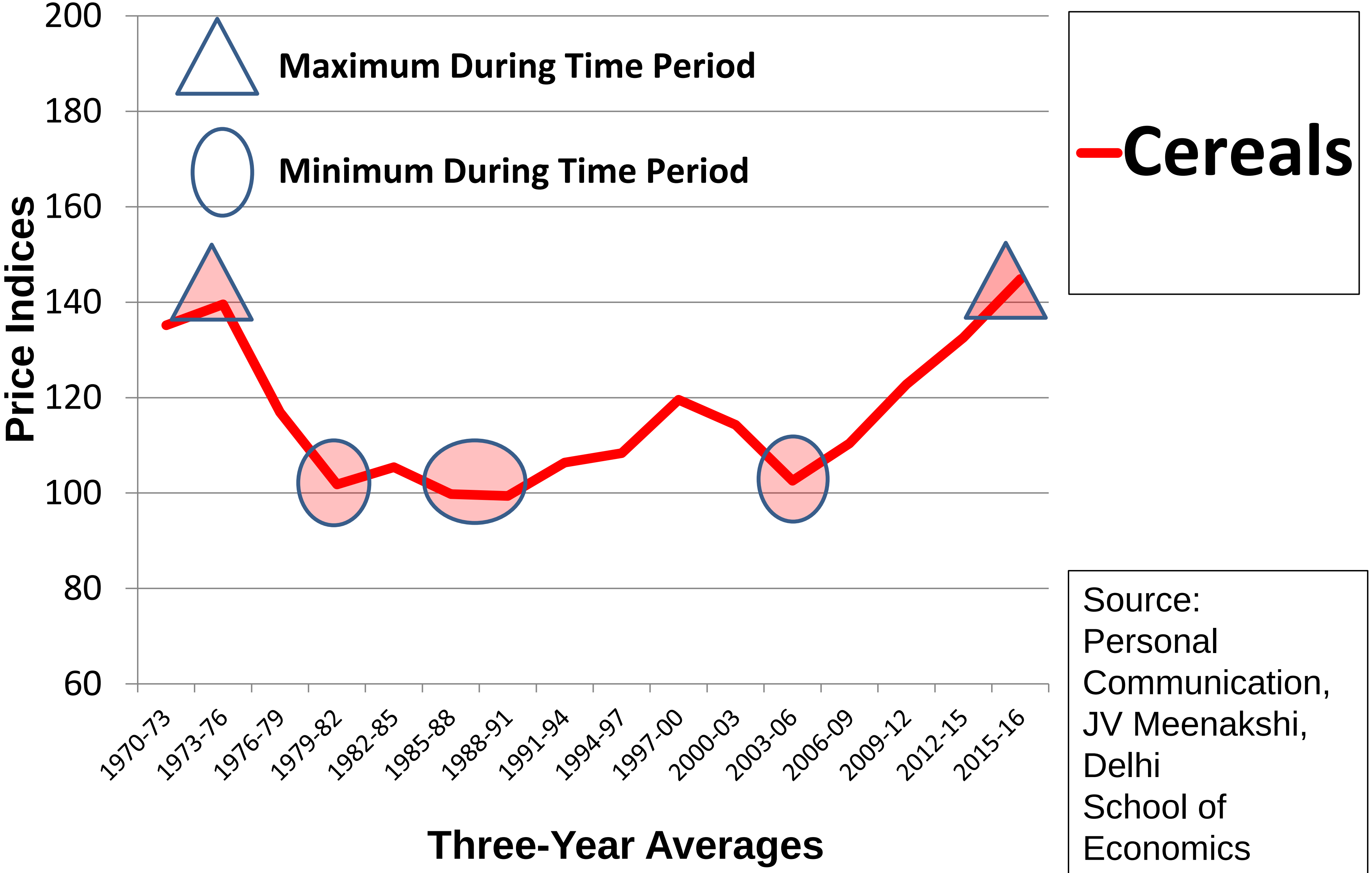
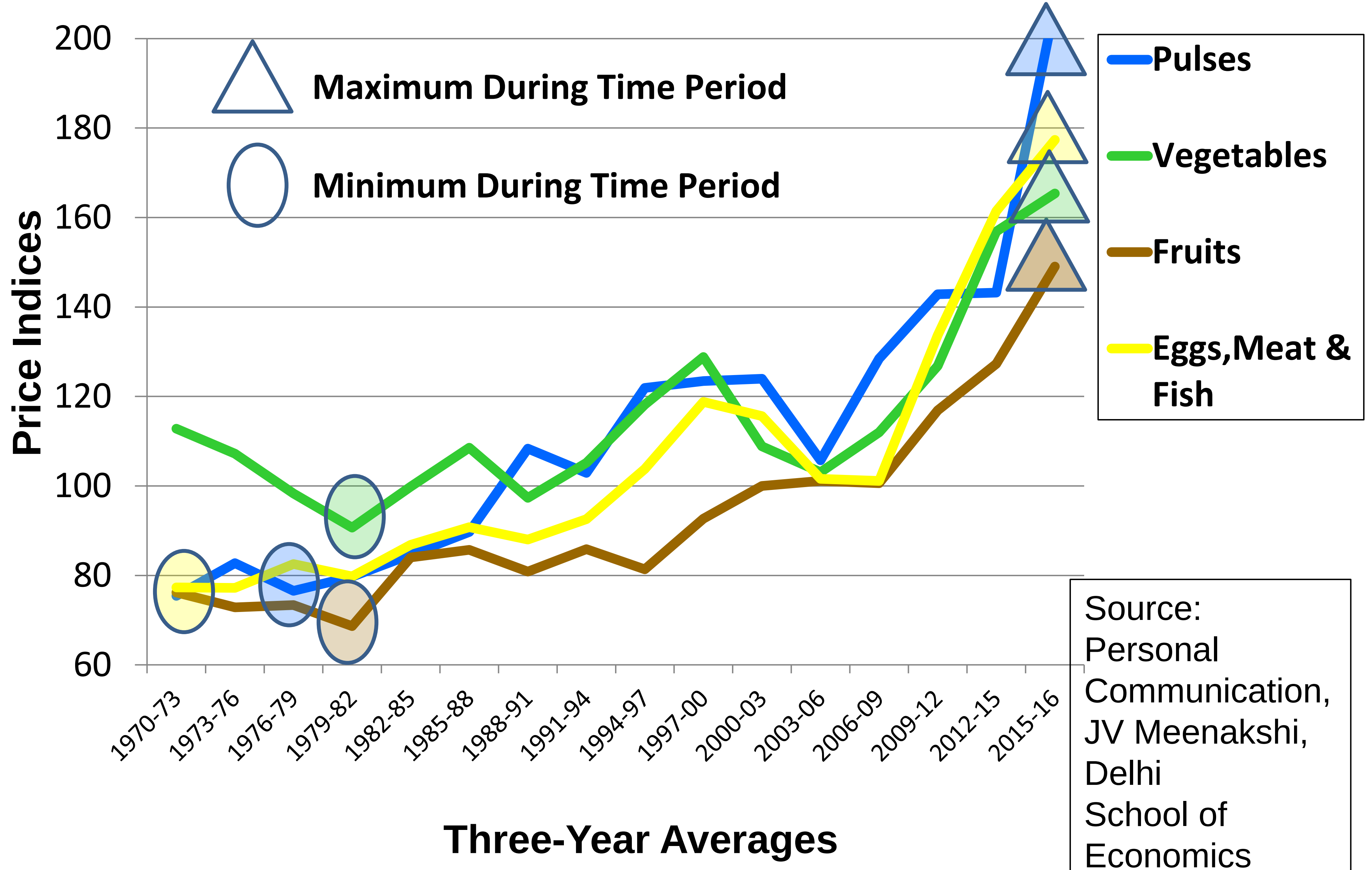


