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Addressing the Food Loss and Waste Challenge – a WRAP perspective

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Introduction

Unsustainable production and consumption of food constitutes one of the biggest environmental threats to our planet. Eliminating food loss and waste to the largest extent possible – at all stages from producer to final consumer – stands out as an urgent and indispensable step towards more sustainable food systems. In fact, recent research shows that tackling food waste is the third most effective intervention to reduce greenhouse gas emissions, the most important priority of our time (Hawken 2017).

The United Nations Sustainable Development Goal (SDG) 12.3 sets out a specific target on food waste to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses, by 2030. In order to measure global progress towards SDG 12.3, two indices have been proposed: the Food Waste Index (Global Innovation Exchange 2018) and the Food Loss Index (Fabi and English 2018).

Successfully achieving SDG 12.3 requires new thinking, new partnerships and new actions to reduce resource use, and increase the efficiency of the production, preservation, processing and distribution of food at the producer, intermediary, processor and wholesale level. It needs wider education, increased awareness, and behavioural change among citizens, retailers, and policy makers across the globe. The goal is to produce more food to feed the world's expanding population, while reducing land use, fertilizer applications and critically dramatically reducing greenhouse gas emissions (Flanagan et al. 2019).

To help deliver this critical target, Champions 12.3 has been formed (Champions 12.3 2016). It is a unique coalition of executives from governments, businesses, international organizations, research institutions, and civil society dedicated to inspiring ambition, mobilizing action, and accelerating progress toward achieving SDG Target 12.3. It has produced a trajectory for delivering 12.3, what needs to happen and by when that provides the critical “roadmap for change” (Champions 12.3 2017a).

In this paper we provide the perspective of WRAP (the Waste and Resources Action Programme) on the economic, social and environmental case for action, what research shows works in driving change and how these activities might be scaled to deliver SDG 12.3. WRAP is a not for profit organization, based in the UK and working in more than 20 countries worldwide, that aims to help people and planet thrive. WRAP is a leader in tackling food loss and waste effectively and supporting international food loss and waste prevention projects – including Champions 12.3. Since 2007, WRAP has been a partner in many global food loss and waste projects and initiatives and has co-authored key reports. This includes EU projects such as FUSIONS (2016) and REFRESH (2020a), as well as the development of the Food Loss and Waste Accounting and Reporting Standard (World Resources Institute 2016).

In the UK, WRAP, food businesses and other partners have delivered large-scale interventions to reduce food waste across supply chains, and households for more than ten years (since 2007), supported by UK Governments and by businesses and enabled by a series of collaborative public-private partnerships. WRAP's work in the UK with its partners has helped reduce food by 27% or 1.7 Mt/y saving food worth £5 billion/ year. Cumulatively the total food waste reduction has been 18.5 Mt worth US\$50 billion (WRAP 2020a).

This paper highlights the importance of tackling food loss and waste, using specific recent examples from the UK and Mexico. Second, we discuss the business case for addressing food loss and waste. Thirdly we highlighting two approaches that research shows can be particularly effective at driving change at scale, and we conclude by proposing a three-point plan for tackling food waste to deliver SDG 12.3 over the next 10 years.

The importance of tackling food loss and waste

Food loss and waste is a global issue, with approximately one third of all food produced for human consumption lost or wasted, a staggering 1.3 billion tonnes (Gustavsson et al. 2011). Food waste contributes to climate change and represents a waste of scarce resources such as land, energy and water. Indeed, the 2019 IPCC report on Climate Change and Land has now estimated that global emissions associated with food loss and

waste are at 8-10% of total anthropogenic emissions in CO₂e (IPCC 2019). Furthermore, food waste in Europe accounts for 15 to 16% of Europe's total emissions from the entire food supply chain (Scherhauser et al. 2018). The EU 2030 climate and energy framework commits to at least 40% cuts in greenhouse gas emissions (from 1990 levels). Therefore, reduction and prevention of food waste represents a significant step necessary for the EU and the wider international community to meet current emissions reduction commitments.

