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Food Loss and Waste in the US: The Science Behind the Supply Chain

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Accompanying video "Love Letter to Food" hosted on YouTube

Summary of Findings:

- Roughly 40% of the United States (US) food supply (1500 calories/person/day) is never eaten, which is among the highest rates of food loss[i] globally. Addressing this loss could help reduce food insecurity and the environmental impacts of agriculture.
- Tremendous resources are used to produce uneaten food in the US: 30% of fertilizer, 31% of cropland, 25% of total freshwater consumption, and 2% of total energy consumption.
- Food waste generated when people discard food in homes and foodservice accounts for 60% of food loss, is mostly avoidable, and is under-emphasized as an opportunity to improve the food system.
- Targeting efforts on reducing waste of meat has great potential to benefit both the environment and the household budget.
- Clarifying the meaning of date labels on foods could also reduce consumer food waste.

Background

Roughly 40% of the United States (US) food supply is never eaten.[4] At 1500 food calories lost per person per day, that is twice as much as most other industrialized nations[5] and 50% more than was lost in the 1970s.[4] Producing food uses resources and causes environmental impacts, such as water pollution,[6] soil erosion,[7] and greenhouse gas emissions.[8] Discarding food drains the food supply in a world with a growing demand.[9] Despite the global importance of food loss, much remains unknown about its extent, characteristics, and causes. For instance, a landmark global study reports collectively for the US, Canada, Australia, and New Zealand: 17% of food loss occurs during harvest, 6% in handling and storage, 9% in processing, 7% in retail and distribution, and 61% in the consumption stage.[5] The most comprehensive US study reports only retail and consumption losses (Table 1) and treats restaurants and households as the same entity.[9] Food loss in the distribution, retail and consumption stages is called food waste[i] and presents a major opportunity to improve the efficiency of the food system.

Table 1. Annual rates and values (per capita) of combined retail and consumer food loss[9]

Added sweeteners	41%	$21
Added fats and oils	38%	$43
Dairy	31%	$87
Grains	31%	$36
Vegetables	30%	$97
Fruit	29%	$64
Eggs	28%	$10
Meat, poultry, and fish	26%	$157
Tree nuts and peanuts	15%	$7

Producing uneaten food requires a major investment of resources: 30% of fertilizer use, 31% of cropland,[10] 25% of total freshwater consumption,[4] and 2% of total energy consumption.[11] This food loss is the largest component of municipal solid waste incinerated or sent to landfills,[12] where it creates methane.[8] Meat has among the lowest rates of loss (Table 1),[1, 9] but on a per pound basis, meat loss squanders the most calories[13] and causes the greatest environmental impact,[2] as feed and other resources used over the

[i] Definitions of food loss and waste vary. *Food loss* tends to refer to a decrease in mass or nutritional quality of food originally intended for human consumption,[1, 2] and includes *food waste*, the food fit for human consumption that is discarded or spoils in retail, foodservice, and consumption.[2, 3]

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lifetime of the animals increase the magnitude of the loss. Loss of meat also has the highest monetary value (Table 1).[9]

Reducing food loss would likely reduce food prices,[9] and presents opportunities to directly alleviate food insecurity through redistribution. If 30% of US food loss were redistributed, it could provide the total diet for nearly 50 million people,[14] the number of Americans living in food insecure households.[15] However, even though a majority of food loss is avoidable,[10] current distribution streams and income factors mean only some food could be recovered and reach food insecure populations.

Causes of Food Loss and Waste

Food loss occurs because food is perishable; it passes through complex supply chains between harvest and consumption; and it represents a small portion of total expenditures for many Americans.[9] Thus, the convenience of wasting food often outweighs the cost.

Food loss and waste have many causes, including:

- Overplanting of crops to guarantee supply[9]
- Edible crops left in the field due to diminishing returns on investments in harvesting[9]
- Damage, contamination, or inefficiencies in harvest, storage, processing, and distribution[9]
- High cosmetic standards leading to culling of visually imperfect products[9, 14]
- Overstocked product displays at stores[14]
- Inconsistent date labels that confuse consumers, leading to premature disposal [3, 14, 16, 17]
- Over-preparation, large portion sizes, and aversion to eating leftovers[14]
- Lack of awareness about the occurrence and impacts of food waste[14]

Initiatives to Reduce Food Loss and Waste

In June 2013 the United States Department of Agriculture (USDA) and Environmental Protection Agency (EPA) launched the US Food Waste Challenge, a joint effort of producer groups, processors, distributors, retailers, food service, and government with the goal of leading "a fundamental shift in how we think about and manage food and food waste in this country."[18] The EPA also runs a Food Recovery Challenge to help businesses and organizations measure and reduce their food loss. Organizations working to reduce food waste include the food industry's Food Waste Reduction Alliance, hunger alleviation groups, and environmental non-governmental organizations (NGOs) like World Resources Institute, which is leading an effort to develop a global standard for measuring food loss and waste. This work should be complemented with further US-focused research, as much remains unknown about US food loss, especially regarding the relative importance of the causes of food waste.