Figure 2. Price Indices By Food Group for India, 1970-2016, Deflated by Non-Food Price Index



Source: Personal Communication, JV Meenakshi, Delhi School of Economics

Figure 2. Price Indices By Food Group for India, 1970-2016, Deflated by Non-Food Price Index



Source: Personal Communication, JV Meenakshi, Delhi School of Economics

Per Capita Energy Intakes Per Day for Bangladesh and Philippines By Income Group

	Lower Income	Middle Income	Higher Income
Food Staples	1816	1848	1876
Non-Staple Plant Food	339	427	474
Fish and Animal Foods	47	59	92
All Food Groups	2201	2334	2442

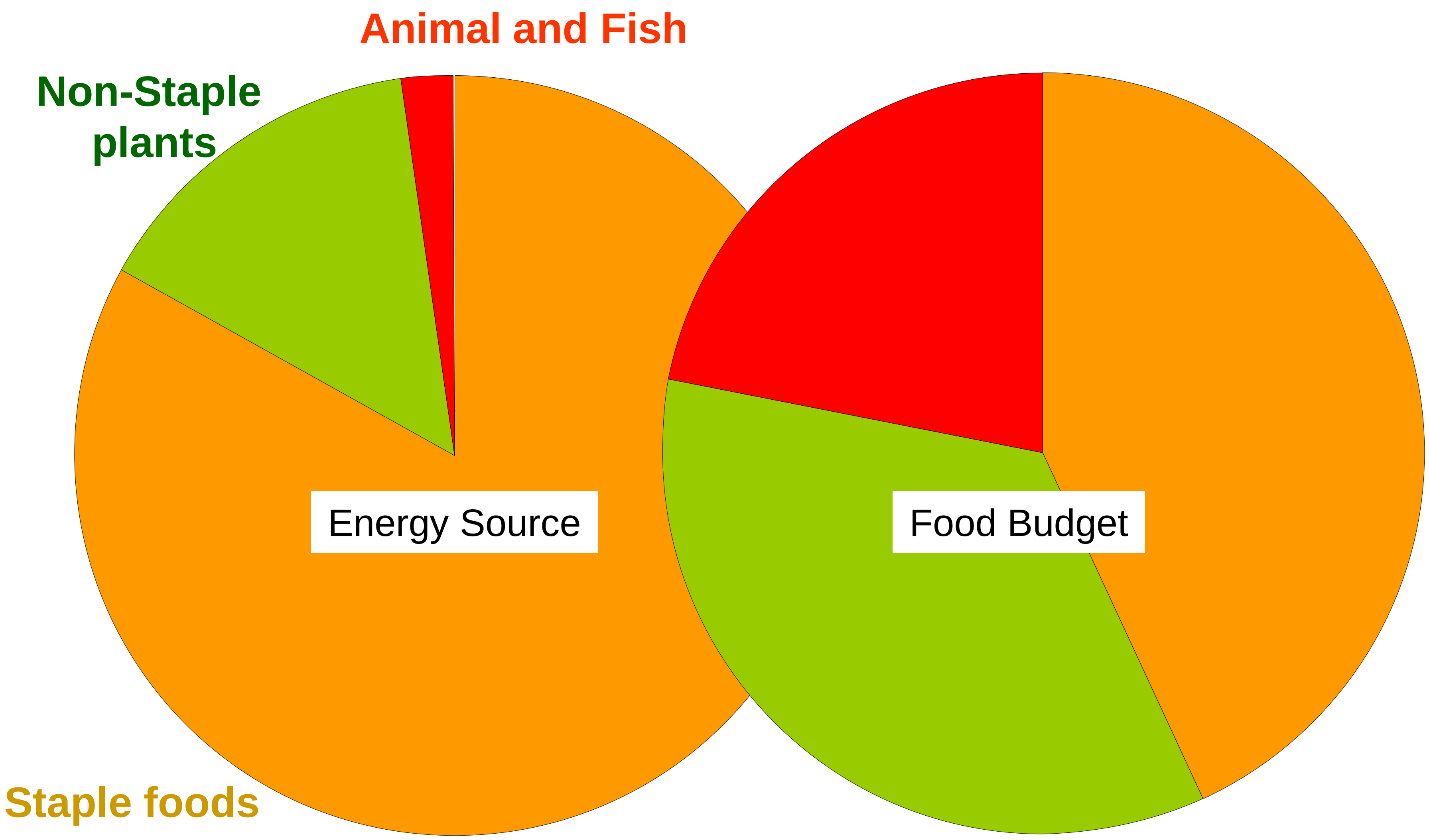
Bangladesh

	Poorest	Middle	Richest
Food Staples	1271	1254	1146
Non-Staple Plant Food	249	287	351
Fish and Animal Foods	137	261	465
All Food Groups	1657	1802	1962

