

K.L.T. be .DJ.

Table 1
Food waste definitions.

Author	Year	Definition
Kling	1943	Food waste is the destruction or deterioration of food or the use of crops, livestock and livestock products in ways which return relatively little human food value.
Food and Agriculture Organization (FAO)	1981	Food waste is all food products allocated for human consumption that are instead discarded, lost, degraded, or consumed by pests at any stage of the food chain.
FAO	2013	Food waste is food appropriate for human consumption that is discarded (generally at retail and consumption stages).
European Commission	2014	Food waste is food (including inedible parts) lost from the food supply chain, not including food diverted to material uses such as bio-based products, animal feed, or sent for redistribution.
United States Environmental Protection Agency (USEPA)	2014	Food waste is uneaten food and food preparation wastes from residences, commercial, and institutional establishments. So, food wastes from homes, grocery stores, restaurants, bars, factory lunchrooms, and company cafeterias are included. Pre-consumer food waste generated during food manufacturing and packaging are excluded.
United States Department of Agriculture (USDA) (Buzby et al., 2014)	2014	Food waste is a subset of food loss and occurs when an edible item goes unconsumed. Only food that is still edible at the time of disposal is considered waste.
World Resources Institute (WRI)	2015	Food loss and waste refers to food, as well as associated inedible parts, removed from the food supply chain.

Table 2
Food waste and loss definitions used in this study.

Term	Definition	Drivers	Sectors included	Examples
Food loss	Decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption	<ul style="list-style-type: none"> - Infrastructure limitations - Climate and environmental factors - Quality, esthetic, or safety standards 	Production, post-harvest, and processing	<ul style="list-style-type: none"> - Edible crops left in the field - Food that spoils due to poor transportation infrastructure from factory to supermarket - Food that is contaminated during food processing
Food waste	Food which was originally produced for human consumption but then was discarded or was not consumed by humans. Includes food that spoiled prior to disposal and food that was still edible when thrown away	<ul style="list-style-type: none"> - Decisions made by consumers and businesses - Quality, esthetic, or safety standards 	Retail and consumer	<ul style="list-style-type: none"> - Plate waste - Food that spoils due to poor storage in home or restaurant - Restaurant food prepared but discarded due to lack of demand

understanding how perceptions of food waste have evolved over time and why certain food wasting behaviors occur today.

2.3. Food waste definitions

Quantification of the magnitude of food waste is essential for the development of effective, well-planned food waste management policies, and can be used to determine if future food waste recovery and prevention efforts considerably change the residual waste stream (Thyberg et al., 2015). Understanding

Table 3
U.S. food waste history timeline.

Period	Food waste activity
Pre-industrial(1750–1850)	- Food waste accounted for the majority of household solid waste

Table 4
Recent estimates of food loss and waste.

Reference	Estimate ^a	Location	Method	Food loss ^b	Food waste ^b
Pekcan et al. (2006)	816.4 g/household/day	Turkey	FAO food supply data, household expenditures and survey		✓ ^c
Lundqvist et al. (2008)	Up to 50% of total production	Global	Food supply and loss data from Smil 2000	✓	✓
WRAP (2009)	8.3 million tonnes/year (22% of purchases)	U.K.	Food diary, composition analysis, and local data		✓ ^c
Hall et al. (2009)	40% of total food supply (1400 calories/person/day)	U.S.	FAO food supply data and human energy expenditure model	✓	✓
DEFRA (2010)	5% of edible food and drink purchases (3% of edible calories)	England	Food purchasing data and WRAP 2009 waste estimates		✓ ^c
Australian Government (2010)	6 million tonnes/year (2.67 million tonnes from households and 1.39 million tonnes from commercial/industrial sources)	Australia	State and local waste data	✓	✓
Buzby et al. (2011)	25% of available food supply	U.S.	USDA food supply data and loss factors		✓ ^d
Gustavsson et al. (2011)	33% of total food production	Global	FAO food supply data and loss factors developed by the authors	✓	✓
Koivupuro et al. (2012)	23 kg/person/year	Finland	Food diary		✓
Kummu et al. (2012)	25% of total food production (6 kg/person/day)	Global	FAO food supply data and loss factors from Gustavsson et al. (2011)	✓	✓
WRAP (2013)	4.2 million tonnes/year	U.K.	Food diary, composition analysis, and local data		✓ ^c
Beretta et al. (2013)	48% of total calories	Switzerland	Mass and energy flow model	✓	✓
USEPA (2014)	34.9 million tonnes/year	U.S.	Materials flow model		✓ ^e
Oelofse and Nel (2013)	9.0 million tonnes/year (17 kg/person/year)	South Africa	FAO food supply data and loss factors from Gustavsson et al. (2011)	✓	✓
Buzby et al. (2014)	31% of available food supply (133 billion pounds)	U.S.	USDA food supply data and loss factors		✓ ^d
FUSIONS (2014)	10 million tonnes/year	European Union	National waste statistics and selected research study findings	✓	✓
WasteMinz (2015)	14 kg/household/year	New Zealand	Waste audits		✓ ^e
Reynolds et al. (2015a)	7.3 million tonnes/year (4.1 million tonnes from municipal sources and household and 3.2 million tonnes from industry)	Australia	Estimation approach using data from government and industry reports	✓ ^f	✓ ^f
Thyberg et al. (2015b)	0.6 kg/person/day (35.5 million tonnes/year)	U.S.	Waste characterization studies		✓ ^g

^a Estimates as reported in each study. Exact definitions of food loss and waste used may differ from the definitions used here. Some of these differences are noted.

