# Food Price Watch

88390

THE WORLD BANK GROUP

YEAR 4 • ISSUE 16 • FEBRUARY 2014

Prices of internationally traded food commodities continued to decline—by 3%—between October 2013 and January 2014, adding another quarter to previously observed price declines since the August 2012 historical high. Record harvests in wheat, maize and rice, increasing availability of supplies, and stronger global stocks have continued to drive down prices. Yet, international prices are still not overly far from their historical peak. Upward pressures from weather concerns and increasing demand, and downward risks from the effects on export prices of an increasingly contested Thai rice procurement program continue to require close monitoring. Domestic food prices show their typical large variations across countries, with stable prices among a number of regions and mixed trends in East and South Asia as a result of seasonal factors, procurement policies, and localized production shortfalls.

This issue of the *Food Price Watch* explores food losses and food waste across the globe. Astonishing figures indicate that the world loses or wastes about one-quarter to one-third of the food it produces for consumption. In Africa and South Asia, regions severely affected by undernourishment, this loss represents 400–500 kcal per person per day. In addition to their impact on food insecurity, food loss and waste cause huge economic, energy, and natural resource inefficiencies and have poverty implications. Potential solutions to prevent food loss and waste include changing agricultural production techniques; making large investments in transport and storage infrastructure; and changing consumer and commercial behavior.

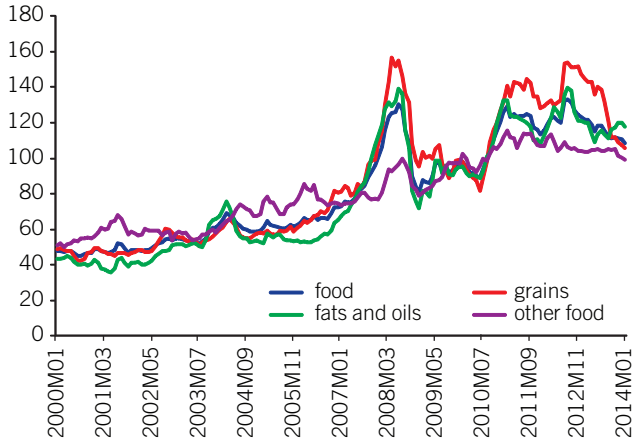


## Global Price Trends

**International prices of food continued to decline between October 2013 and January 2014** (figure 1). The World Bank's Food Price Index decreased an additional 3% during that period. Declines have been sustained month after month in line with already favorable and improving supply prospects. Nonetheless, the size of the recent decline in internationally traded food prices is half of that observed between June and October of 2013. The Bank's Food Price Index in January 2014 was 11% lower than a year ago, and 18% below the all-time peak in August 2012 (table 1). Hence, despite steady declines, prices of internationally traded food remain not overly far from their historical peak.[1]

**Declines in the prices of internationally traded grains and in the "other" category—mostly sugar—have driven the overall decrease in food prices between October 2013 and January 2014.** The prices of grains and other foods were

### Figure 1. World Bank Global Food Price Index




*Source*: World Bank, DECPG.
*Note*: The Food Price Index weighs export prices of a variety of food commodities around the world in nominal U.S. dollar prices, 2010 = 100. Note that the previous base, 2005 = 100, has now been changed to 2010.

*Food Price Watch*, produced by the Poverty Reduction and Equity Department at the World Bank, is a series that aims at drawing attention to trends in domestic food prices in low- and middle-income countries and their policy implications. Contact: José Cuesta (jcuesta@worldbank.org)

**Table 1. Price Change of Key Food Commodities**

| Indices | Oct. 2013–Jan. 2014 (%) | Jan. 2013–Jan. 2014 (%) | Aug. 2012–Jan. 2014 (%) |
|---|---|---|---|
| Food | -3 | -11 | -18 |
| Grains | -5 | -27 | -31 |
| Fats and oils | 0 | -2 | -16 |
| Other | -5 | -4 | -6 |
| Fertilizer | 4 | -21 | -24 |
| **Prices** | | | |
| Maize | -2 | -35 | -40 |
| Rice (Thai, 5%) | 3 | -20 | -21 |
| Wheat (U.S., HRW) | -15 | -18 | -21 |
| Sugar (world) | -16 | -17 | -25 |
| Soybean oil | -4 | -21 | -25 |
| Crude oil, average | -3 | -3 | -3 |

*Source*: World Bank, DECPG.

both 5% lower in January 2014 than in October 2013. Prices of fats and oils remained unchanged during the same period.

**International grains prices have followed mixed trends during the last quarter.** International **wheat** prices decreased by 15% between October 2013 and January 2014. This price decline is the largest among grains and reverses previous increases—especially a sharp rise in October 2013—associated with past weather uncertainties. The price of internationally traded **maize** fell by only 2% between October 2013 and January 2014. Yet, sustained monthly reductions during those three months extended to nine the consecutive months of price declines. In January 2014, maize prices were 35% lower than a year ago, but most of that reduction took place between June and October 2013, as reported by the November 2013 *Food Price Watch*.[2] **Rice** prices, based on origin and quality, followed different patterns between last October and January 2014. Prices of Thai 5% rice increased by 3%, while Vietnamese rice prices—not reported here—increased by 11%. In contrast, export prices of Indian rice and lower quality Thai rice declined during this same period as a result of large available supplies, even though public procurement programs partially limited such declines. Regarding commodities other than grains, the Bank's average price of **crude oil** was US$104 per barrel during the quarter ending January 2014, and was, in January 2014, some 3% below its October 2013 average. **Fertilizer** prices increased by 4% during this period, against a backdrop of sharp annual declines.[3] **Sugar** prices experienced marked decreases (16%), while those of **soybean oil** declined more moderately (by 4%).[4]