8th NNS (FNRI-DOST, 2013)

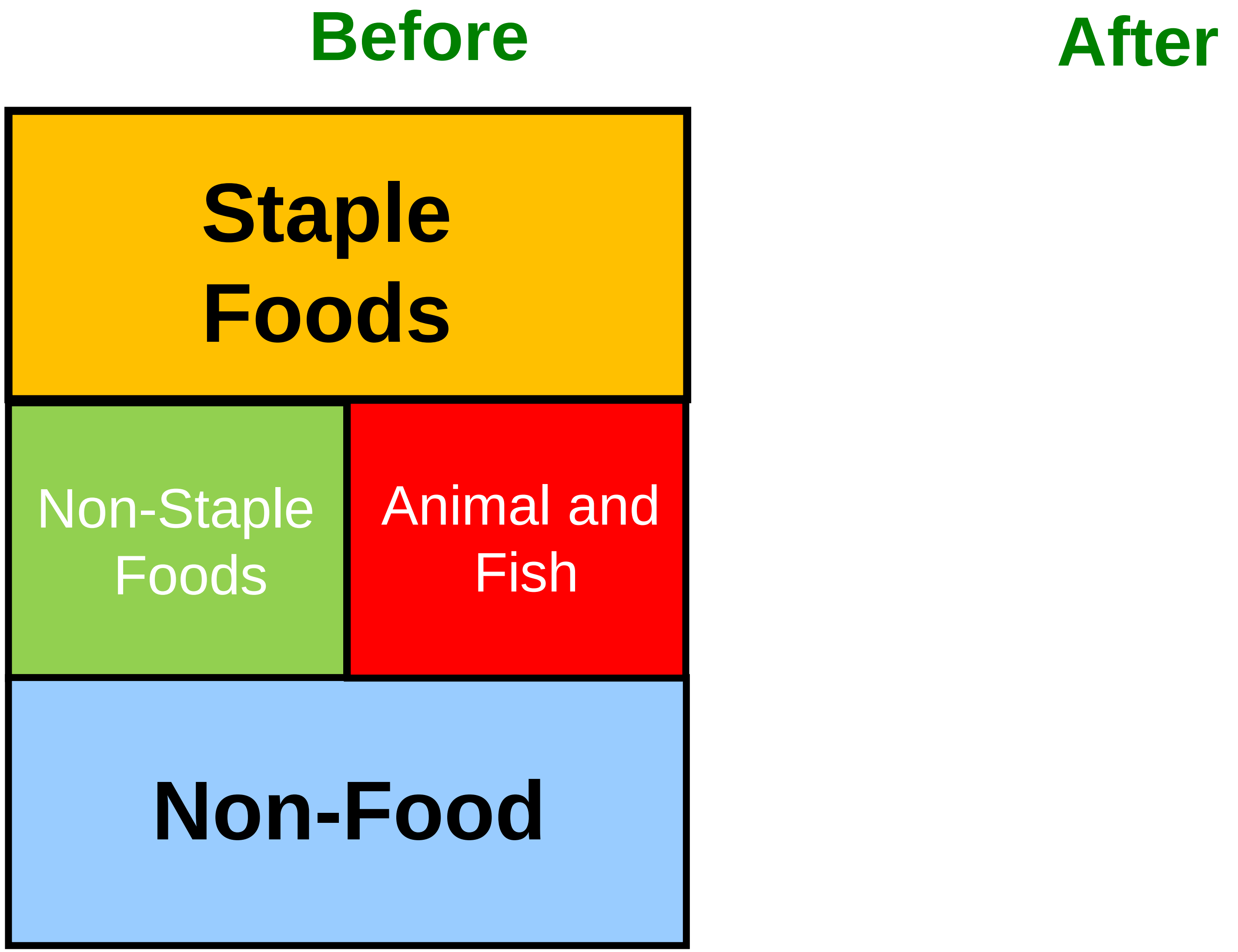
Philippines

Share of Energy Source & Food Budget in Rural Bangladesh



50% Increase in All Food Prices

