

Why we do not need to produce 70% more food to feed the growing world population

A key factor that drives current food policy is the assumption that by 2050 we need to produce 70% more food to feed the growing world population. And on this basis we are told that further industrialisation is necessary. However, estimates of the number of people that could be fed from current food production vary from 11.5 billion to nearly 16 billion.^{1 2 3} We produce sufficient food; the problem is that over half is lost or wasted in various ways.

Losses and waste post-harvest and by consumers and food businesses

A report by the High Level Panel of Experts on Food Security and Nutrition (HLPE) states that worldwide 25% of food calories are lost or wasted post-harvest or by being discarded by consumers or food businesses. If such loss and waste could be halved an extra 1.4 billion people could be fed.⁴

Losses from feeding human-edible cereals to farm animals

Animals convert cereals very inefficiently into meat and milk. Smil (2000) and Lundqvist *et al* (2008) calculate that on average 1700 calories/capita/day are fed to animals globally but of these only 500 calories/ capita/day are delivered for human consumption as meat and dairy products.^{5 6} This means that for every 100 calories fed to animals in the form of human-edible crops, we receive just 30 calories in the form of meat and dairy products.

A report by the United Nations Environment Programme (2009) suggests that the conversion rate may be even lower.⁷ It estimates that a kilo of cereals provides six times as many calories if eaten directly by people than if it is fed to livestock. This indicates that for every 100 calories fed to animals in the form of human-edible crops we receive just 17 calories in the form of meat and dairy products.

More recent studies calculate that for meat the conversion efficiency is poorer than the 17-30% indicated by the above studies. Cassidy *et al* (2013) have calculated calorie and protein conversion rates for different types of animal products when human-edible grain is fed to animals.⁸ They conclude that for every 100 calories of grain fed to animals, we get only about 40 new calories of milk, 22 calories of eggs, 12 of chicken, 10 of pork, or 3 of beef.

Regarding the conversion of grain protein into meat protein, Cassidy *et al* report that for every 100 grams of grain protein fed to animals, we get only about 43 new grams of protein in milk, 35 in eggs, 40 in chicken, 10 in pork, or 5 in beef.

The UN Environment Programme calculates that the cereals which, on a business-as-usual basis, are expected to be fed to livestock by 2050, could, if they were instead used to feed people directly, provide the necessary food energy for over 3.5 billion people.⁹ If a target were adopted of halving the use of cereals for feed an extra 1.75 billion people could be fed.

Overconsumption

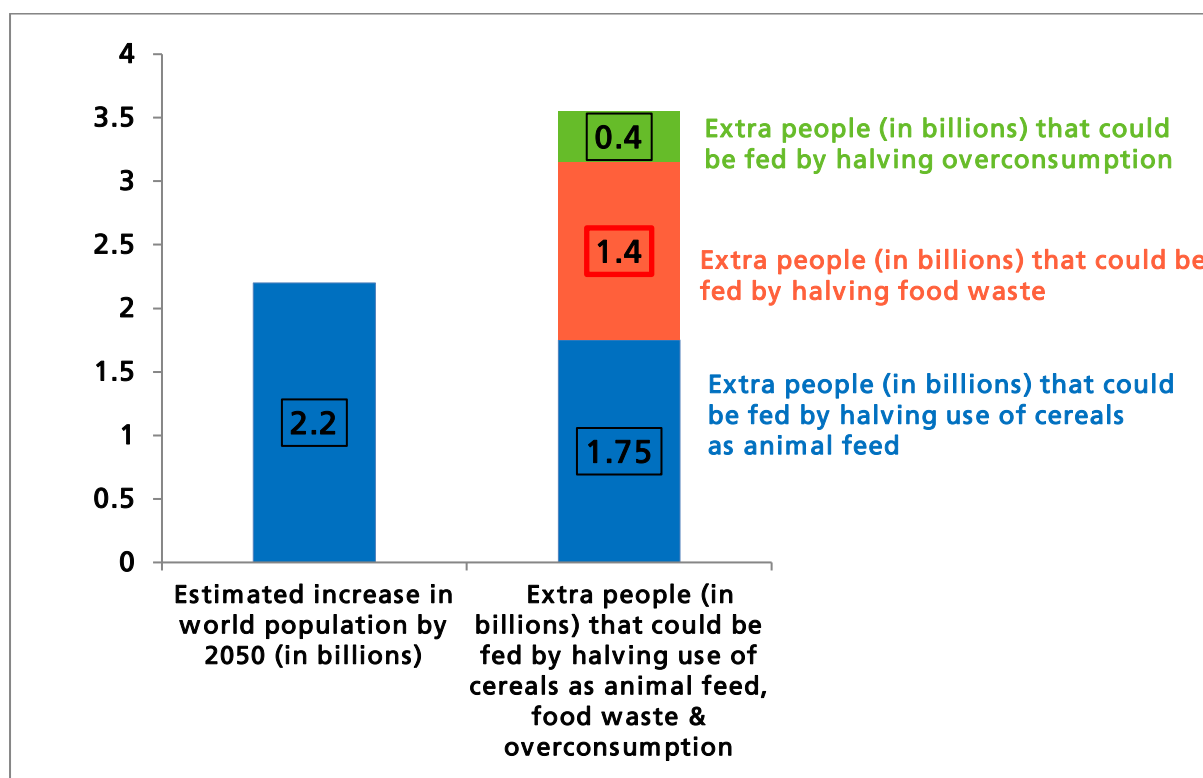
Alexander *et al* (2017) calculate that 2.9 EJ (exajoules) are lost each year through overconsumption i.e. consumption in excess of nutritional requirements.¹⁰ An extra 400 million people could be fed if such overconsumption was halved.

