Eating the Platter Clean

Large amounts of waste generated by vegan diets can be profitably used in a light meat and dairy diet, making the latter less demanding of land.

A good half of the livestock industry must plead guilty to the charge of inefficiency. The industrial sector feeds chickens, pigs and beef cattle on grains and pulses which humans could eat. The meat it supplies for human consumption at best provides only one quarter of the nutrients contained in the animal feed, and in the case of beef not even one tenth.[1]

The inefficiency is compounded by the fact that the feed is grown on good quality arable land, stripped of much of its original soil carbon, and demanding fertiliser and fossil fuel inputs. Moreover, the inefficiency of animal digestive systems means that most of the nutrients which are eaten are excreted; and since industrial meat animals nowadays are usually reared far from where feed is produced, this creates a mountain of potentially polluting manure.

Pigs hoovering up windfalls in an orchard

In short feeding livestock on food that humans could eat is not just inefficient; on the scale that it is currently practiced, occupying about 40 percent of all arable land, it is a shameful waste of resources.

Default Livestock

The remainder of the world's livestock does precisely the opposite: it reduces the amount of arable land we use. These so-called "default" livestock[2] don't compete for food with humans: they are fed on matter that humans can't or won't eat, mostly grass, leaves and waste materials, which they turn into food for humans.

In the last few years a number of researchers have examined the potential of default livestock to address the global food security issue. Hannah van Zanten of Wageningen University, has aggregated the results of eight studies, to show that default livestock could provide between 9 and 23 grams of protein per day for everyone alive, which is equivalent to between 18 and 46 percent of the recommended intake of protein.[3] A global diet including meat and milk from default livestock would therefore use less land than a strictly vegan diet.

In the future this could be crucial, as another succinct and readable paper by van Zanten and colleagues explains.[4] If the world went vegan tomorrow, the land currently devoted to animal feed crops would comfortably provide enough land to produce grains and pulses to substitute for the meat and milk foregone. With the current global population of 7.7 billion, the 1.56 billion hectares of arable land would deliver more than 0.2 hectares per person — a lot more than the 0.14 ha estimated to be sufficient to feed someone on a very basic vegan diet.[5] Up to a third of the land could be turned over to a more benign use — for example providing green manure for more organic agriculture — and almost certainly capturing more carbon in the soil or in vegetation.

However if the world's population grows to a projected 9.7 billion by 2050, and yields don't improve, then the margin becomes rather tight, with only 0.16 ha available per person. Most of the gains made from freeing up former feed-crop land would be lost. If global warming, a lack of artificial fertilisers or some other factor reduced yields, then the area of cropland might have to expand, with harmful consequences to biodiversity and carbon sequestration.

On the other hand, a diet which included meat and milk from default livestock would need less cropland than would a vegan diet. Van Zanten estimates that animal products would provide 21 grams of protein per day, more than a third of dietary requirements (as well as fat, and other nutrients). This, she claims, could free up 25 percent of cropland, for other more benign uses.

The Surprisingly Big Resource

It is revealing to examine where this 21 grams of protein per person comes from.

- Fourteen grams comes from feeding animals on food processing residues and consumer food waste;
- Three grams comes from ruminants grazing on marginal lands unsuitable for arable crops;
- Four grams comes from ruminants grazing on land that is potentially arable.

It is noticeable that none of this diet is attributable to crop

residues, even though these are a significant source of animal feed in many countries. In the UK they include barley and oat straw, substandard or surplus vegetables, windfall apples and so on. The reason van Zanten gives for not using them is that "using crop residues as livestock feed can lead to depletion of soil organic carbon and therefore they should be left on the field". However, one does wonder whether the cropland saved by increasing the amount of meat and milk for human consumption would not compensate for any loss in soil carbon, particularly since the bulk of the nutrients and carbon ingested by animals can be returned in the form of dung.

A vegan diet generates 129 kilos of processing waste which can be fed to livestock.

More importantly, two thirds of this dietary protein comes from processing residues and food waste. Van Zanten calculates that a basic vegan diet for one person generates annually 129 kilos of high value processing co-products from potatoes, soya beans, sugar beet and cane, and wheat. This does not include residues from luxury items, such as distillers' and brewers' grains, nor less nutritious items such as raw potatoes and vegetables. Since all of this is basically waste, it calls into question whether a vegan diet is quite as efficient as it is often made out to be.