Share of Total Expenditures



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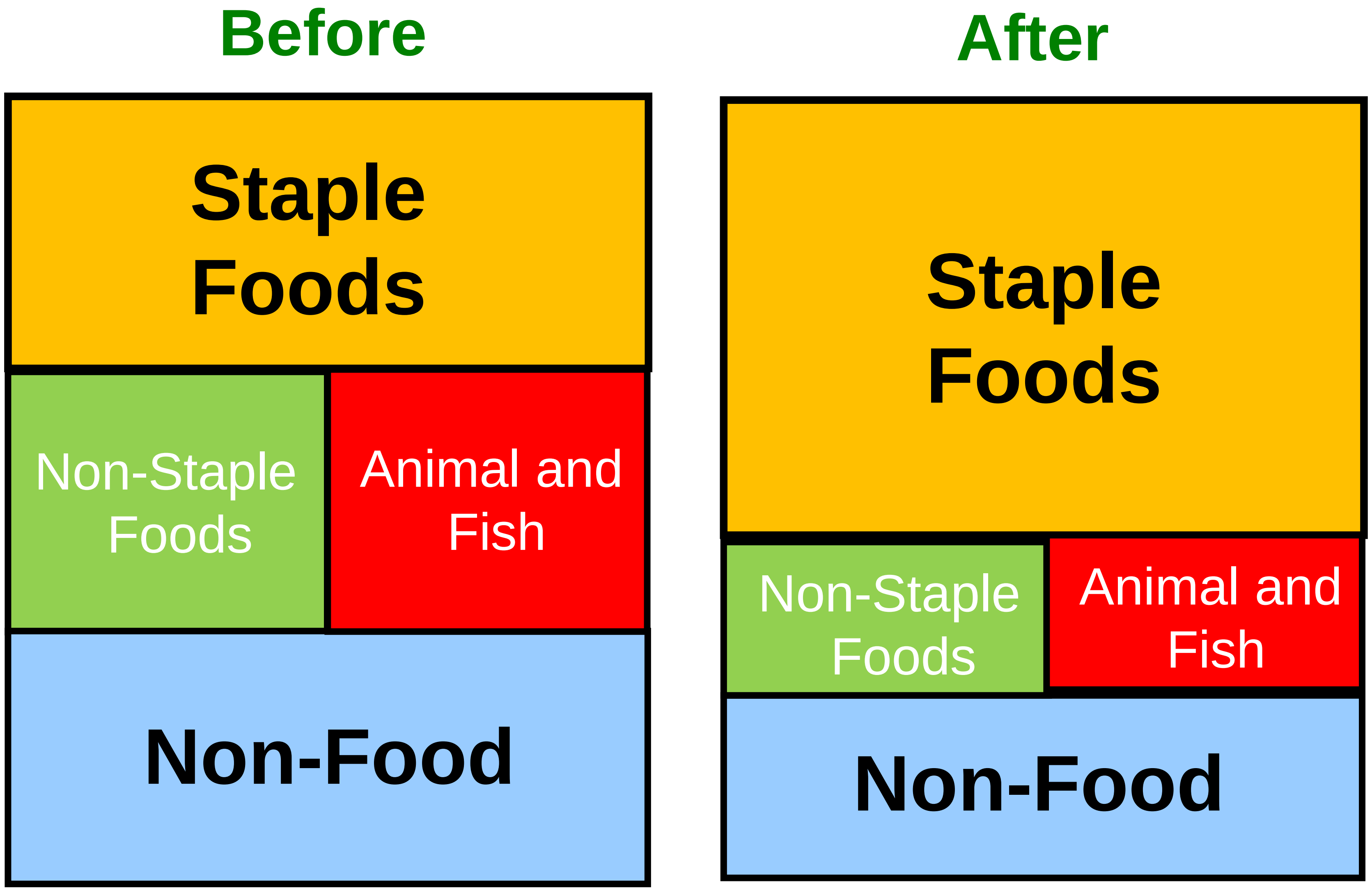
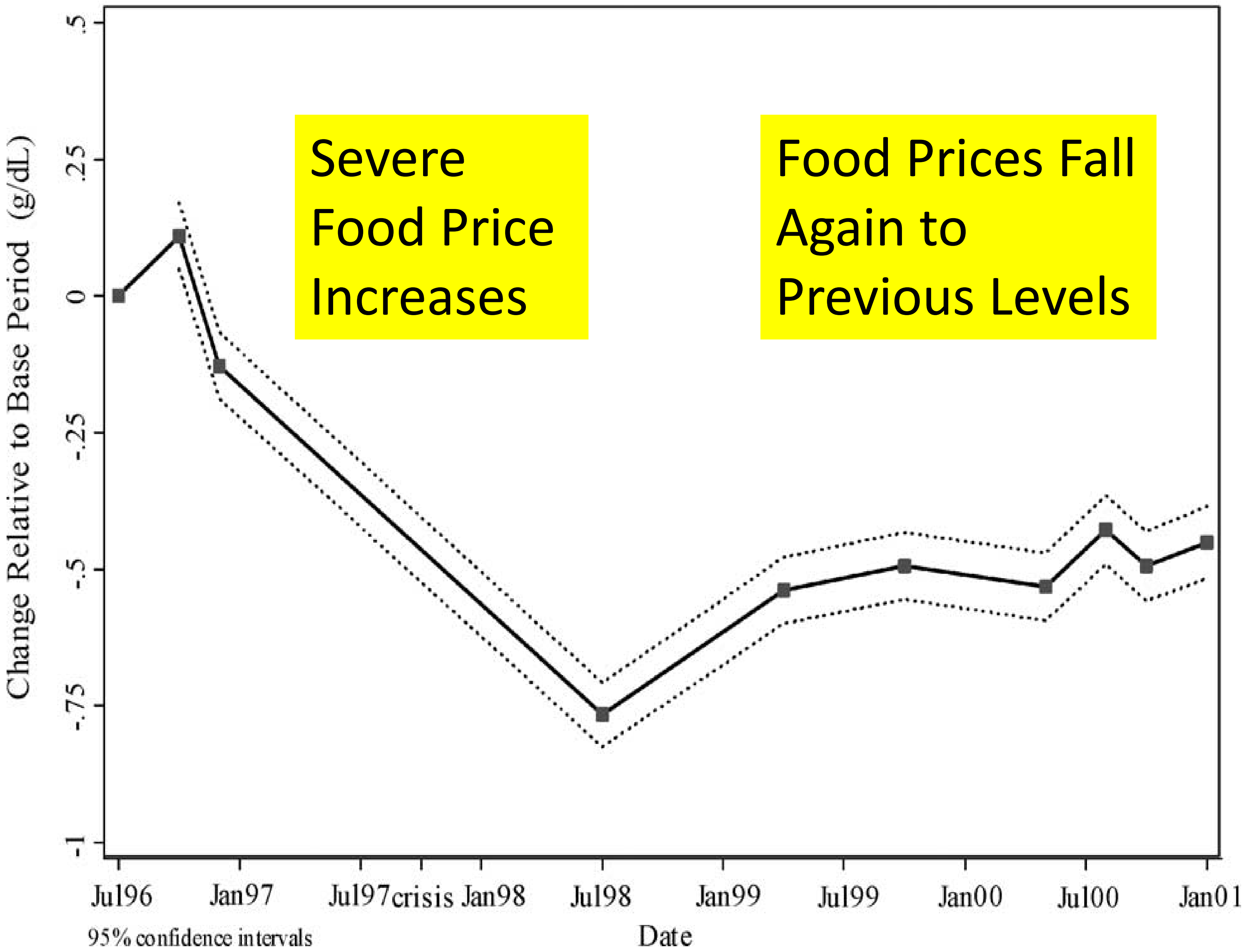