Halving all forms of food loss and waste

If all the above steps were taken (i.e. if all forms of food loss and waste were halved), an extra 3.55 billion people could be fed; this is more than the anticipated 2.2 billion increase in world population by 2050¹¹ (see Figure 1). We do not need to produce large amounts of extra food; we simply need to use our food more wisely. This said, increased production is needed in certain regions such as sub-Saharan Africa and South Asia but this must be achieved in a genuinely sustainable manner.

Figure 1

Feeding the 2.2 billion extra people anticipated by 2050



Based on data from: UNEP, 2009; Cassidy *et al*, 2013, High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2014 & Alexander *et al*, 2017

How the world's crop calories are used

As indicated earlier, globally 25% of calories are lost or wasted post-harvest or at the retail or consumer level.

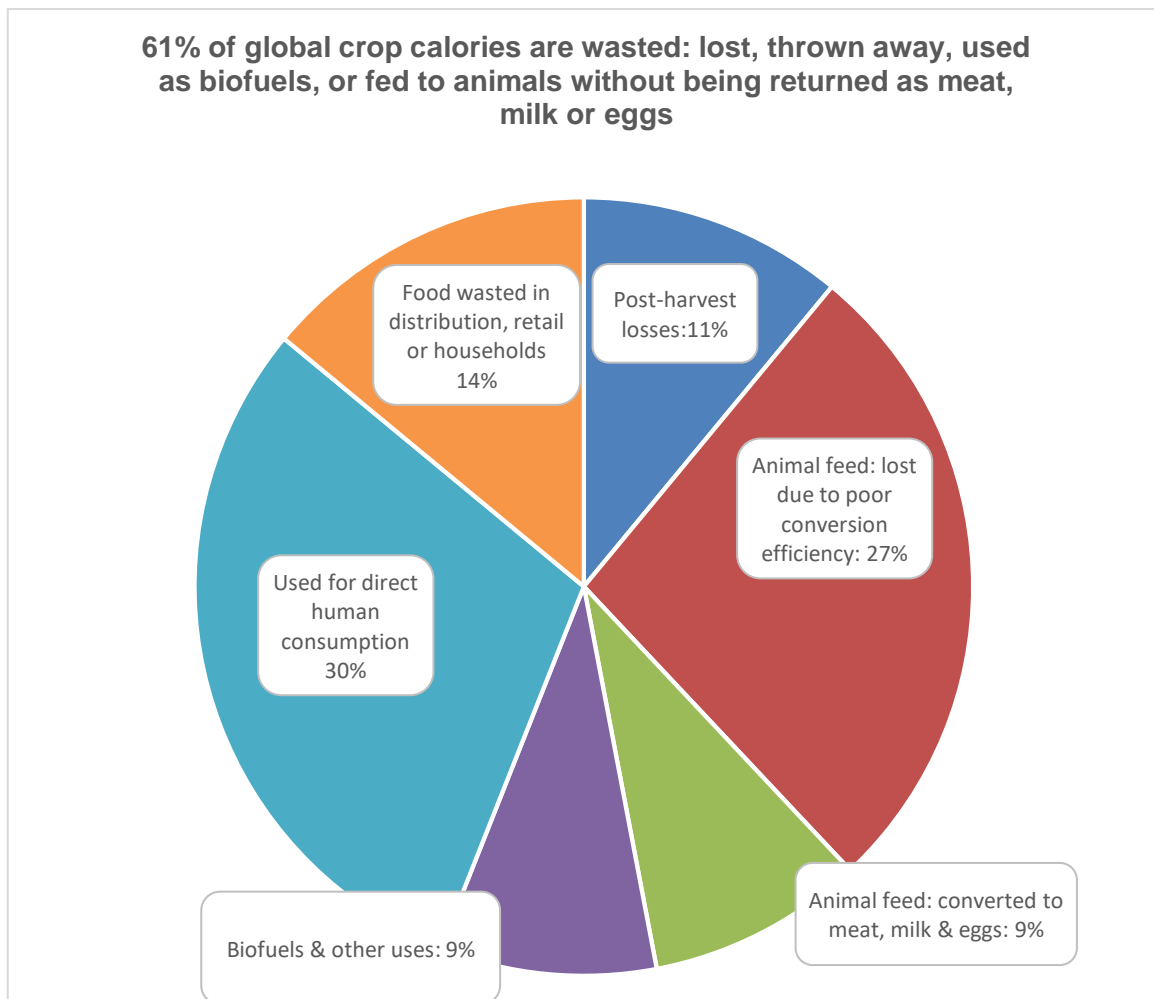
In addition, globally 36% of cereals are used as animal feed.¹² However, as we have seen, at most only 17-30% of these calories are returned for human consumption as meat or milk. The effect of this is that 70-83% of the 36% of the world's crop calories that are used as animal feed are wasted; they produce no food for humans. This means that 25-30% (70-83% of 36%) of the world's crop calories are being wasted by being fed to animals; the below Figure uses an approximate mid-point of 27%.