The value of lost and wasted food is huge, at \$940 billion, nearly double the turnover of Walmart, the world's biggest retailer (Walmart 2019; FAO 2020). In the EU alone the cost of food waste is estimated to be around EUR 143 billion (Stenmark et al. 2016). This includes costs to producers, who leave produce un-harvested; processors, who discard edible products that do not adhere to market size and aesthetic standards; retailers, who lose products due to spoilage during transport, and throw away unsold products; and households, who waste edible food for a variety of reasons including spoilage, lack of knowledge, over-purchase, and confusion about best-before/consume-by dates (Quested et al. 2013). In addition to the monetary cost of the food wasted, there are also additional financial costs for collecting, managing and treating food waste.

Food waste highlights the inequity of our food system. While 88 million tonnes of food are wasted yearly in the EU, in 2017, 112 million people in the EU were living in households at risk of poverty or social exclusion (22% of the population), with 5.8 million people (7.4% of the population) living in severely materially-deprived circumstances, meaning they have limited access to suitable food and healthy diets (Eurostat 2019). This is repeated at the global scale with 820 million people in the world hungry today (1 in every 9 people), while over 2 billion are now obese – linked to unhealthy diets, and overconsumption of food (Ng et al. 2014). By 2050 it is estimated that there will be an additional 2 billion extra mouths to feed (FAO 2009). Reductions of food loss and waste combined with gleaning, food rescue, and redistribution activities can be used as part of a whole systems approach to address the huge problem of hunger and food insecurity (Watkins and Simister 2017).

Finally, food waste is also a major indirect cause of biodiversity loss (FAO 2013; Feldstein 2017). This is due to uneaten, wasted food compounding unsustainable agriculture practices and agricultural expansion into wild areas (e.g., deforestation), as well as unsustainable fishing, and aquaculture. Likewise, a quarter of all agricultural water – over 17 percent of total water withdrawals – is used in the production of wasted food (Anyabwile and Walker 2019). Given many countries are becoming more drought prone, in part as a result of climate change, this waste of water could have profound local impacts on human communities (Holden et al. 2015).

Food waste in the UK

WRAP has reported UK food loss and waste statistics for over a decade. WRAP first published estimates of UK household food and drink waste in 2008 (WRAP 2008). WRAP then published two of the most detailed studies on household food and drink waste (WRAP 2014b; WRAP 2014a) that have been completed around the world, as well as one of the most detailed quantifications of hospitality and food service waste (WRAP 2013a). These reports have become global examples of best practice food loss and waste evidence and reporting.

In 2018 the UK wasted around 9.5 Mt of food (post-farm gate), enough to fill St Peter's Square in Rome to the height of the great church's dome. Around 6.4 Mt (almost 70% of the total) was edible and could have been eaten (WRAP 2020a). WRAP also estimates that food surplus & waste in primary production is approximately an additional 3.6 million tonnes a year, or 7.2% of all food harvested (WRAP 2020a). This volume of post-farm gate food waste represents over 25% of total food purchased in the UK, worth US\$25bn, nearly 1% of total GDP. As with other wealthy countries, waste in our homes is the single biggest source of food waste across the supply chain. Household food waste makes up 70% of the total UK food waste post-farm gate, at 6.6 Mt. Over two-thirds of this (68%; 4.5 Mt) was food intended to be eaten, with a value of almost £14 billion in 2018 (WRAP 2020a). This represents a cost of £700 per year for an average family with children. The total GHG emissions associated with wasted food and drink in the UK account for approximately 25 Mt CO₂e. Additional information on these figures can be found in Table 1. The total cumulative value of the food no longer wasted in the UK is estimated at around £38 billion.

Household food insecurity is also an issue in the UK, with 10% of adults living in households classified as marginally food insecure, and 10% reported living in households with moderate or severe food insecurity (2020b). WRAP has supported food rescue and redistribution operations in the retail, manufacturing and the hospitality & food service sectors to alleviate food insecurity (2019). As result of a combined effort of businesses and charities, the amount of food redistributed doubled (96% increase) between 2015 and 2018. The value of the food redistributed was £166 million (2018). This was enough food to make the equivalent of 133 million meals. In 2019 WRAP opened a £4m Food Waste Fund to further substantially cut food waste and encourage more redistribution efforts.