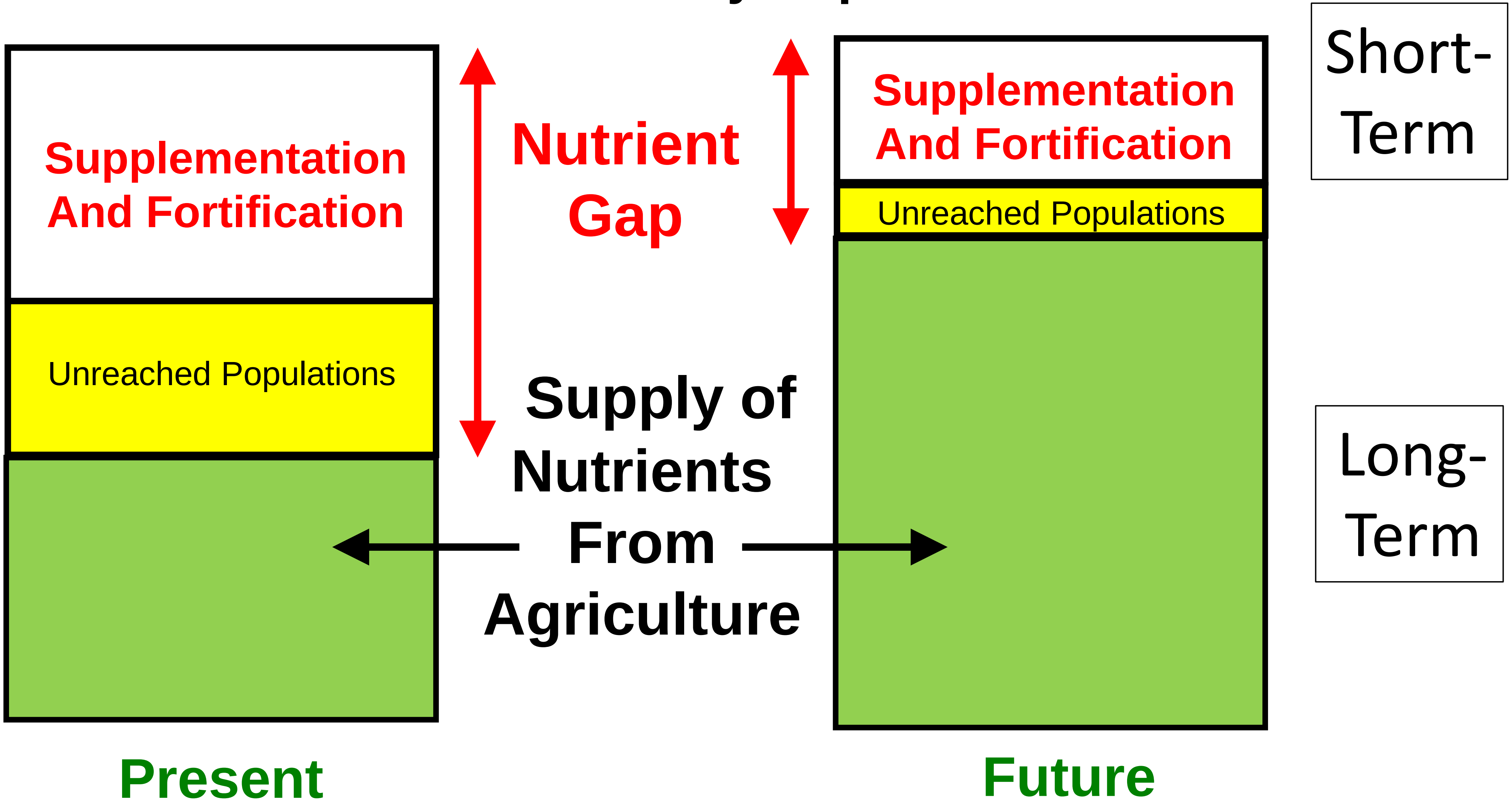
Fig. 4. Conditional time path of child hemoglobin concentration for Indonesia



"Macro shocks and micro outcomes: child nutrition during Indonesia's crisis"

Steven Block, Lynnda Kiess, Patrick Webb, Soewarta Kosen, Moench-Pfanner, Regina, Martin W. Bloem and Peter Timmer, Economics & Human Biology, 2004, vol. 2, issue 1, 21-44

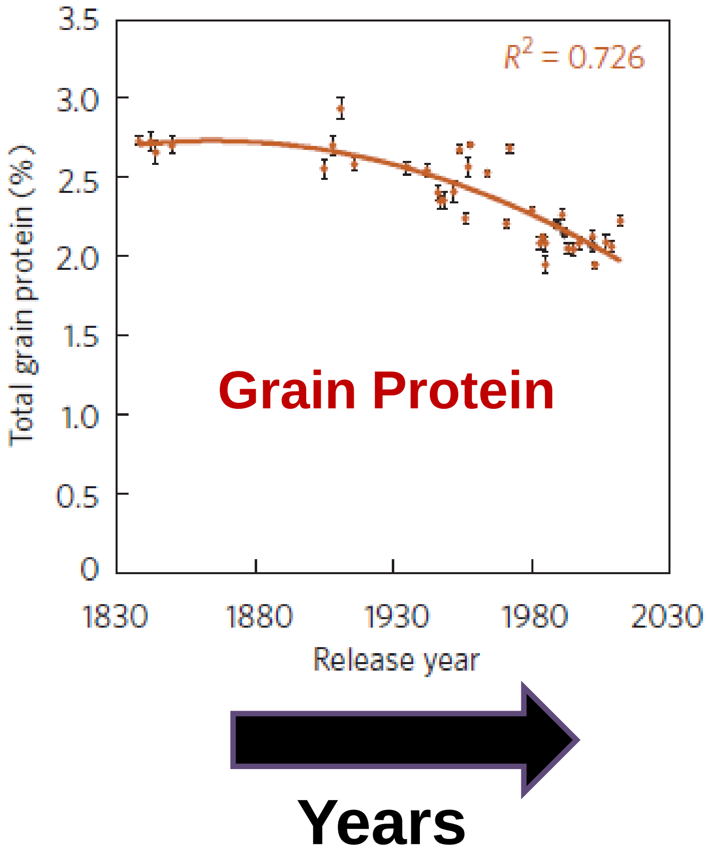
A Primary Role of Agriculture Is To Provide Nutrients for Healthy Populations