^b Food loss and waste as defined in

Table 5
Economic costs of food waste and loss.

Country	Year	Estimate ^a	Sectors included	Reference
New Zealand	2015	\$589 million/year	Avoidable household waste	WasteMinz (2015)
Australia	2015	\$5.8 billion/year	All sectors	Food Wise (2015)
Global	2013	\$750 billion/year	All sectors (seafood excluded)	FAO (2013)
U.K.	2012	\$18.3 billion/year, \$689/household/year	Household	WRAP (2013)
U.S.	2011	\$197.7 billion/year, \$643.3/person/year	Avoidable distribution, retail and consumer waste	Venkat (2011)
U.S.	2010	\$161.6 billion/year, 1249 calories/person/day	Avoidable retail and consumer food waste	Buzby et al. (2014)
Canada	2010	\$21.1 billion/year	All sectors	Gooch et al. (2010)
U.S.	2008	\$165.6 billion/year, \$390/person/year	Avoidable retail and consumer food waste	Buzby and Hyman (2012)

^a Estimates given in currencies other than U.S. dollars were converted to U.S. dollars.

Reducing food waste will improve future food availability in the context of global population growth and increasing resource scarcity ([Buzby et al., 2014](#); [Godfray et al., 2010](#); [Pearson et al., 2013](#)). The United Nations estimate that the world population will reach 9.3 billion by 2050 ([United Nations, 2013](#)) and this growth will require an increase in food production by about 70 percent ([FAO, 2009](#)). To produce enough food to sustain this high population, pressure will be increased on agricultural land and other limited resources. It is necessary to develop ways to provide more food with fewer inputs so that the world's food

Table 6
Modernization's effects on food systems.

Factor

Description

products (Pingali and Khwaja, 2004; Sobal, 1999). Food now travels long distances (Pretty et al., 2005), and to more supermarkets in place of small, local markets, and so consumers purchase more non-local foods. Changes in diets spurred by globalization affect the type of food that is disposed; people also may be more likely to waste food as they do not have a deep connection and understanding of it.

4.2. Cultural factors

Culture plays a fundamental role in shaping food, eating, and nutrition (Rozin, 2005; Sobal, 1998), as well as waste generation. The amount of food a society wastes is dependent on cultural habits and attitudes. People from different cultures regard different foods and food parts as edible, and throw different parts away (Strasser, 1999). Pollan (2007) points out that some cultures, particularly the U.S. and Australia, have weak food traditions of their own, meaning there

food that is improperly labeled

Table 7
Mechanisms to prevent food waste based on waste generating behaviors and attitudes.

Factor	Description	Mechanisms to prevent waste
Over preparation/large portion sizes/undesired food	Excess food that is prepared but that is not consumed (includes plate waste)	1.

Table 8
Potential food waste prevention policies.

Prevention policy	Description	Category
Education to promote the importance of food waste prevention in terms of environmental, social, and economic impacts	Education campaigns addressing the issue of food waste, quantities generated, and why it is important to prevent food waste. These programs can focus on moral issues of wasting food and the potential to save money by preventing food waste. The campaigns may be done through various media outlets, including mailings, face-to-face	tr37610eF11Tf6.376.37Tf6.3761006I3/GS

6.3. *Securities, evidence, and access*

There are regulatory, social, and political obstacles to

- input–output approach with Australian case study. *J. Mater. Cycles Waste Manag.*, 1–10.
- Reynolds, C.J., Piantadosi, J., Boland, J., 2015b. Rescuing food from the organics waste stream to feed the food insecure: an economic and environmental assessment of Australian food rescue operations using environmentally extended waste input–output analysis. *Sustainability* 7 (4), 4707–4726.
- Rispo, A., Williams, I.D., Shaw, P.J., 2015. Source segregation and food waste prevention activities in high-density households in a deprived urban area. *Waste Manag.* 44, 15–27.
- Robertson, R., 1990. Mapping the global condition: globalization as a central concept. *Theory Culture Soc.* 7 (2/3), 15–30.
- Rozin, P., 2005. The meaning of food in our lives: a cross-cultural perspective on eating and well-being. *J. Nutr. Educ. Behav.* 37 (2), S107–S112.
- Salhofer, S., Obersteiner, G., Schneider, F., Lebersorger, S., 2008. Potentials for the prevention of municipal solid waste. *Waste Manag.* 28 (2), 245–259.
- Schneider, F., 2013a. Review of food waste prevention on an international level. *Waste Resour. Manag.* 166 (4), 187–203.
- Schneider, F., 2013b. The evolution of food donation with respect to waste prevention. *Waste Manag.* 33 (3), 755–763.
- Schott, A.B.S., Vukicevic, S., Bohn, I., Andersson, T., 2013. Potentials for food waste minimization and effects on potential biogas production through anaerobic digestion. *Waste Manag. Res.* 31 (8), 811–819.
- Schott, A.B.S., Canovas, A., 2015. Current practice, challenges and potential methodological improvements in environmental evaluations of food waste prevention – a discussion paper.