**Favorable conditions have confirmed previous projections of record grain harvests, resulting in further—but lower—price declines between October 2013 and January 2014.** In the case of **wheat**, overall conditions have been favorable both across northern and southern hemispheres, leading to record high production forecasts for 2013–14. Although at different stages of their seasons, the major producers in the Black Sea, United States, European Union, Canada, China, and India all report favorable crop conditions.[5] Among major southern hemisphere producers, including Australia, Argentina and South Africa, prospects are typically favorable, but recent concerns, based on heat and dryness conditions, have not fully dissipated regarding prospects for Argentina and Australia.[6] The decreasing use of wheat for feeding purposes—substituted by cheaper maize and other coarse grains—has eased pressure on its international prices.[7] In contrast, increasing import demand in North Africa, Middle East and Japan, and increased procurement prices in India, have increased pressure on export prices.[8]

The anticipated record **maize** harvest in the world's top producer and exporter, the United States (after last year's sharp decline); significant output increases for EU and Black Sea producers; and improved harvests in China[9] continue to exert downward pressures on international maize prices. Further price decreases may be tempered by increasing demand for feeding purposes, especially in China and the United States.[10] The use of maize to produce ethanol in the United States is increasing, reflecting strong ethanol production and increases in gasoline projections in that country.[11] Nevertheless, recent downward adjustments for maize output are reported for Argentina, the Russian Federation and European Union, with weather-related stresses also reported in Brazil and South Africa, and increases in procurement prices reported in China.[12]

In the case of **rice**, bumper crop expectations have been revised further upward on account of improved yields and increases in harvested area in United States, Brazil, and Pakistan; bumper crops among large Asian producers, such

as Thailand and India; and improved prospects for Indonesia.[13] These production records, the ample public reserves in India, and the efforts of the Thai government to release massive stockpiles are exerting downward pressures on export prices. Yet, prices of certain varieties and origins have recently increased, the result of the increasingly contested paddy mortgage program in Thailand;[14] increased demand for Vietnamese rice in the aftermath of the Haiyan Typhoon in the Philippines;[15] and disappointing output in China, which expects a reduced crop for the first time in 10 years.[16]

**Going forward, pressures are anticipated to weaken in the short term.** The latest World Bank *Commodity Markets Outlook*[17] talks of "normal trends" in terms of crop conditions, which favorably add to well-supplied markets and strong cereal global stocks.[18] Further decreasing fertilizer prices, unforeseen dramatic changes in the production of biofuels, and the continuation of sensible trade policies (as those seen during the latest price hike in 2012) all point to a favorable outlook. Nonetheless, deteriorating weather concerns among major producers and exporters, especially those in Argentina, Australia, and parts of China;[19] higher oil prices; and the effects of an increasingly anticipated release of public stockpiles in Thailand on export rice prices all constitute risks to monitor in the short term.

## Domestic Price Trends

**Domestic prices of grains have remained mostly stable, with some regions reporting mixed trends**. In western Africa, cereal prices have remained stable or have decreased in recent months, after increasing supplies from coastal countries (notably Nigeria) more than offset limited production in the Sahel.[20] In southern Africa, the price of maize remained high or increased across the region, while soaring to record levels in South Africa on seasonal tighter supplies, increasing demand, currency depreciations, and concerns about upcoming harvests.[21] In eastern Africa, maize prices have followed seasonal trends, decreasing lately from ongoing harvests, but remaining at high levels. In Central America, prices of maize remained stable or decreased—from abundant supplies and favorable prospects—with mixed trends for the price of beans.[22] In South America, wheat prices remained high even after recent declines from completed harvests, while maize prices remained low and stable from ample supplies. In East and South Asia, prices of staples have followed mixed trends: domestic prices of rice have decreased among major exporting countries due to recent bumper crops; have increased elsewhere from unfavorable weather conditions; and, in the case of wheat, have remained stable at high levels from limited supplies. In Central Asia, prices of wheat also remained stable at high levels as a result of high oil and transportation costs, despite recent good harvests and lowered export prices in the region.[23]

**Between October 2013 and January 2014**, the largest **wheat** price increases (table 2) took place across monitored markets in Sudan (30%), due to increasing demand and currency depreciation, and in Uruguay (20%), Ukraine (13%), and Russia (11%), national averages, due to strong regional export demand.[24] Sizable wheat price reductions, mostly because of the availability of recent harvests, were observed in monitored markets in Argentina (59%), Ethiopia (21%), Moldova (20%), Brazil (13%, national average), and Tajikistan (6%, national average).[25] Domestic **maize** prices experienced the largest increases, between 47 and 41%, registered in monitored markets in South Africa, Malawi, and Mozambique on account of tighter supplies, increasing fuel prices, and depreciating currencies.[26] Large increases were also observed in monitored markets in Bolivia (27%), Tanzania (26%), Ecuador (21%), and Zambia (17%, national average) because of reduced national supplies.[27] Domestic maize prices declined in monitored markets in Ethiopia (41%), as the main—bumper—crop arrived to markets, Moldova (30%), Togo (29%), and Honduras (16%). Between October 2013 and January 2014, **rice** prices increased by 18% in monitored markets in Somalia, partially reflecting depreciation of the local currency,[28] and 10, 9, and 9% in markets in Peru, Malawi, and Sri Lanka, respectively.[29] The largest declines in rice prices occurred in the capital cities of Mauritania (16%, from a strong increase in domestic production[30]) and the Republic of the Union of Myanmar (13%) and Cambodia (11%), mainly reflecting new supplies and favorable prospects.