Recommended Actions

- Standardize and clarify date labels on foods to help reduce consumer food waste.[16]
- Target efforts on reducing waste of meat, which would benefit the environment[2] and household budgets.[9]
- Institute a national research program to identify the quantity and causes of food loss and waste as a step towards committing to reduction targets.[5, 14]
- Create public awareness campaigns devoted to reducing consumer food waste. A United Kingdom campaign helped reduce household food waste by 19% from 2007 to 2012.[19]

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References

1. FAO. 2011. Global food losses and food waste – extent, causes and prevention. Rome: United Nations Food and Agriculture Organization.
2. FAO. 2013. Food wastage footprint: Impacts on natural resources. Summary Report.
3. Parfitt, J., Barthel, M., & Macnaughton, S. 2010. Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences* 365(1554): 3065-3081.
4. Hall, K. D., Guo, J., Dore, M., & Chow, C. C. 2009. The progressive increase of food waste in America and its environmental impact. *PLoS One* 4(11): e7940.
5. Lipinski, B. et al. 2013. "Reducing Food Loss and Waste." Working Paper, Installment 2 of Creating a Sustainable Food Future. Washington, DC: World Resources Institute.
6. Ribaudo, M., et al. September 2011. Nitrogen in Agricultural Systems: Implications for Conservation Policy, ERR-127. US Department of Agriculture, Economic Research Service. (USDA-ERS)
7. Montgomery, D. R. 2007. Soil erosion and agricultural sustainability. *Proceedings of the National Academy of Sciences* 104(33): 13268-13272.
8. EPA. April 2013. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011.
9. Buzby, J.C., Wells, H.F. & Hyman, J. February 2014. The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States, EIB-121. USDA-ERS.
10. Kummu, M. et al. 2012. Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Science of the Total Environment* 438: 477-489.
11. Cuéllar, A. D., & Webber, M. E. 2010. Wasted food, wasted energy: the embedded energy in food waste in the United States. *Environmental Science & Technology* 44(16): 6464-6469.
12. EPA. 2011. Municipal Solid Waste in the United States: 2011 Facts and Figures.
13. Cassidy, E., West, P.C., Gerber, J.S., & Foley, J.A. 2013. Redefining Agricultural Yields: From Tonnes to People Nourished per Hectare. *Environmental Research Letters* 8: 034015.
14. Gunders, D. 2012. Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill. Natural Resources Defense Council Issue Paper.
15. Coleman-Jensen, A., Nord, M., Andrews, M., & Carlson, S. 2011. Household food security in the United States in 2010, ERR-125. USDA-ERS.
16. Broad Leib, E.M., Gunders, D., Ferro, J., Nielsen, A., Nosek, G. & Qu, J. September 2013. The Dating Game: How Confusing Date Labels Lead to Food Waste in America. Natural Resources Defense Council Report.
17. WRAP. 2011. Consumer Insight: Date Labels and Storage Guidance. Waste & Resources Action Programme.
18. USDA. 2013. U.S. Food Waste Challenge. Office of the Chief Economist. Accessed 10 December 2013: http://www.usda.gov/oce/foodwaste/
19. WRAP. November 2013. Executive Summary: Household Food and Drink Waste in the United Kingdom 2012.