Table 1. Summary of UK food waste arisings (kt, per capita – excluding inedible parts – and £bn) for SDG 12.3 and Courtauld 2025 baseline years and 2018, and changes over time.

a) Summary of UK food waste arisings (kt) for SDG12.3 and Courtauld 2025 baseline years and 2018, and changes over time

SDG 12.3 baseline (kt)

2015

(kt)

2018

(kt)

Change vs 2015 (kt)

Change vs 2015 (%)

Change vs SDG baseline (kt)

Change vs SDG baseline (%)

Household

8,085

7,050

6,646

-405

-5.7%

-1,440

-17.8%

Supply chain

3,110

2,951

2,880

-71

-2.4%

-230

-7.4%

Retail

290

261

277

16

6.0%

-13

-4.6%

Manufacture

1,900

1,668
 1,505
 -163
 -9.8%
 -395
 -20.8%
 HaFS*
 920
 1,022
 1,098
 76
 7.5%
 178
 19.3%
Total
 11,195
 10,001
 9,525
 -476
 -4.8%
 -1,670
 -14.9%

b) Summary of UK food waste arisings (per capita – excluding inedible parts) for SDG 12.3 and Courtauld 2025 baseline years and 2018, and changes over time

SDG 12.3 baseline (kg/yr)

2015

(kg/yr)

2018

(kg/yr)

Change vs 2015 (kg)

Change vs 2015 (%)

Change vs SDG baseline (kg)

Change vs SDG baseline (%)

Household

100.0

76.7

68.5

-8.3

-10.8%

-31.5

-31.5%

Supply chain

32.3

29.4

28.0

-1.4

-4.9%

-4.3

-13.4%

Retail

4.7

4.0

4.2

0.2

3.9%

-0.5

-10.6%

Manufacture

16.9

13.8

11.6

-2.2

-15.9%

-5.3

-31.4%

HaFS*

10.7

11.6

12.2

0.6

5.3%

1.5

13.7 %

Total

132.3

106.1

96.4

-9.7

-9.1%

-35.9

-27.1%

c) Value of UK wasted food (post-farm gate) (£bn; all expressed in 2018 prices)

SDG 12.3 baseline (£bn)

2015

(£bn)

2018

(£bn)

Change vs 2015 (£bn)

Change vs SDG baseline (£bn)

Household

18.58

15.16

13.80

-1.35

-4.78

Supply chain

5.15

5.10

5.19

0.08

0.03

Retail

0.92

0.82

0.87

0.05

-0.04

Manufacture

1.58

1.32

1.14

-0.19

-0.44

HaFS*

2.66

2.96

3.18

0.22

0.51

Total

23.74

20.26

18.99

-1.27

-4.75

*It is important to stress that this is a modelled result for the HaFS sector, based on changes in the number and types of hospitality and food service sites, and the assumption that food waste per site has remained constant since 2011. Currently there is not a data source to enable a UK-level estimate for food waste from this sector to be robustly estimated even though we know that many sites have taken action, see www.guardiansofgrub.com

Food waste in Mexico

In 2019 the World Bank and WRAP, on behalf of the government of Mexico, prepared a Conceptual Framework that compiled the data on food loss and waste in Mexico for the first time, painting a compelling picture of the current situation and creating a framework for action (World Bank Group 2019). It was found that around 20 Mt of food was lost or wasted every year from farm gate to retail in Mexico. In addition, there is an estimated 11 Mt of food waste generated by households. Together, this represents over 35% of total food produced in Mexico, and would be worth \$25bn, (~2% of GDP). This food loss and waste is occurring at the same time as 24 million people are food insecure and nine million live in extreme poverty in Mexico.

The contrast between the UK figures is instructive, as the bulk of the food loss and waste is in the supply chain rather than the home. Compared to the UK, financially the scale of the opportunity is a significantly larger share of GDP, as is the scale of the opportunity to help tackle food insecurity. By taking these 2 examples, it suggests that all countries could benefit massively from prioritizing action on food loss and waste, although the main sources of food loss and waste are likely to be more country specific.

WRAP is now working with partners in Mexico to tackle this, with one important focus being on recovering surplus produce to sell or donate to those in need. The steps identified in the World Bank Group Report (2019) can be used as foundational elements to develop a national strategy for Mexico.

Understanding the true cost of food loss and waste

The cost of food waste is often understood by many in industry or households to be related to only the “visible” costs of collection, recycling or disposal of food loss and waste (WRAP 2013a). However, there are other “invisible” expenditure and costs that need to be considered, including purchase of ingredients, labour, processing equipment cost, energy, and water which account for nearly 90% of the total cost of food waste (FAO 2014). In the UK the visible cost of waste management is between £80 to £100 per tonne, depending on industry sector (WRAP 2013a), plus additional costs for landfill taxes and gate fees of £88 to £168 (WRAP 2018). However, WRAP has estimated the total cost of food loss and waste is between £1,600 and £4,000 depending on industry sector and the point in the supply chain it is wasted (WRAP 2013a).