**Domestic price variations between January 2013 and January 2014 show the usual wide range in yearly prices**. The price of **wheat** in January 2014 was 168% higher than 12 months ago in Argentina (Buenos Aires), because of tight supplies and uncertain prospects; 92% higher in Sudan (Dongola), resulting from currency depreciation and low imports from foreign currency shortages; 54% higher in Belarus; and 50% higher in Ethiopia (Debre Marcos) and 39% higher in Bolivia (La Paz), reflecting reduced production and imports, respectively. Russia

## Table 2. Largest Variations in Domestic Prices

| Quarterly Price Movements: October 2013 – January 2014 | | | |
|---|---|---|---|
| **Wheat** | **% change** | **Maize** | **% change** |
| Sudan, Dongola, wholesale, Sudanese pound/local | 30 | South Africa, Randfontein, yellow, wholesale, rand/ton | 47 |
| Uruguay, natl. avg., flour, wholesale, Uruguayan peso/kg | 20 | Malawi, Lizulu, retail, kwacha/kg | 45 |
| Belarus, natl. avg., flour, retail, Belarussian ruble/kg | 15 | Mozambique, Milange, white, retail, metical/kg | 41 |
| Ukraine, natl. avg., 3rd class, bid, EXW, processing, hryvnia/ton | 13 | Bolivia, Cochabamba, hard yellow, cubano, wholesale, boliviano/local | 27 |
| Russian Federation, natl. avg., EXW, wholesale, ruble/kg | 11 | Tanzania, Arusha, wholesale, US$/ton | 24 |
| Tajikistan, natl. avg., flour, 1st grade, retail, somoni/kg | -6 | Ecuador, Quito, yellow, wholesale, US$/kg | 21 |
| Brazil, natl. avg., wholesale, Brazilian real/kg | -13 | Zambia, natl. avg., white, retail, kwacha/local | 17 |
| Moldova, Chisinau, retail, Moldovan leu/kg | -20 | Honduras, Tegucigalpa, white, wholesale, US$/kg | -16 |
| Ethiopia, Jimma, white, wholesale, Ethiopian birr/local | -21 | Togo, Korbongou, white, retail, CFA franc/kg | -29 |
| Argentina, Buenos Aires, wholesale, US$/kg | -59 | Moldova, Chisinau, retail, Moldovan leu/kg | -30 |
| | | Ethiopia, Addis Ababa, wholesale, US$/kg | -41 |
| **Rice** | **% change** | **Sorghum** | **% change** |
| Somalia, Mogadishu, imported, retail, Somali shilling/kg | 18 | Somalia, Hargeisa, red, retail, Somali shilling/kg | 29 |
| Peru, Lima, milled, corriente, wholesale, nuevo sol/kg | 10 | Sudan, Dongola, feterita, wholesale, Sudanese pound/local | 17 |
| Malawi, Lilongwe, retail, kwacha/kg | 9 | Togo, Korbongou, retail, CFA franc/kg | 14 |
| Sri Lanka, Colombo, white, retail, Sri Lanka rupee/kg | 9 | Mali, Ségou, local, wholesale, CFA franc/local | -9 |
| Mozambique, Nampula, retail, metical/kg | 7 | El Salvador, San Salvador, Maicillo, wholesale, US$/local | -15 |
| Bangladesh, Dhaka, coarse, wholesale, taka/kg | 6 | Niger, Maradi, local, wholesale, CFA franc/local | -25 |
| India, Patna, retail, Indian rupee/kg | -9 | Chad, Abeche, retail, CFA franc/kg | -32 |
| Togo, Amegnran, imported, retail, CFA franc/kg | -9 | Ethiopia, Addis Ababa, red, wholesale, US$/kg | -35 |
| Cambodia, Phnom Penh, mix, wholesale, riel/kg | -11 | | |
| Myanmar, Rep. of the Union of, Yangon, Emata, Manawthukha FQ, wholesale, kyat/kg | -13 | | |
| Mauritania, Nouakchott, imported, retail, ouguiya/kg | -16 | | |
| **Annual Price Movements: January 2013 – January 2014** | | | |
| **Wheat** | **% change** | **Maize** | **% change** |
| Argentina, Buenos Aires, flour, wholesale, US$/kg | 168 | Malawi, Lilongwe, retail, kwacha/kg | 89 |
| Sudan, Dongola, wholesale, Sudanese pound/local | 92 | Bolivia, La Paz, hard yellow, cubano, wholesale, boliviano/local | 54 |
| Belarus, natl. avg., flour, retail, Belarussian ruble/kg | 54 | South Africa, Randfontein, white, wholesale, rand/ton | 47 |
| Ethiopia, Debre Marcos, white, wholesale, Ethiopian birr/local | 50 | Somalia, Hargeisa, white, retail, Somali shilling/kg | 36 |
| Bolivia, La Paz, flour, imported, Argentina, wholesale, boliviano/local | 39 | Zambia, natl. avg., white, retail, kwacha/local | 28 |
| Afghanistan, Kabul, flour, retail, afghani/kg | -16 | Tanzania, Dar es Salaam, wholesale, US$/ton | -22 |
| Ukraine, natl. avg., 3rd class, bid, EXW, processing, hryvnia/ton | -19 | Togo, Cinkassé, white, retail, CFA franc/kg | -25 |
| Moldova, Chisinau, retail, Moldovan leu/kg | -26 | Haiti, Port-au-Prince, meal, local, retail, gourde/local | -33 |
| Russian Federation, natl. avg., EXW, wholesale, ruble/kg | -30 | Moldova, Chisinau, retail, Moldovan leu/kg | -34 |
| | | Russian Federation, natl. avg., offer EXW, wholesale, ruble/kg | -38 |
| | | Ukraine, natl. avg., bid, EXW, processing, wholesale hryvnia/ton | -38 |

*table continues on next page*

| Annual Price Movements: January 2013 – January 2014 *(continued)* | | | |
|---|---|---|---|
| **Rice** | **% change** | **Sorghum** | **% change** |
| Bolivia, La Paz, grano de oro, wholesale, boliviano/local | 41 | Somalia, Baidoa, red, retail, Somali shilling/kg | 75 |
| Bangladesh, Dhaka, coarse, wholesale, taka/kg | 28 | Ethiopia, Addis Ababa, white, wholesale, US$/kg | 65 |
| Peru, Lima, milled, corriente, wholesale, nuevo sol/kg | 20 | Sudan, Al-Fashir, feterita, wholesale, Sudanese pound/local | 52 |
| Malawi, Lilongwe, retail, kwacha/kg | 18 | Chad, Moundou, retail, CFA franc/kg | 25 |
| Somalia, Buale, imported, retail, Somali shilling/kg | -12 | Niger, Agadez, local, wholesale, CFA franc/local | 17 |
| Colombia, natl. avg., 1st quality, retail, Colombian peso/kg | -13 | Mali, Kayes, local, wholesale, CFA franc/local | 10 |
| Mali, Sikasso, local, wholesale, CFA franc/local | -20 | Burkina Faso, Ouagadougou, local, wholesale, CFA franc/local | 7 |
| Rwanda, Kigali, wholesale, US$/ton | -22 | El Salvador, San Salvador, Maicillo, wholesale, US$/local | -5 |
| Thailand, Bangkok, 25% broken, wholesale, baht/ton | -27 | Togo, Cinkassé, retail, CFA franc/kg | -31 |

*Source:* Food and Agriculture Organization (FAO), and Global Information and Early Warning System (GIEWS).
*Note:* Currencies as originally reported by FAO.