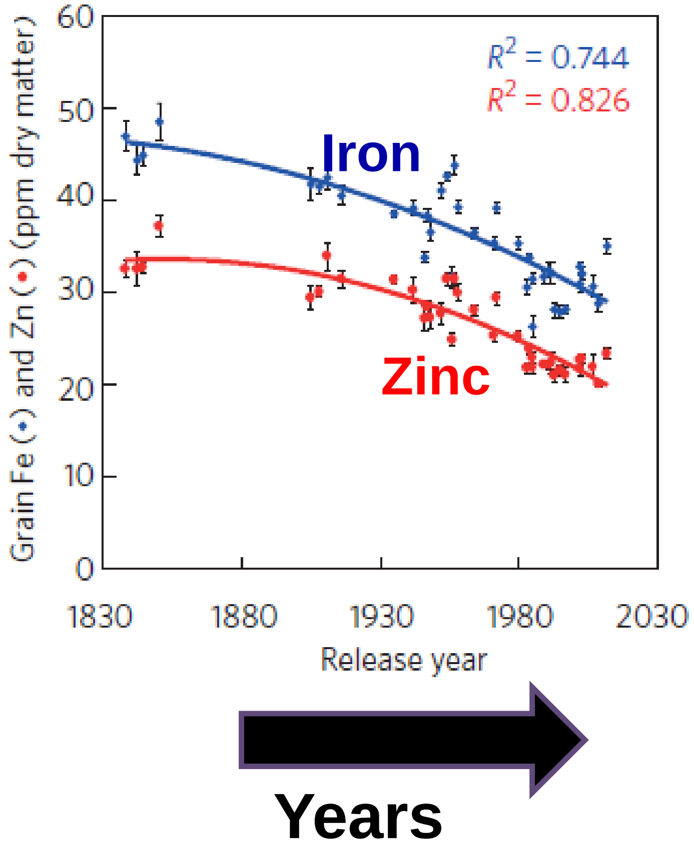


Interventions: Staple Foods

	Lower Income	Middle Income	Higher Income
Food Staples	1816	1848	1876
Non-Staple Plant Food			
Fish and Animal Foods			
All Food Groups	2201	2334	2442

Historical changes in grain protein and grain zinc and iron concentrations (with increasing grain yield)





Shewry et al. 2016, Nature Plants

Per Capita Zinc Intakes (mg/day), Rural Bangladesh By Income Group, 2005 (EAR ≈ 13 mg Zn/day)

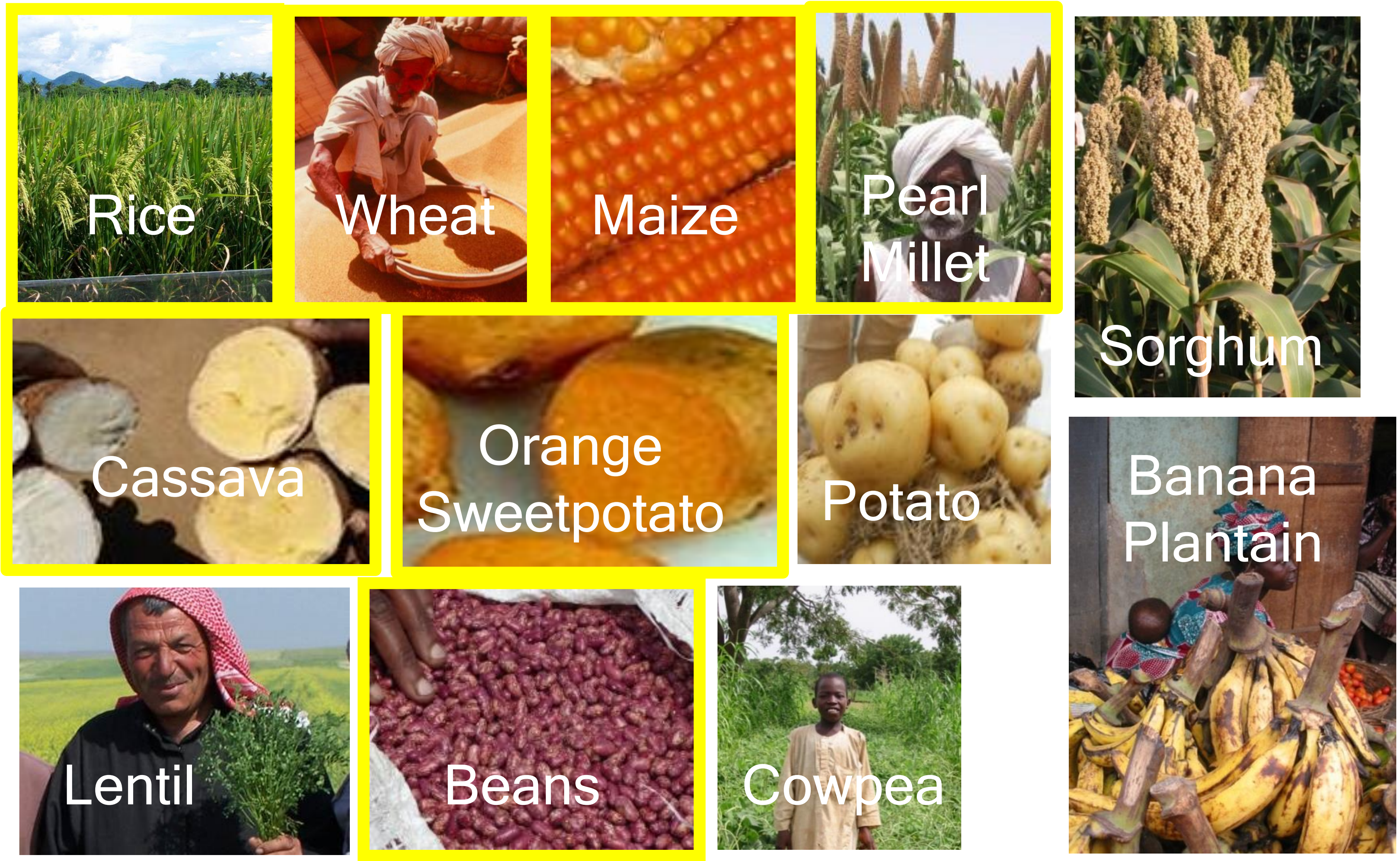
	Lower Income	Middle Income	Higher Income
Food Staples	5.9	6.4	6.9
Non-Staple Plant Food	1.8	2.1	2.4
Fish and Animal Foods	0.6	0.8	1.5
All Food Groups	8.3	9.3	10.8

Present: **15 mg/kg Zn** milled rice x 400 gms rice intake/day = 6 mg Zn/day

Biofortified: **30 mg/kg Zn** milled rice x 400 gms rice intake/day = 12 mg Zn/day