Understanding the true cost of food loss and waste enables us to quantify the immense benefits that food loss and waste reduction action can achieve. For example, WRAP has recently estimated that around 150,000 tonnes of household food waste were avoided in 2015 compared to 2007, as a result of technical changes to products (changes to packaging, labelling, pack size, etc). It is estimated that these technical changes have saved UK families around £400 million a year and that an additional 350,000 tonnes of avoidable household food waste (worth an additional £1 billion annually), could be prevented through further changes to key food items in the UK’s shopping aisles (WRAP 2017; WRAP 2019a). These technical changes can be low cost, and due to the immense total cost of food loss and waste can result in large savings.

Further evidence of the capacity for food loss and waste interventions to be cost effective comes from the Champions 12.3 network, who have published multiple sector specific “Business Cases for Reducing Food Loss and Waste” (Champions 12.3 2017b; Champions 12.3 2017c; Champions 12.3 2018). These show that

nearly every site that invested in food loss and waste reduction achieved a positive return, with half seeing a 14-fold or greater return on investment.

Methods to reduce food loss and waste

Over the last decade the global community has united to address the issue of food loss and waste. Collectively, we now know more about what is effective and what works. There are multiple types of intervention possible to reduce food loss and waste (Reynolds et al. 2019), and two approaches seem to be particularly effective and can work at scale, specifically:

- Public-Private partnerships (also known as voluntary agreements),
- Citizen Behaviour change campaigns.

Both actions have a wide evidence base of working in OECD countries, and working on shorter time scales to rapidly reduce food loss and waste across the entire food system. However, both actions need to be further adapted and tested in a wider array of countries, with a variety of demographics, cultures, and contexts beyond the current OECD examples.

Public-Private Partnerships

Public-Private Partnerships (PPPs, also known as voluntary agreements), in the context of food loss and waste, are schemes in which public and private sector organisations make commitments to improve their environmental performance, without the need for legislation or additional regulations. They cover arrangements such as public voluntary programmes, negotiated agreements or unilateral commitments (Boulding and Devine 2019).

In recent decades PPPs have often been implemented in an attempt to help tackle a wide variety of environmental issues: GHG emissions, unsustainable clothing, plastic waste and food loss and waste. Across the EU for example, a number of PPP have been set up to tackle food loss and waste, either covering a wide variety of sectors and stakeholders across the food chain or focusing on specific sectors.

A world-leading example of a PPP is Courtauld 2. Following on the success of the Courtauld 1 (2005-2009), Courtauld 2 was a PPP administered by WRAP that ran for three years (2010-2012), with 53 signatories (including most of the UK retailers, and major brands and suppliers) in the UK (WRAP 2020b). The main aims of Courtauld 2 were to reduce primary packaging and household food and drink waste. It also included reductions in 1) secondary and tertiary packaging, and supply chain waste, and 2) reducing the carbon impact of packaging. The influence of Courtauld 2 resulted in a 10% reduction in packaging carbon impact, 3.7% reduction in household food and drink waste, and 7.4% less supply chain waste (this represents a total of 1.7 million tonnes of waste). This impact has a monetary value of £3.1 billion and equates to a reduction of 4.8 million tonnes of CO₂e. Courtauld 2 was run in conjunction with the consumer-facing campaign of Love Food Hate Waste, and part of the effectiveness of Courtauld 2 can be attributed to this joint approach. Overall the VA approach has helped the UK to reduce total edible food waste by 27% per capita up to 2018 (WRAP 2020a).

In considering their set up, PPPs support the notion that collective action can be more cost-effective and provide greater impact than that experienced when organisations tackle issues in isolation. PPPs have the potential to offer efficient, flexible, and effective alternatives to traditional regulatory structures (Steelman and Rivera 2006), whilst improving the image of both the regulator and the regulated by signalling the willingness of both sides to engage in a more flexible process of environmental protection (Koehler 2007). It is this beneficial flexibility which was highlighted in the REFRESH project (WRAP 2019b), which suggested PPPs help collaboration between stakeholders and supply chains and highlight the best practice approaches necessary to deliver change.