(30%, national average), Moldova (Chisnau, 26%), Ukraine (national average, 19%), and Afghanistan (Kabul, 16%) report more moderate decreases in domestic wheat prices, mainly due to bumper crops.[31] Large increases in the annual **maize** price occurred in monitored markets in Malawi (Liwonde, 89%) due to the devaluation of its currency and localized production declines;[32] Bolivia (La Paz, 54%), reflecting poor production last year; and in South Africa (Randfontein, 47%) and Somalia (Hargeisa, 36%), partially reflecting market disruptions from civil insecurity. Maize prices declined over the last year in Ukraine and Russia (national average, 38%), and in the capital cities of Moldova (34%), Haiti (33%) and Tanzania (22%), generally due to bumper crops in 2013.[33] **Rice** prices increased in monitored domestic markets in Bolivia (41%), Bangladesh (28%), Peru (20%), and Malawi (18%).[34] In contrast, the annual rice price dropped more than 20% in Thailand, Rwanda, and Mali.[35]

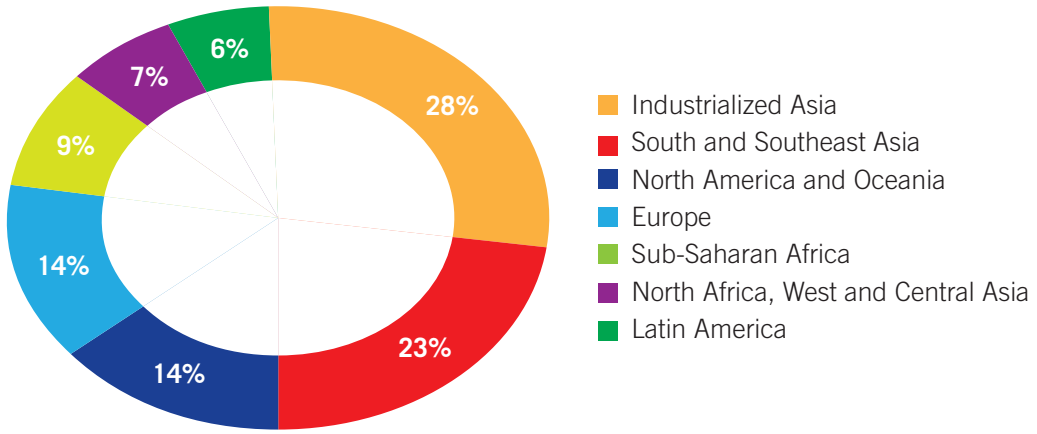
## Food Loss and Food Waste

Food loss and food waste refer to edible parts of plants and animals intended for human consumption that are not ultimately consumed by people.[36] Food loss typically occurs at the production, storage, processing, distribution, and marketing stages of the food value chain. It is the unintended result of technical limitations or poor infrastructure,[37] widely agreed to mostly happen in developing countries.[38] In developed countries, food waste typically takes place at the retail and consumption stages of the food value chain, the result of a conscious decision to throw food away. Until the recent onset of cheap food, many considered the deliberate decision to waste food an "embarrassment of riches"; but after the repeated food price hikes post-2008 and increasing demand from a growing population,[39] food loss and food waste are increasingly attracting global attention. Global attention and concern are fully justified by these staggering figures:

- Between one-fourth and one-third of the nearly 4 billion metric tons of food produced annually for human consumption is lost or wasted.[40]
- Cereals represent more than half of all food lost or wasted, 53%, by calorie content. By weight, fruits and vegetables represent, at 44%, the largest share of global food loss and food waste.[41]
- Most losses and waste take place at the consumption (35%), production (24%), and handling and storage (24%) stages of the food value chain.
- Yet there are marked differences between developed and developing countries and across regions. Overall, some 56% of total food loss and food waste occurs in the developed world; the remaining 44% across developing regions. Figure 2 presents regional breakdowns.