1. Huijsdens X.W., Bosch T., van Santen-Verheuvel M.G., Spalburg E., Pluister G.N., van Luit M., Heck M.E., Haenen A., de Neeling A.J. (2009, September 24). Molecular characterisation of PFGE non-typable methicillin-resistant *Staphylococcus aureus* in The Netherlands, 2007. *Euro Surveillance*, 14:19335.
2. Wulf M.W., Verduin C.M., van Nes A., Huijsdens X., Voss A. (2012, January). Infection and colonization with methicillin resistant *Staphylococcus aureus* ST398 versus other MRSA in an area with a high density of pig farms. *European Journal of Clinical Microbiology & Infectious Diseases*, 31(1):61-5.
3. van Cleef B.A., van Benthem B.H., Haenen A.P., Bosch T., Monen J., Kluytmans J.A. (2013, August 29). Low incidence of livestock-associated methicillin-resistant *Staphylococcus aureus* bacteraemia in The Netherlands in 2009. *PLoS ONE*, 8(8):e73096.
4. Lozano C., Aspiroz C., Ezpeleta A.I., Gómez-Sanz E., Zarazaga M., Torres C. (2011). Empyema caused by MRSA ST398 with atypical resistance profile, Spain. *Emerging Infectious Diseases*, 17: 138-140
5. Klevens R.M., Morrison M.A., Nadle J., Petit S., Gershman K., Ray S., Harrison L.H., Lynfield R., Dumyati G., Townes J.M., Craig A.S., Zell E.R., Fosheim G.E., McDougal L.K., Carey R.B., Fridkin S.K. (2007). Invasive methicillin-resistant *Staphylococcus aureus* infections in the United States. *JAMA*, 298(15):1763-1771.

The Food Policy Research Center, University of Minnesota, is supported by the National Institute on Food and Agriculture, USDA.

6. Golding G.R., Bryden L., Levett P.N., McDonald R.R., Wong A., Wylie J., Graham M.R., Tyler S., Van Domselaar G., Simor A.E., Gravel D., Mulvey M.R. (2010). Livestock-associated methicillin-resistant *Staphylococcus aureus* sequence type 398 in humans, Canada. *Emerging Infectious Diseases*, 16(4):587-594.
7. Schijffelen M.J., Boel C.H., van Strijp J.A., Fluit A.C. (2010). Whole genome analysis of a livestock-associated methicillin-resistant *Staphylococcus aureus* ST398 isolate from a case of human endocarditis. *BMC Genomics*, 11:376.
8. Hallin M., De Mendonça R., Denis O., Lefort A., El Garch F., Butaye P., Hermans K., Struelens M.J. (2011). Diversity of accessory genome of human and livestock-associated ST398 methicillin resistant *Staphylococcus aureus* strains. *Infection, Genetics and Evolution*, 11: 290-299.
9. McCarthy A.J., van Wamel W., Vandendriessche S., Larsen J., Denis O., Garcia-Graells C., Uhlemann A.C., Lowy F.D., Skov R., Lindsay J.A. (2012). *Staphylococcus aureus* CC398 clade associated with human-to-human transmission. *Applied Environmental Microbiology*, 78(24):8845-8848.
10. Uhlemann A.C., Porcella S.F., Trivedi S., Sullivan S.B., Hafer C., Kennedy A.D., Barbian K.D., McCarthy A.J., Street C., Hirschberg D.L., Lipkin W.I., Lindsay J.A., DeLeo F.R., Lowy F.D. (2012, February 28). Identification of a highly transmissible animal-independent *Staphylococcus aureus* ST398 clone with distinct genomic and cell adhesion properties. *MBio*.2012;3(2):10.1128/mBio.00027-12.
11. Cavaco L.M., Hasman H., Aarestrup F.M. (2011). Zinc resistance of *Staphylococcus aureus* of animal origin is strongly associated with methicillin resistance. *Veterinary Microbiology*, 150(3-4):344-8
12. Davies P.R., Sun J., Linhares L., Sreevatsan S., Yang M. (2013, November). MSSA spa types in US pigs and swine veterinarians correspond with MRSA spa types reported globally in swine. Proceedings, 3rd ASM-ESCMID Conference on Methicillin-resistant Staphylococci in Animals: Veterinary and Public Health Implications, Copenhagen, Denmark, November 4-7, 2013, 47A.
13. van Meurs M.L., Schellekens J.J., de Neeling A.J., Duim B., Schneeberger P.M., Hermans M.H. (2013, April). Real-time PCR to distinguish livestock-associated (ST398) from non-livestock-associated (methicillin-resistant) *Staphylococcus aureus*. *Infection*, 41(2):339-46. doi:10.1007/s15010-012-0319-5.
14. Porphyre T., Giotis E.S., Lloyd D.H., Stärk K.D. (2012). A metapopulation model to assess the capacity of spread of meticillin-resistant *Staphylococcus aureus* ST398 in humans. *PLoS ONE*, 7(10):e47504. doi: 10.1371/journal.pone.0047504.

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