As new food waste PPPs are set up across the world it is imperative that the global community addresses the most frequent challenges they face, to ensure desired food loss and waste reduction outcomes are realised by PPPs. Some of the most relevant approaches are:

- Ensuring new PPPs follow core principles and well-described fundamentals for the establishment of successful PPPs – such as the REFRESH blueprint (WRAP 2019b)
- Enlisting government support and ensuring the most appropriate lead organisation is selected
- Ensuring PPPs are adequately resourced to assist signatories in delivering targets and developing new best practice where needed
- Continuously revising the dynamics of the PPPs and understanding the mechanisms necessary to ensure high levels of engagement (subsequently achieving impact),
- Setting ambitious yet realistic goals, and

- Further developing appropriate methods to monitor and evaluate progress.

Citizen Behaviour-change campaigns

In higher income countries the household is where the majority of food waste occurs. Across the EU, over 53% of food waste happens at this level (Stenmark et al. 2016). In the UK, even though attitudes towards food waste have improved, research shows that 70% of people in the UK believe they produce low or small amounts of food waste (WRAP 2020c). This lack of perception of the problem and scale of food loss and waste is replicated across OECD countries.

Citizen Behaviour change campaigns represent the combination of multiple public facing components to reduce food waste. A citizen behaviour-change campaign is more than just an awareness raising campaign – campaigns that exclusively provide information and increase awareness about the negative impacts of food waste. WRAP has found awareness raising alone has limited long-term effectiveness in relation to actual food waste reduction; for longer term effectiveness a more complex campaign (ie a citizen behaviour-change campaign) is required. Citizen behaviour-change campaigns 1) aim to influence social norms (social norm campaigns are impactful as they exploit the tendency of individuals to conform to what they perceive those around them do), and 2) increase the skills of citizens around food management and food practices (WRAP 2013b).

Indeed, the literature shows that there are many factors that can influence household food waste, including a range of behavioural and technical interventions and shifts in demographic profiles and economic conditions (Quested et al. 2013). WRAP developed and has implemented a new strategy for citizen food waste prevention, which includes a refocused Love Food Hate Waste campaign and targeted behaviour change interventions (such as those under the EU-funded TRiFOCAL project (2020c)). In addition, an enhanced programme aims to drive changes in food packaging design and labelling to make it easier for people to buy what they need and make use of what they buy (WRAP/UK Government/Food Standards Agency guidance to industry was published in 2017, and progress in this area was reported in November 2019 (WRAP 2019a)).

To support citizen behaviour-change campaigns effectively, policy makers should deploy additional interventions based on regulation, economic instruments and nudging approaches. These may be best harmonised through the development of a national food strategy, to provide an integrated approach to food loss and waste reduction linking to national health policies, the economic policies, and wider resource efficiency and waste policies. Citizen behaviour-change campaigns and their accompanying interventions need to be monitored and evaluated to gain insights about their effectiveness and allow for adjustments to further improved food loss and waste reduction.

WRAP has been at the forefront of citizen food waste behaviour-change campaigns, developing and launching the Love Food Hate Waste campaign in 2007. The campaign helps raise awareness of the issue of food waste and empowers consumers to waste less food and save money through practical advice, effective tools and helpful tips. The Love Food Hate Waste campaign has resulted in increased consumer awareness of food waste issues and has contributed to 24.2% reductions in household food waste – saving around £4.7 billion worth of food per year (WRAP 2020a). The Love Food Hate Waste campaign is now being used in 8 countries including Australia, New Zealand, Canada, Saudi Arabia and Central Europe. Behaviour-change campaigns on food loss and waste are also being effectively run in the Netherlands (Champions 12.3 2017d) and Germany (Federal Office of Agriculture and Food 2020).

How to scale-up food loss & waste reduction

It is clear that there are approaches to reducing food loss and waste which are effective and drive systemic change. The scale of change is sufficient to suggest that halving food waste and reducing food loss by 2030 is possible (for example, a 27% reduction in food loss and waste across the supply chain has already been achieved in the UK). The return on investment of the public money invested in these initiatives has been impressive, ranging from 80:1 to over 100:1 (Champions 12.3 2017b). To achieve this though requires:

- 1) Commitment from Governments around the world to prioritise food loss and waste reduction for economic, social and environmental reasons. For example, food waste reduction has been rated as the third most impactful intervention globally to reduce greenhouse gas emissions. This commitment could be best expressed by including food loss and waste reduction in countries' Nationally Derived Commitments (Hawken 2017).
- 2) The development and implementation of national food waste strategies focusing on national priorities and tailored to national needs.
- 3) The adequate funding of these interventions to ensure they deliver. The support of the international community in ensuring adequate funds are available is key.