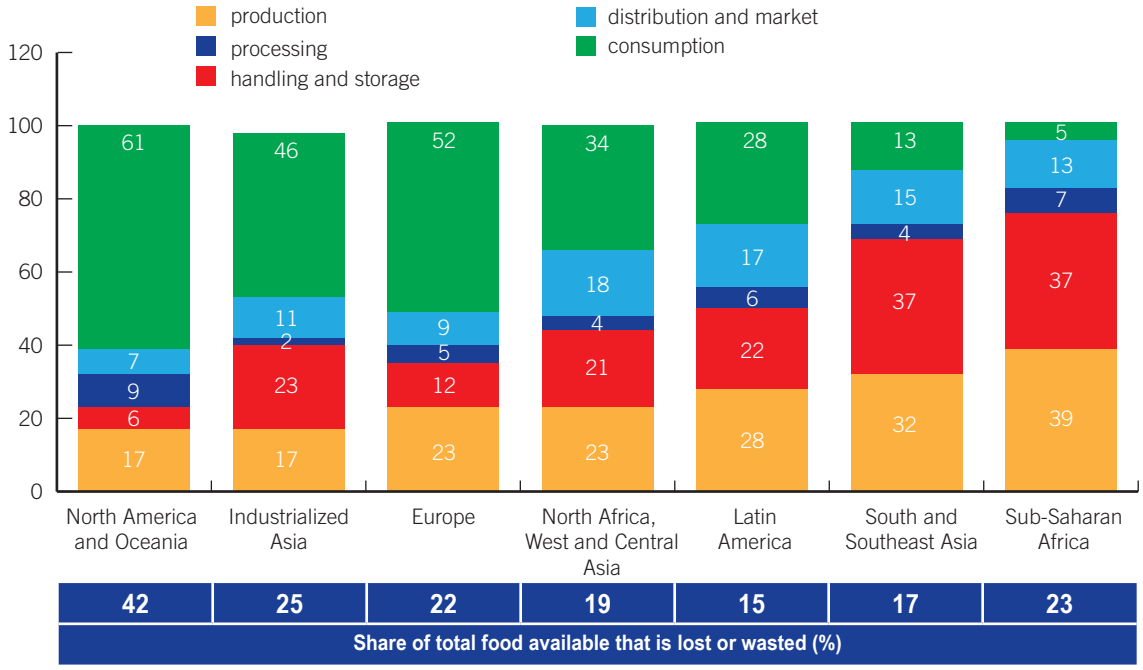
This astonishing volume of food loss and waste constitutes a serious food insecurity concern, because it reduces the availability of food for human consumption. According to Food and Agricultural Organization (FAO) data,[42] per capita food losses in the developed world average a whopping 250–300 kg per year, of which 75–115 kg are the result of consumers' waste. This total food waste in the developed world amounts to 750–1,500 kcal per person per day![43] In turn, the developing world loses 120–220 kg of food per person per year, which means that even regions ridden by undernutrition, such as South Asia and Sub-

## Figure 2. Global Food Loss and Waste by Region
### a. Percent of total loss




*Source:* Brian Lipinski, Craig Hanson, Richard Waite, et al., "Reducing Food Loss and Waste," World Resources Institute Working Paper, June 2013; Jenny Gustavsson, Christel Cederberg, Ulf Sonesson, et al., "Global Food Losses and Food Waste—Extent, Causes and Prevention," FAO, Rome (2011).
*Note:* Share of global food loss and waste, 2009 (100% = 1.5 quadrillion kcal).

### b. By food chain stage




*Source:* Lipinski, et al., "Reducing Food Loss and Waste"; Gustavsson et al., "Global Food Losses and Food Waste."
*Note:* Percent of total kcal lost and wasted, 2009. Numbers may not total 100 due to rounding.

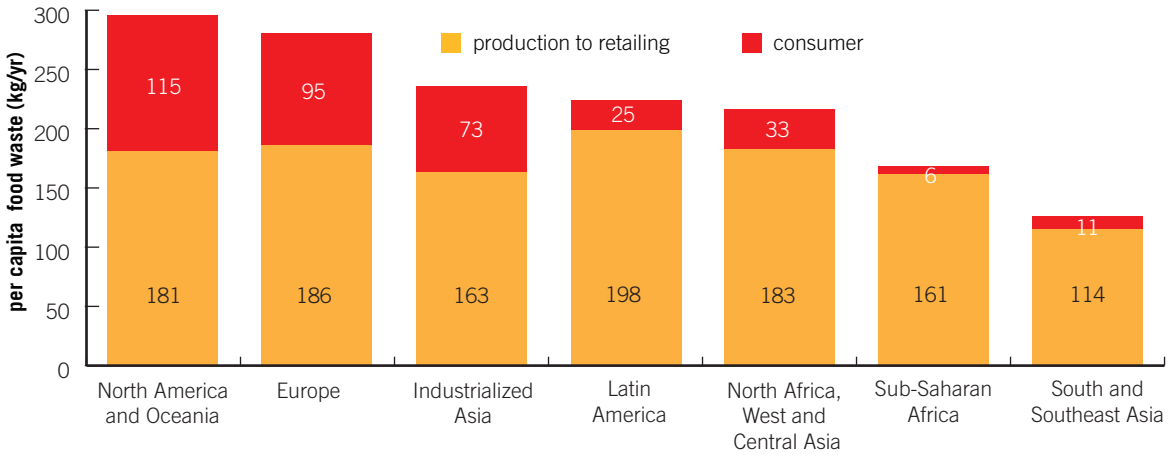
*figure continued on next page*

Saharan Africa, lose as many as 400–500 kcal per person per day, every day.

In addition to the food security dimension, food loss and waste also have grave economic, environmental, natural resource, and poverty implications. Food losses represent squandered investment in agriculture; cause unnecessary greenhouse gas emissions; generate enormous inefficiencies in the use of water, energy, fertilizers, and land; and reduce the incomes of (typically small) farmers, while requiring (poor) consumers to increase their spending to satisfy minimum calorie intakes. For example, 1 calorie of food requires, on average, 7–10 calories of inputs to be produced.[44] Similarly, producing 1 ton of apples requires, on average, 822 $m^3$ of water; a ton of rice (paddy) requires 1,673 $m^3$ of water; soybean oil (refined) needs 4,190$m^3$ of water; and coffee (roasted) needs 18,925$m^3$.[45]