These co-products can be coupled with food waste estimated to be 10 percent of total consumption — assuming, optimistically, that more than two thirds of the food currently thrown away at the moment will not be wasted in the future. Fed to pigs the food waste and co-products together supply about 26 kilos of pork a year per person, which is 71 grams of pork containing 14 grams of protein per day — equivalent to five quarter pound burgers a week.

Waste food is big business. This tanker, belonging to the Dutch multinational Duynie, is delivering potato peelings to a farm in Shropshire. As well as peelings, Duynie supply seven other kinds of potato waste, bakery, biscuit and confectionery products, reject breakfast cereals, culms and barley screenings from maltings, brewers and distillers' grains (draff), brewers' yeast, citrus pulp, and ethanol manufacturing residues.

Smallholders will be more familiar with these sacks of Trident sugar beet pellets available from every animal feed supplier. Trident started up in 1984 marketing 750,000 tonnes of this co-product generated from the monopoly production of sugar at British Sugar's various UK plants. It is now a division of Associated British Foods, and the largest UK supplier of co-products from the food industry, including molasses, distillers grains and oilseed meals.

To Graze or Not to Graze?

The 14 grams of daily protein which are derived from food and processing wastes do not involve any land use whatsoever. Grazing, by contrast occupies a vast area of land, yet somewhat surprisingly, only supplies seven grams of protein or one third of the ration.

This is partly because the model used by the authors allocates 86 percent of the grazing to beef, nine percent to sheep and goats and only five percent to dairy cows. Dairy production is about six times as efficient at converting feed into protein and energy as is beef[6] so even a relatively small shift to dairy production could increase the return from grazing land significantly. If dairy was dominant you could be washing each of those five pork burgers down with a milk shake.

Unfortunately there is a hitch: grazing for meat and dairy, especially on poorer pastures is subject to the charge that it is not very productive and the land could be better used for some other purpose, such as biomass for energy, forestry or rewilding. This is addressed on pages 30-47.

Nonetheless the elements that make up a balanced agro-ecological system tend to be multi-functional, and that is often the case with grazing animals.

A key role for many grazing animals before the arrival of artificial nitrogen fertilisers was to harness fertility from the hinterland during the day and deposit it at night on arable land or in the farmyard. When fossil fuels are a thing of the past, this may once again become a priority. Similarly, as plastic falls into disfavour because of its potential to pollute and its reliance on fossil fuels, we are like to see a revival in demand for wool and leather.

Other uses for grazing animals include:

- Conservation grazing to enhance biodiversity (*see p.40*);
- Clearing land for agriculture or some other purpose;
- Keeping land clear in parks, commons and other public spaces, around solar farms and wind generators, and anywhere a canopy of trees is undesirable;
- Fire prevention in dry areas where a build up of scrub is a fire risk. (*see box p.27*)
- Maintaining rare breeds of animals and genetic diversity.

New Kid on the Block

The latest arrival in the co-product market is the "slurry" generated by the bewildering array of milk substitutes that have become fashionable. Oat drinks have been particularly successful, not least because of the high profile faux-naif advertising campaign conducted by the Swedish firm Oatly. Oatly is twice the price of organic cow's milk for half the nutritional value; yet Waitrose report that in this "era of the mindful consumer", 25 percent of their "milk" range is made up of non-dairy options, and the biggest area of growth is in oat "milk".[1] At least the oats can be easily grown in Britain whereas others such as almond, coconut and soya are sourced from abroad; and oats require less land to provide a litre of beverage than cows do.

All these milk substitutes generate slurries. Every 1000 litres of soya drink, which is about three percent protein, generates 250 kg of a slurry called *okara*, which contains about six percent protein.[2] It can be eaten by humans, but since it consists of 80 percent water and quite a lot of fibre, most of it isn't. Instead it is fed to animals, or even occasionally burnt or land-filled. There is a considerable literature on the internet about how okara could be better used.

There is very little information about oat milk slurry, and its manufacturers seem to be cagey about their waste streams. In response to queries about the nutritional value and treatment of the slurry, Oatly's sustainability officer said she didn't have the information; and the press office of Hain Daniels, manufacturers of Oat Dream, promised a response that never came. Ripple were equally reticent about their pea milk.