Also key to the successful deployment of approaches that reduce food waste is localisation. These approaches won't be suitable for every country and for most will require adaptation to local conditions and local supply chains. As such a key challenge for food loss and waste practitioners is building capacity of in-country of local partners, who can then tailor the approaches in country and ensure they are effectively deployed.

Let's unite in the food waste fight

In this paper we have offered two mechanisms for scaling food loss and waste reduction at the regional, national and international levels. In this final section we propose a simple three-point plan for tackling food waste to deliver SDG 12.3 over the next 10 years:

- 1. Integrate food loss and waste policies into the strategies of all G20 governments** and as many more as we can.
- 2. Accelerate the uptake of public-private partnerships globally** – sharing best practice, and building a network for effective delivery.
- 3. Work together on effective and tailored behaviour-change strategies** so that not wasting food is the social norm, and we learn to value food and not waste it. These approaches work.

This is a key priority for all working on food loss and waste reduction, building the coalition of the willing and securing the funding that enables countries around the world to deliver food loss and waste reduction rapidly and cost-effectively. Tackling climate change requires urgent action and reducing food loss and waste offers an approach that can be deployed rapidly and deliver impact at scale, using tried and tested approaches. The imperative now is to act and act now.

Bibliography

Anyabwile A, Walker S (2019) 5 Ways to Put Food on a Water Diet | World Resources Institute. <https://www.wri.org/blog/2019/06/5-ways-put-food-water-diet>. Accessed 29 Jan 2020.

Boulding A, Devine R (2019) Evaluation of Framework for Action pilots – Final Synthesis Report D2.8. REFRESH.

Champions 12.3 (2016) <https://champions123.org/> Accessed 29 Jan 2020.

Champions 12.3 (2017a) Road Map to Achieving SDG Target 12.3.

Champions 12.3 (2017b) The Business Case for Reducing Food Loss and Waste. 1-24.

Champions 12.3 (2017c) The Business Case for Reducing Food Loss and Waste: Hotels. 1-12.

Champions 12.3 (2018) The Business Case for Reducing Food Loss and Waste: Catering. 1-14.

Champions 12.3 (2017d) The Netherlands' Work to Reduce Food Loss & Waste.

Eurostat (2019) Archive: People at risk of poverty or social exclusion – Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php/People_at_risk_of_poverty_or_social_exclusion Accessed 29 Jan 2020.

Fabi C, English A (2018) SDG 12.3.1: Global Food Loss Index. FAO, Rome.

FAO (2020) Key facts on food loss and waste you should know! | SAVE FOOD: Global Initiative on Food Loss and Waste Reduction | Food and Agriculture Organization of the United Nations. <http://www.fao.org/save-food/resources/keyfindings/en/> Accessed 29 Jan 2020.

FAO (2009) FAO's Director-General on How to Feed the World in 2050. *Popul Dev Rev* 35:837-839. doi: 10.1111/j.1728-4457.2009.00312.x

FAO (2013) Food wastage footprint. Impacts on natural resources. Summary Report. Food wastage footprint Impacts on natural resources 63.

FAO (2014) Food wastage footprint full-cost accounting: Final report. Food Wastage Footprint – FAO, Rome

Federal Office of Agriculture and Food (2020) Too Good for the Bin – Zu gut für die Tonne. <https://www.zugutfuertonne.de/navigation/sub-footer-navigation/english/> Accessed 29 Jan 2020.