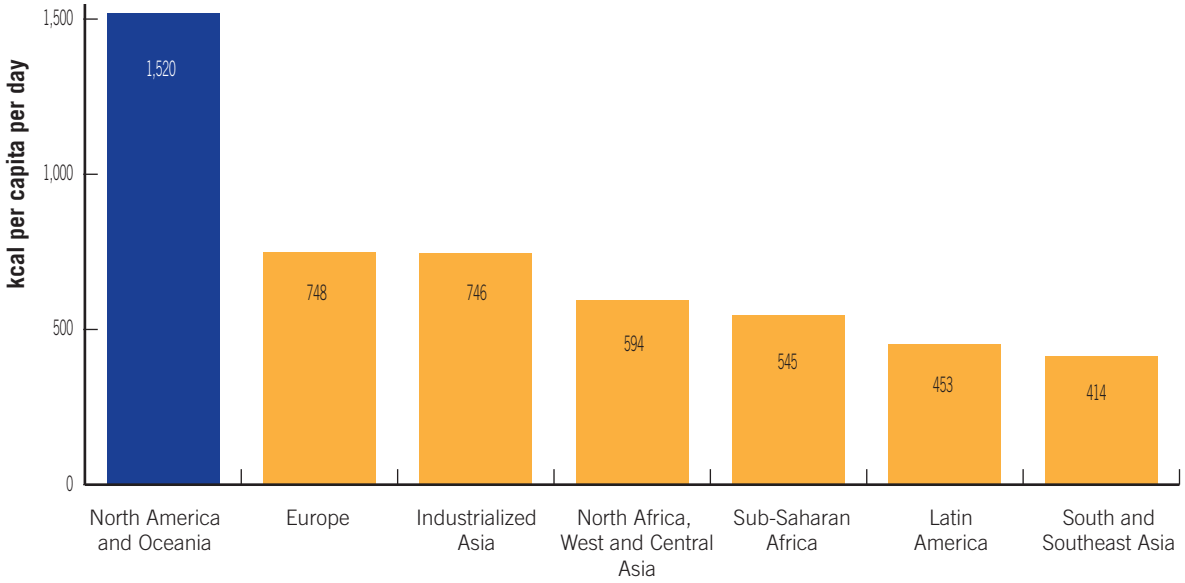
## Figure 2. Global Food Loss and Waste by Region *(continued)*

### c. In annual per capita kilograms




*Source:* Lipinski, et al., "Reducing Food Loss and Waste"; Gustavsson et al., "Global Food Losses and Food Waste."

### d. In daily per capita kilocalories




*Source:* Lipinski, et al., "Reducing Food Loss and Waste"; Gustavsson et al., "Global Food Losses and Food Waste."
*Note:* Developed regions include North America and Oceania; Europe; and industrialized Asia (China, Japan, and the Republic of Korea); the rest are considered developing regions.

At the household level, in countries like the United States and the United Kingdom, an average family of four wastes US$1,600 and US$1,100 per year at the consumption stage, and evidence points to such losses as having increased over time.[46] By socioeconomic status, recent evidence for Turkey, South Africa, and Australia[47] finds that lower-income groups waste less food than higher income groups in terms of weight, calories, and spending (table 3).[48] This evidence supports analyses reporting that higher-income households produce more solid waste (food and others) than poorer households.[49]

Despite a global problem, the causes of food loss and waste are context specific and multiple. The primary causes of food loss include inadequate agricultural practice knowledge, transport infrastructure and logistic systems, and poorly engineered storage facilities. Food waste is closely related to commercial practices and cultural factors. For example, in developed countries, large supermarkets' purchasing policies may incentivize overproduction.[50] In addition, promotional offers and high-pressure advertising campaigns may encourage overpurchasing behaviors among consumers, which lead to food waste at home.

**Table 3. Food Waste by Socioeconomic Group, Selected Countries**

| Country | Lower-income group | Middle-income group | Higher-income group |
|---|---|---|---|
| Turkey, 2005: Total food waste per household in terms of grams per person per day | 274 | 285 | 319 |
| South Africa, 2011: Total food waste by household in grams per person per day | 410 | 740 | 1,290 |
| Australia, 2009: Total food waste by household per year in dollars | 518 | 635 | 803 |

*Source:* Turkey: G. Pekcan, E. Koksal, O. Kucukerdonmez, and H. Ozel, "Household Food Wastage in Turkey," Working Paper ESS/ESA No. 6e, FAO, Rome (2006); South Africa: A. Nahman, W. de Lange, S. Oelofse, and L.Godfrey, "The Costs of Household Food Waste in South Africa," *Waste Management* 32, 2147–53 (2012); Australia: D. Baker, J. Fear, and R. Denniss, "What a Waste: An Analysis of Household Expenditure on Food," Policy Brief No. 6, Australia Institute (2009).

Consumers' poor understanding of complex and conservative "use by" labeling may encourage food waste home. Wherever food is culturally regarded as a cheap and abundant item, it is more likely to become "grossly undervalued" and readily thrown away.[51]

Effective solutions to reduce food loss and waste clearly require multiple interventions. Even though it may not be realistic to expect zero food loss and waste, there are simple, promising, and cost-effective engineering solutions—specific to context and available technologies—already exist.[52] These include evaporative coolers, already in use in Tanzania and India; hermetically sealed plastic storage bags for crops, such as cowpeas in Nigeria; small metal silos that have been tested in Kenya; or the use of plastic crates—instead of bags—for harvesting tomatoes, such as in Afghanistan.[53] On a larger scale, developing countries need to improve and expand infrastructure related to roads, railways, electricity generation, potable water supplies, heating, ventilation, and storage facilities.[54] Particularly pertinent in developed countries are the purposeful efforts of the Waste & Resources Action Programme (WRAP) in the United Kingdom; Food Use for Social Innovation by Optimising Waste Prevention Strategies (FUSIONS) in the European Union; and the Food Waste Reduction Alliance (FWRA)[55] in the United States. These initiatives are striving for more efficient waste management, for food and other resources; increased food donations; and changes in the behaviors, perceptions, and preferences of consumers and retailers. Internationally, more coordinated efforts are advocating raising awareness; setting targets; facilitating the transfer of knowledge and technologies; and resource mobilization.[56] After all, future progress in agricultural production and climate change will mean very little for global food security if we keep losing and wasting a third of the food meant to be consumed.