Biofortified crops released in **30+ countries**

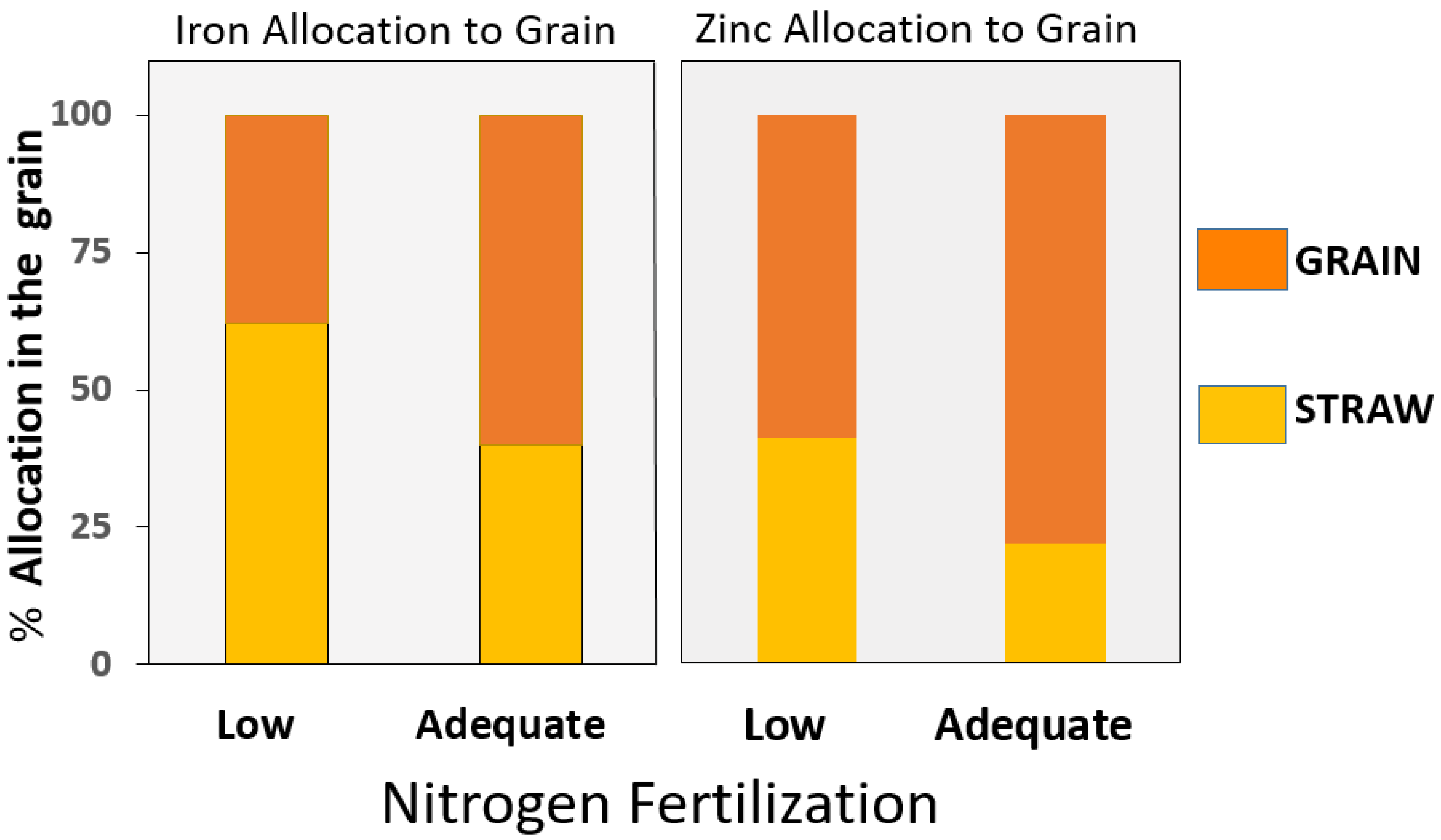
Testing for releases in these and another **25+ countries**



Over 340 Biofortified Varieties Released;
10 Million Farm Households are Producers*

* Statistics are for CGIAR Biofortification Strategy which includes International Potato Center (CIP) activities

Effect of low and adequate nitrogen fertilization on allocation (translocation) of zinc and iron from leaves into grain in wheat



Kutman et al., 2011, Plant and Soil

Average **grain concentrations of zinc, iodine (I) and selenium** after **application of a micronutrient cocktail to foliar sprays for wheat grown** in China, India, Pakistan, Mexico, South Africa and Turkey

Treatment	Zinc (mg kg^{-1})	Iodine	Selenium (µg kg^{-1})
No (control)	29	24	92
Treatment of Zn+I+Se	**48**	**249**	**338**

Zou et al., 2019, J. Agric Food Chem

Effect of High Zinc Wheat Intervention on Morbidity Indicators

Indicator	High Zinc Wheat Subjects	Low Zinc Wheat Subjects	Days of Sickness Averted For ~ 1300 Subjects Over 180 Days	Difference Significant at 5% Level of Confidence?
Children 4-6 Years				
Days With Pneumonia	203	244	41	YES
Days With Vomiting	60	99	39	YES
Women 15-49 Years				
Days With Fever	999	1092	93	YES

Sazawal S, et al. Nutr J. 2018 17(1)

Interventions: Food Staples

- **Biofortification**
  - **Substitute one-for-one; more nutrients, but no extra cost to the consumer**
  - Plant breeding (developed centrally, then spread globally)
    - Conventional or Transgenic
  - Agronomic, adding zinc and other trace minerals through fertilizers and sprays
  - Alternative breeding objectives:

    How is gut health affected by resistant starches, prebiotics

Interventions: Fish and Animal Products

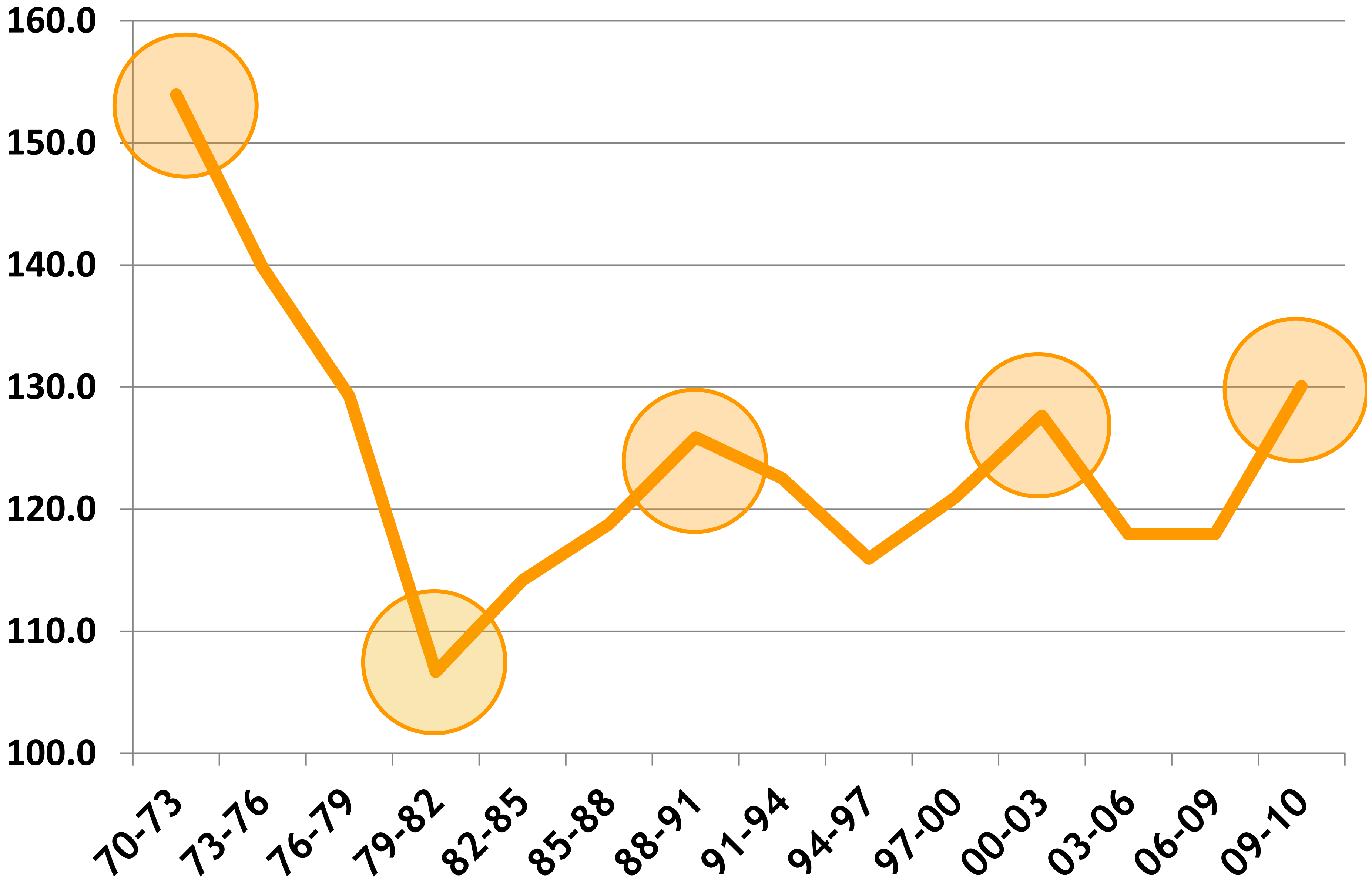
	Lower Income	Middle Income	Higher Income
Food Staples			
Non-Staple Plant Food			
Fish and Animal Foods	47	59	92
All Food Groups	2201	2334	2442

Iron Intakes, Rural Philippines, 1984-85, By Income Group

(Milligrams per adult equivalent per day)

	Income Poorest 20%	Income Richest 20%
Food Staples	3.52	4.35
Non-Staple Plant Food	1.96	2.26
Fish and Animal Foods	1.17	3.66
All Food Groups	6.65	10.27

Milk Price Indices for India, Three Year Averages



Interventions: Animal and Fish Products

- Increase supply of specific foods at the national level (not project level) that can contribute importantly to nutrition and **where productivity can be increased cost-effectively**
  - **Milk**, e.g. Operation Flood in India
- **The price goes down so more of that nutritious food will be purchased for the same food expenditure**

Interventions: Animal and Fish Products

- **Eggs** tend not to be traded internationally; therefore if productivity can be increased, prices will fall
- **Fish** – small fish eaten whole are very dense in minerals and vitamins
- Small-holder producers will sell animal and fish products – considered an unnecessary luxury if eaten at home
- Nutrition education will not be effective because of the budget constraint and relative luxury of consuming animal and fish products

Interventions: Non-Staple Plant Foods

	Lower Income	Middle Income	Higher Income
Food Staples			
Non-Staple Plant Food	339	427	474
Fish and Animal Foods			
All Food Groups	2201	2334	2442

Vitamin A Intakes, Rural Philippines, 1984-85, By Income Group

(International units per adult equivalent per day)

	Income Poorest 20%	Income Richest 20%
Food Staples	10	2
Non-Staple Plant Food	3771	4465
Fish and Animal Foods	1010	1733
All Food Groups	4791	6200

Interventions: Non-Staple Plant Foods

- Identify specific vegetables and fruits for promotion (very country-specific)
  - Some are high in a range of nutrients and affordable at least during particular seasons
  - Reducing perishability (more efficient value chains) increases the supply and **so reduces the price**
- Nutrition education, if effective, will increase demand which will tend to increase the price; **productivity increases are still required to increase supply**
- Home gardening requires substantial behavior change
- Lentils – e.g. international trade from Canada to India

Approaches to Improving Dietary Quality

Behavior / Food Type	"Indirect" Approaches Which Rely on Present Behaviors: •Profit Incentive •Desire for Dietary Diversity	"Direct" Approaches Which Seek to Change Behavior: Nutrition Education An Essential Component
Staple Foods (e.g. cereals, roots & tubers)	• **Biofortification: Iron and Zinc** • **Trace Minerals in Fertilizers**	• **Biofortification: Provitamin A**
Non-Staple Foods (e.g. Vegetables, Fruits, Pulses, Animal Products)	• Increased Income • Lower Prices o Yield Increases through Agricultural Research o Operation Flood India • Introducing Novel Crops o Cowpea in India	• Nutrition Education • Nutrition-Sensitive Agricultural Projects: o Homestead Gardens

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Bangkok

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HRH Princess Maha Chakri Sirindhorn

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