- Feldstein S (2017) Wasting biodiversity: why food waste needs to be a conservation priority. *Biodiversity* 18:75-77. doi: 10.1080/14888386.2017.1351891
- Flanagan K, Robertson K, Hanson C, Timmermans AJ (2019) Reducing food loss and waste: Setting a Global Action Agenda.
- Global Innovation Exchange (2018) Food Waste Index. <https://www.globalinnovationexchange.org/innovation/food-waste-index> Accessed 29 Jan 2020.
- Gustavsson J, Cederberg C, Sonesson U, van Otterdijk R (2011) Global Food Losses and Food Waste; Extent, Causes and Prevention.
- Hawken P (2017) *Drawdown: The Most Comprehensive Plan Ever Proposed To Reverse Global Warming*, 1st edn. 256.
- Holden J, Haygarth PM, MacDonald J, et al. (2015) Agriculture's impacts on water quality.
- IPCC (2019) Special Report Climate Change and Land – Summary for Policymakers. IPCC.
- Koehler DA (2007) The Effectiveness of Voluntary Environmental Programs – A Policy at a Crossroads? *Policy Studies Journal* 35:689-722. doi: 10.1111/j.1541-0072.2007.00244.x
- Ng M, Fleming T, Robinson M, et al. (2014) Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 384:766-781. doi: 10.1016/S0140-6736(14)60460-8
- Quested TE, Marsh E, Stunell D, Parry AD (2013) Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling* 79:43-51. doi: 10.1016/j.resconrec.2013.04.011
- Reynolds C, Goucher L, Quested T, et al. (2019) Review: Consumption-stage food waste reduction interventions – What works and how to design better interventions. *Food Policy* 83:7-27. doi: 10.1016/j.foodpol.2019.01.009
- Scherhauser S, Moates G, Hartikainen H, et al. (2018) Environmental impacts of food waste in Europe. *Waste Manag* 77:98-113. doi: 10.1016/j.wasman.2018.04.038
- Steelman TA, Rivera J (2006) Voluntary environmental programs in the United States. *Organ Environ* 19:505-526. doi: 10.1177/1086026606296393
- Stenmark Å, Jensen C, Quested T, Moates G (2016) Estimates of European food waste levels. 80.
- Walmart (2019) 2019 Annual Report. Walmart Inc.
- Watkins DA, Simister M (2017) *Our Food, Our Future: Eat Better, Waste Less, Share More (Wicked & Wise)*. 368.
- World Bank Group (2019) Mexico – Conceptual Framework for a national strategy on food loss and waste. World Bank Group.
- World Resources Institute (2016) Food Loss and Waste Accounting and Reporting Standard. 160.
- WRAP (2008) The food we waste.
- WRAP (2013a) The True Cost of Food Waste within Hospitality and Food Service. 67.
- WRAP (2013b) Food Waste Message for Maximum Impact How to Engage Your Residents in Prevention And Collections.
- WRAP (2014a) Household food and drink waste: A people focus. Banbury
- WRAP (2014b) Household food and drink waste: A product focus.
- WRAP (2017) Helping Consumers Reduce Food Waste – Retail Survey 2015. 38.
- WRAP (2018) Gate fees 2017/2018 Final Report. Comparing the cost of alternative waste treatment options. 1-15.
- WRAP (2019a) Helping Consumers Reduce Food Waste Through Better Labelling and Product Changes. Banbury
- WRAP (2019b) A voluntary approach to cutting food waste. WRAP Global, REFRESH.

WRAP (2020a) UK progress against Courtauld2025 targets and UN Sustainable Development Goal 12.3. Banbury.

WRAP (2020b) History of Courtauld | WRAP UK. <https://www.wrap.org.uk/food-drink/business-food-waste/history-courtauld> Accessed 29 Jan 2020.

WRAP (2020c) Food Waste Trends Survey 2019. Banbury.

(2016) EU FUSIONS. <https://www.eu-fusions.org/> Accessed 29 Jan 2020.

(2020a) REFRESH: Resource Efficient Food and Drink for the Entire Supply Chain. <https://eu-refresh.org/> Accessed 29 Jan 2020.

(2020b) Household food insecurity in the UK | ENUF. <https://enuf.org.uk/household-food-insecurity-uk> Accessed 29 Jan 2020.

(2019) UK food redistribution continues to increase | WRAP UK. <https://www.wrap.org.uk/cy/content/uk-food-redistribution-continues-increase> Accessed 29 Jan 2020.

(2017) New Food Waste Reduction Fund will help charities feed people | WRAP UK. <https://www.wrap.org.uk/content/new-food-waste-reduction-fund-will-help-charities-feed-people> Accessed 29 Jan 2020.

(2020c) TRiFOCAL | Transforming City Food Habits for Life. <http://trifocal.eu.com/> Accessed 29 Jan 2020.

END NOTES

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