## Notes

1. The international trade price of maize is a notable exception, it remained some 40% lower in January 2014 than the level registered in August 2012, the historical peak (table 1).
2. The plunge in internationally traded maize between June and October 2013 responds to anticipated record harvests in the United States and strong recoveries among producers in the Black Sea and China on the one hand, and overall weak demand on the other, leading to easing markets and a buildup in inventories (World Bank, *Food Price Watch*, November 2013).
3. Increases during the last two months in the prices of natural gas, a critical production cost for fertilizers, explain the recent increase in the fertilizer prices (World Bank, *Global Economic Prospects: Commodity Markets Outlook*, January 2014).
4. Substantial price declines in internationally traded sugar are explained by surplus production exceeding expectations in Brazil—the world's largest producer and exporter—along with favorable conditions among other northern hemisphere producers such as India, Mexico, and Thailand (World Bank, *Global Economic Prospects: Commodity Markets Outlook*, January 2014). In the case of soybeans, increased production expected in the United States and Brazil is partly counteracted by a tight U.S. market and weather concerns in the southern cone of Latin America, specifically Argentina (United States Department of Agriculture [USDA], *World Agricultural Supply and Demand Estimates* [WASDE], No. 525, January 10, 2014; USDA, WASDE, No. 526, February 10, 2014; World Bank, *Global Economic Prospects*.
5. FAO, *Cereal Supply and Demand Brief*, December 5, 2013; USDA, WASDE, No. 526; Agricultural Market Information Systems (AMIS), *Market Monitor*, No. 14, December 2013.
6. USDA, *World Agricultural Weather Highlights*, February 10, 2014, and January 10, 2014; AMIS, *Market Monitor*, No. 14.
7. AMIS, *Market Monitor*, No. 15, February 2014.
8. USDA, WASDE, No. 525. In India, the government has increased the price paid for wheat by 4% under the minimum price support program (AMIS, *Market Monitor*, No. 14). In addition, it has reduced the floor price for wheat exports by 13% on October 30, 2013 (FAO, *Global Food Price Monitor*, February 10, 2014; AMIS, *Market Monitor*, No. 14).
9. Improved output in China is anticipated because of better than expected weather and an increase in harvested area (USDA, WASDE, No. 525).
10. FAO, *Cereal Supply and Demand Brief*.
11. USDA, WASDE, No. 525.
12. In Brazil, increasing export interest and public support measures add to weather concerns (USDA, WASDE, Nos. 525 and 526).
13. FAO, *Crop Prospects and Food Situation*, No. 4, December 2013.
14. Problems with the Thai program include delayed payments to farmers, allegations of corruption, and a caretaker government currently in office. For more information, see, for instance, *The Wall*

*Street Journal* ("Thai Farmers Begin Deserting Government Over Late Rice Payments," January 18, 2014) or Thomson Reuters Eikon ("Rice debacle Could Spell End of Thai government," February 7, 2014).

15. Because harvests mostly were complete in affected areas, the typhoon did not cause huge production losses.
16. AMIS, *Market Monitor*, No. 15. This decline is attributed to belated rains affecting intermediate crops (dry conditions that have, incidentally, also affected important producing areas in northeastern states in India; see also FAO, *Crop Prospects and Food Situation*).
17. FAO and the Organisation for Economic Co-operation and Development (OECD) share a similar favorable price outlook also extended into the long term (OECD and FAO, *Agricultural Outlook 2013–2022*, Paris: OECD [2013], http://www.oecd.org/site/oecd-faoagriculturaloutlook/).
18. In the case of maize, global stocks are expected to reach record high volumes. For all three major grains, global stocks-to-use ratios (major exporter stock-to-disappearance ratios) remain comfortable: 24.9% (16.1%) for wheat; 17.6% (13%) for coarse grains; and 35.9% (28.1%) for rice (USDA, WASDE, several issues; FAO, *Cereal Supply and Demand Brief*, several issues).
19. USDA, *World Agricultural Weather Highlights*, February 10, 2014.
20. FAO, *Global Food Price Monitor*, February 10, 2014.
21. FAO, *Global Food Price Monitor*, February 10, 2014; FEWS NET, *Price Watch*, January 31, 2014.
22. FAO, *Global Food Price Monitor*, February 10, 2014.
23. FAO, *Global Food Price Monitor*, December 10, 2013, and November 11, 2013.
24. Ibid.
25. In Moldova and Tajikistan, domestic price declines are the result of lower export prices of a key regional exporter, Kazakhstan, and a recent decline in fuel prices in Tajikistan (FAO, *Global Food Price Monitor*, February 10, 2014).
26. South Africa and Malawi currencies depreciated during this period. Ibid.
27. Reduced imports, in the case of Ecuador.
28. FAO and Global Information and Early Warning System (GIEWS), "Country Brief: Somalia," January 28, 2014.
29. These price increases are partially the result of limited production, as in Sri Lanka, more expensive imports, as in Somalia, and increasing costs from currency depreciation and higher fuel prices, as in Malawi (FAO and GIEWS, "Country Brief: Somalia," January 28, 2014).
30. GIEWS, "Country Brief: Mauritania," January 28, 2014.
31. FAO, *Crop Prospects and Food Situation*.
32. FEWS NET, *Price Watch*, January 31, 2014.
33. In the case of Tanzania, low rice prices have also contributed to lower maize prices (rice is a substitute for maize in urban areas; FAO, *Global Food Price Monitor*, February 10, 2014). In Moldova, maize supplies increased after the suspension of maize exports in 2013, following reduced production in 2012–13 (FAO and GIEWS, "Country Brief: Moldova," February 25, 2013).
34. Public procurement programs in Bangladesh; currency depreciation in Malawi; reduced domestic production in Bolivia; and increasing import demand throughout the year in Peru (FAO, *Global Food Price Monitor*, February 10, 2014; FAO and GIEWS, "Country Brief: Peru," November 7, 2013, "Country Brief: Bolivia," December 12, 2013) contributed to these price increases.
35. Prices went down due to increased imports and an improved security situation in Mali; public stock releases and decreased export prices in Thailand; and because of increasing supplies in Rwanda (FAO, *Global Food Price Monitor*, February 10, 2014; FEWS NET, *Price Watch*, January 31, 2014).
36. Brian Lipinski, Craig Hanson, Richard Waite, et al., "Reducing Food Loss and Waste," World Resources Institute Working Paper, June 2013; Jenny Gustavsson, Christel Cederberg, Ulf Sonesson, et al., "Global Food Losses and Food Waste—Extent, Causes and Prevention," FAO, Rome (2011).
37. Ibid.
38. Ibid.
39. In addition, there are other factors such as large international dietary shifts and urbanization processes that, among other things, imply less people willing to work in agriculture (J. Parfitt, M. Barthel, and S. Macnaughton, "Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050," *Philosophical Transactions of the Royal Society Biological Sciences* 365, 3065–81 [2010]).
40. Specifically, 24% when measured through calories, 32% when measured by weight (Lipinski et al., "Reducing Food Loss," based on Gustavsson et al., "Global Food Losses"). The Institution of Mechanical Engineers (IME, "Global Food: Waste Not, Want Not," London [2013]) raise this share to half.
41. By food commodity, roots and tubers are the most lost and/or wasted: 63% of production, based on calories. For fruits and vegetables, the lost or wasted share reaches 42%; for cereals, 26%; and for meat, 19% (Lipinski et al., "Reducing Food Loss"; Gustavsson et al., "Global Food Losses").
42. Gustavsson et al., "Global Food Losses."
43. The reported kcal per person per day numbers refer to the total food waste in developed countries, not to the food waste incurred by consumers.
44. This average hides large differences across foodstuffs. For example, 36 calories of input are needed for 1 of beef (IME, "Global Food").
45. See Lipinski et al., "Reducing Food Loss." Other illustrations of inefficiencies include postharvest losses, which have been estimated to be up to US$4 billion per year in Sub-Saharan Africa. In China, consumers' food waste is worth US$32 billion a year, not far from the reported US$48 billion in the United States (W. Zhou, "Food Waste and Recycling in China: A Growing Trend?" http://blogs.worldwatch.org/nourishingtheplanet/food-waste-and-recycling-in-china-a-growing-trend/). One hundred seventy-three billion cubic meters of water, 198 million hectares of land, and 28 million tons of fertilizers are used annually to grow food that is lost or wasted, and between 3,300 and 5,600 million metric tons of $CO_2$ equivalent greenhouse gas (GHG) emissions are created (Lipinski et al., "Reducing Food Loss"). These figures represent 10–15% of total GHG emissions in 2011 (EPA, *Overview of Greenhouse Gases*, 2014, http://www.epa.gov/climatechange/ghgemissions/gases.html); 24% of all water used in agriculture worldwide; and the area of Mexico, respectively, as reported by Lipinski et al. ("Reducing Food Loss").
46. These figures refer to present estimates as reported by Lipinski et al., ("Reducing Food Loss") and the Waste & Resources Action Programme (WRAP) and Reducing Household Food Waste in the United Kingdom (http://www.wrap.org.uk/sites/files/wrap/Information%20sheet%20-20reducing%20household%20food%20waste%20in%20the%20UK%202012_0.pdf). Another study by T.