The figures used in the previous paragraph – and hence in Figure 2 – are very cautious in two respects:

- Some recent studies report that more than 36% of global crop calories are used as animal feed.^{13 14}
- Cassidy *et al* (2013) calculate that less than 17-30% of the calories fed to animals in the form of human-edible cereals are returned for human consumption as meat or milk. These authors state that only 12% of the global crop calories fed to animals contribute to the human diet (as meat and other animal products).

Figure 2 shows how the world’s crop calories are used. Our calculation that 61% of global crop calories are lost or wasted in various ways is similar to that produced by a 2018 Chatham House report.¹⁵ This states: “Once post-harvest losses, processing, livestock, consumer waste and overeating are included, losses for the global food system exceed 60 per cent of calories produced”.

Figure 2: Use - and waste - of calories produced by world’s crops



Based on data from UNEP, 2009; Lundqvist *et al*, 2008; HLPE report 8, 2014; & Cassidy *et al*, 2013

Note: The HLPE calculates that 25% of global crop calories are lost or wasted. It is difficult to divide these up as between post-harvest losses and food wasted by consumers and food businesses. This note follows the division used by Lundqvist *et al* who allocated 11% to post-harvest losses and 14% to food wasted by consumers and food businesses.

¹ Calculations based on Cassidy E.M *et al*, 2013. Redefining agricultural yields: from tonnes to people nourished per hectare. University of Minnesota. Environ. Res. Lett. 8 (2013) 034015

² De Schutter O, 2014 *Nous pourrions nourrir deux fois la population mondiale, et pourtant...* Le point.fr 09/09/2014 http://www.lepoint.fr/environnement/nous-pourrions-nourrir-deux-fois-la-population-mondiale-et-pourtant-09-09-2014-1861529_1927.php

³ For crop and animal production: FAOSTAT: Production database: production data for crops primary, crops processed, livestock primary. Production data from 2012-2014 period as available on database. For calorific values: FAOSTAT Food supply database: Food balance and food supply. People fed calculated as 2250 kcal per person per day for one year. <http://faostat3.fao.org/home/>

⁴ Calculation based on Cassidy et al (*Op. Cit.*) which states that 9.46×10^{15} calories available in plant form are produced by crops globally,

⁵ Smil V. 2000. *Feeding the world: a challenge for the twenty-first century*. MIT Press

⁶ Lundqvist J., de Fraiture C. and Molden D. 2008. *Saving Water: From Field to Fork – Curbing Losses and Wastage in the Food Chain*. Stockholm International Water Institute Policy Brief.

⁷ Nellemann, C., MacDevette, M., Manders, et al. (2009) *The environmental food crisis – The environment's role in averting future food crises*. A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal, www.unep.org/pdf/foodcrisis_lores.pdf

⁸ Cassidy et al (*Op. Cit.*)

⁹ Nellemann et al (*Op. Cit.*)

¹⁰ Alexander P et al, 2017. Losses, inefficiencies and waste in the global food system. *Agricultural Systems* 153: 190–200.

¹¹ UN Department of Economic and Social Affairs <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html> Accessed 6 September 2017

¹² Cassidy E.M et al (*Op. Cit.*)

¹³ Pradhan et al, 2013. Embodied crop calories in animal products. *Environ. Res. Lett.* 8 (2013) 044044

¹⁴ ATKearney, 2019. How will cultured meat and meat alternatives disrupt the agricultural and food industry? <https://www.atkearney.com/retail/article/?/a/how-will-cultured-meat-and-meat-alternatives-disrupt-the-agricultural-and-food-industry>

¹⁵ Bailey R & Lee B, 2018. Breaking the vicious circle: food, climate and nutrition <https://hoffmanncentre.chathamhouse.org/article/breaking-the-vicious-cycle-food-climate-nutrition/>