From the information available to *The Land*, it appears that roughly 40 percent of the calories in whole oats go into the slurry, and 60 percent of the protein, but Oatly's sustainability officer was unable to verify this. What we do know for certain is that the slurry is currently being fed to livestock[3] — so the "wow no cow" slogan is stretching a point.

Oatly are trying to develop a human edible product from the slurry. Good luck to them. Porridge is a bit of a hard sell at the best of times, and with half its goodness taken out it will be even more of a challenge. But of course you can always add that goodness back simply by pouring the oat "milk" over it.

1.Waitrose Food and Drink Report 2018-2019, www.waitrose.com

2. Laura B.Harthan1Debbie J.R.Cherney , "Okara as a protein supplement affects feed intake and milk composition of ewes and growth performance of lambs", *Animal Nutrition*, Volume 3, Issue 2, June 2017, Pages 171-174; SRN Shuhong Li et al, Soybean Curd Residue: Composition, Utilization, and Related Limiting Factors, *Industrial Engineering*, Vol 2013,; Okara Nutrition, https://oureverydaylife.com › Food & Drink

3. Email correspodence with Elin Roos & Oatly.14, 21 & 31 Oct 2018

- Maintaining pastoral traditions that are an important cultural heritage.
- Providing children with access to large mammals.
- Providing a role for people who enjoy working with farm animals.

The Feed Buffer

As if all the above were not enough to supply the modern millennial with a comfortably flexitarian diet, there is also a case for feeding a limited amount of surplus grain to animals. This is because in order to guarantee that there is sufficient wheat, corn and rice to feed everybody in the world during a year of poor harvests, we have to sow a quantity that is sufficient to create a surplus in the good years. The knowledge that if supply exceeds demand for human food the crop can be sold for animal feed is what currently ensures that farmers grow enough to keep us all fed.

This is known as the feed buffer. The 50 kilo difference in per capita grain production between the best and the worst years since 1970[7] suggests that a feed buffer averaging at least 25 kilos per person might be wise. This is the equivalent of at least five kilos of pork or chicken a year, or yet another quarter pound burger every week.

There are alternatives. One is to centrally manage grain reserves and control global prices to ensure that one year's surplus is kept aside for another year's deficit. However even those of us with socialist leanings have to admit that the record of the planned economies of the 20th century in staving off starvation in this manner has been lamentable. The best way of ensuring that there is enough for everyone is to produce more than enough. Unfortunately, in a capitalist system, that doesn't guarantee that everyone gets enough.

Another alternative is to convert the surplus into bioethanol. From your 25 kilos of grain you might end up with the equivalent of perhaps seven litres of diesel, after subtracting the energy that went into processing it. Whether this is more or less efficient than turning it into five kilos of meat is a matter of debate.

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NOTES AND REFERENCES

1.H Ritchie and .M Roser, *Meat and Seafood Production & Consumption, I.9* https://ourworldindata.org/meat-and-seafood-production-consumption

2. The term "default" livestock conveys the concept of a livestock population that is the natural expression of a stable ecological system. It comes from *Meat: a Benign Extravagance*, by S Fairlie, and is the term used in *The Land* magazine, in the absence of anything better. Van Zanten also uses the term "low-cost livestock", which unfortunately has monetary connotations. Tara Garnett has coined the phrase "ecological leftovers" for the resources these animals consume, but it is less easily applied to the animals themselves. "Low impact livestock" doesn't work because grazing can be very high impact.

3. H van Zanten et al "Defining a Land Boundary for Sustainable Livestock Consumption", *Global Change Biology*, 2018 1-10. Nutritional requirements found at https://www.nutrition.org.uk/attachments/article/261/Nutrition%20Requirements_Revised%20Oct%202017.pdf

4.. H van Zanten et al, "The Role of Livestock in a Sustainable Diet: a Land-Use Perspective, *Animal*, 10:4, 2016.

5. This area does not allow for luxuries such as drinks and snacks, or for non-comestible goods such as cotton for clothes.

6. Op cit 1. 7. *World Grain Production Per Person, 1950-2007*, Earth Policy Institute, USDA data www.earth-policy.org/datacenter/xls/update72_11.xls