Jones ("The Value of Food Loss in the American Household," Bureau of Applied Research in Anthropology [2004], as cited by Parfitt ["Food Waste"]) talks of US$589 worth of wasted food for a family of four in the United States in the mid-2000s. In the Netherlands, using data from the Ministry of Agriculture, Nature and Food Quality, about US$800 per family of four would be thrown away by households (€2.4 billion per year out a population of 16.854 million in 2010; http://www.scp-knowledge.eu/sites/default/files/knowledge/attachments/LNV%20-%20Factsheet%20drieluik%20A4%20Voedselverspilling%20Eng.pdf).

47. Additional evidence of increasing food waste by socioeconomic group is reported by R. Sibrián, J. Komorowska, and J. Mernies ("Estimating Household and Institutional Food Wastage and Losses in the Context of Measuring Food Deprivation and Food Excess in the Total Population," FAO Statistics Division, Working Paper Series No. ESS/ESSA/001e, Rome [2014]) for the Philippines using 1978 census data, and for a specific city in Ethiopia by A. Aydamo, A. Nair, and M. Zuberi ("Household Solid Waste Generation Rate and Physical Composition Analysis: The Case of Hosa'ina City," SNNPRS, *Journal of Recent Trends on Bioscience* 2 [1], 22–28 [2012]).

48. R. A. Richardson and J. Havlicek, "Economic Analysis of Composition of Household Solid Wastes," *Journal of Environmental Economic Management* 5, 103–11 (1978); N. Bandara, P. Hettiarachchii, S. Wiorasinghe, and S. Pilapitiya, "Relation of Waste Generation and Composition of Socioeconomic Factors: A Case Study," *Environmental Monitoring Assessment* 135, 31–39 (2007); R. Afroz, K. Hanaki, and R. Tuddin, "The Role of Socioeconomic Factors on Household Waste Generation: A Study of Waste Management Program in Dhaka City, Bangladesh," *Research Journal of Applied Sciences* 5 (3), 183–90 (2010). Solid waste includes, in addition to food, paper, plastic, glass, other organic waste, construction and demolition debris, hazardous waste, and other waste materials.

49. Empirical evidence from econometric analyses indicates that income level is positively correlated to food waste, along with household size and demographic composition (see Parfitt ["Food Waste"] and references there).

50. Overproduction is encouraged when large supermarket chains impose penalties to suppliers if they fail to deliver agreed quantities during the year. Also, large field losses occur if physical appearance of the product pre- or postharvest does not satisfy certain high cosmetic standards (IME, "Global Food").

51. Ibid, p. 23.

52. H. de Groote presented "Economic Analysis of Maize Storage Facilities in East and Southern Africa" at the Agriculture and Food Security Post-Harvest Management (PHM) Conference in Sub-Saharan Africa, Addis Ababa, October 29, 2013.

53. Lipinski et al., "Reducing Food Loss."

54. Another solution advocated by some analysts is the transfer of know-how and adaptation of agricultural education, training services, and management systems to less-developed countries (IME, "Global Food").

55. http://www.wrap.org.uk/; http://www.eu-fusions.org/what-is-fusions; http://www.foodwastealliance.org/. For other examples, see Food Tank, "21 Inspiring Initiatives Working to Reduce Food Waste around the World," June 3, 2013, http://foodtank.com/news/2013/06/twenty-one-inspiring-initiatives-working-to-reduce-food-waste-around-the-wo.

56. Lipinski et al., "Reducing Food Loss."