ZERO WASTE ALLIANCE IRELAND

Towards Sustainable Resource Management

Feedback to the European Commission on Food Waste Reduction Targets

Revised and Expanded

24 August 2022

Zero Waste Alliance Ireland is a member of

EEB European Environmental Bureau

and

IEN Irish Environmental Network

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1. INTRODUCTION

When the European Commission announced a public consultation on food waste and particularly on food waste reduction targets, as part of the programme of revision of the Waste Framework Directive, we saw this an excellent opportunity to provide feedback on a topic in which Zero Waste Alliance Ireland has had a long and continuing interest. It has always appeared to us that the wasting or discarding of uneaten food cannot be seen in isolation, but must be addressed as part of a larger issue, encompassing our lifestyles and the way in which the global economy has developed, away from local needs and local services.

In Europe, the transformation of food from a biological necessity to a form of raw material for the food industry has, in our opinion, contributed significantly to large-scale generation of food waste. In rural areas, we have witnessed the change from small-scale farming where very little materials were uselessly discarded, to the present day situation where between 25% and 30% by weight of livestock slaughtered in Ireland for human consumption is considered as “waste”. This discarded material, instead of being utilised beneficially in ecological terms, is converted to “meat-and-bone” meal at high energy cost; and, in most cases its final destination is a cement production plant or an incinerator where it serves as a fuel for the partial recovery of some of its embodied energy.

When the initial deadline of 16 August 2022 was announced for this public consultation, we made a submission; but, owing to a technical problem on that day, the European Commission made a decision to extend the deadline to 24 August. Zero Waste Alliance Ireland is therefore pleased to have the opportunity to make a further revised and expanded submission, which we hope will be useful and possibly interesting.

2. ZERO WASTE ALLIANCE IRELAND (ZWAI)

At this point we consider that it is appropriate to mention the background to our submission, especially the history, policy, strategy and activities of ZWAI.

2.1 Origin and Early Activities of ZWAI

Zero Waste Alliance Ireland, established in May 1999, and registered as a company limited by guarantee in 2004, is a Non-Government Environmental Organisation (eNGO) and a registered charity. During the past two decades ZWAI has submitted to the Government and to State Agencies many policy documents on waste management, on using resources sustainably, on promoting re-use, repair and recycling, and on development and implementation of the Circular Economy. During more recent years (2021 and 2022), ZWAI has responded to the European Commission's call for submissions on a variety of topics on wastewater and solid wastes.

One of our basic guiding principles is that human societies must behave like natural ecosystems, living within the sustainable flow of energy from the sun and plants, producing no materials or objects which cannot be recycled back into the earth's systems, or reused or recycled into our technical systems, and should be guided by economic systems and practices which are in harmony with personal and ecological values.

Our principal objectives are:

i) sharing information, ideas and contacts,

ii) finding and recommending environmentally sustainable and practical solutions for domestic, municipal, industrial and agricultural waste management; and for more efficient and ecologically appropriate uses of natural resources such as water and soil;

iii) lobbying Government and local authorities to implement environmentally sustainable waste management practices, including clean production, elimination of toxic substances from products, re-use, recycling, segregation of discarded materials at source, and other beneficial practices;

iv) lobbying Government to follow the best international practice and EU recommendations by introducing fiscal and economic measures designed to penalise the manufacturers of products which cannot be re-used, recycled or composted at the end of their useful lives, and to financially support companies making products which can be re-used, recycled or are made from recycled materials;

v) raising public awareness about the long-term damaging human and animal health and economic consequences of landfilling and of the

destruction by mass burning of potentially recyclable or re-usable materials by incineration;

vi) investigating, raising public awareness and lobbying Irish Government departments and agencies about our country's failure to take adequate care of vulnerable and essential natural resources, including clean water and air, biodiversity, and soil;

vii) advocating changes in domestic and EU legislation to provide for more ecologically appropriate, environmentally sustainable and efficient uses of natural resources; and,

viii) maintaining contact and exchanging information with similar national networks in other countries, and with international zero waste organisations.

2.2 Our Basic Principles

In nature, the waste products of every living organism serve as raw materials to be transformed by other living creatures, or benefit the planet in other ways. Instead of organising systems that efficiently dispose of or recycle our waste, we need to design systems of production that have little or no waste to begin with.

There are no technical barriers to achieving a "zero waste society", only our habits, our greed as a society, and the current economic structures and policies which have led to the present environmental, social and economic difficulties.

"Zero Waste" is a realistic whole-system approach to addressing the problem of society's unsustainable resource flows – it encompasses waste elimination at source through product design and producer responsibility, together with waste reduction strategies further down the supply chain, such as cleaner production, product repairing, dismantling, recycling, re-use and composting.

ZWAI strongly believes that Ireland and other Member States, and the EU as a whole, should have a policy of not sending to other countries our discarded materials for further treatment or recycling, particularly to developing countries where local populations are being exposed to dioxins and other very toxic POPs. Relying on other countries' infrastructure to achieve our "recycling" targets is not acceptable from a global ecological and societal perspective.

ZWAI also strongly believes that soil and its associated biodiversity (surface and sub-surface living organisms) are vitally important components of the Earth's global ecosystem, and that the destruction or unnecessary wasting of these natural resources must not be allowed to continue. The importance of healthy soil ecosystems must be strongly emphasised; and, by ensuring that food waste which cannot be utilised for other purposes is returned to the soil in the form of a

beneficial compost, we are engaging in a natural recycling process common to all sustainable ecosystems.

2.3 What We are Doing

One of our principal objectives is to encourage the European Union (including Commission and Parliament), Irish government agencies, Irish local authorities and other organisations to develop and implement environmentally sustainable resources and waste management policies, especially resource efficiency, waste reduction and elimination, the promotion of re-use, repair and recycling, and the development and implementation of the Circular Economy.

As an environmental NGO, and a not-for-profit company with charitable status since 2005, ZWAI also campaigns for the implementation of the UN Sustainable Development Goals, including (but not limited to) Goal 12, Responsible Consumption and Production; Goal 6, Clean Water and Sanitation (having particular regard to the need to avoid wasting water); and Goal 15, to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, to halt and reverse land degradation and halt biodiversity loss.

As an environmental NGO, and a not-for-profit company with charitable status since 2005, ZWAI also campaigns for the implementation of the UN Sustainable Development Goals, including (but not limited to) Goal 12, Responsible Consumption and Production, and Goal 6, Clean Water and Sanitation (having particular regard to the need to avoid wasting water).

In responding to many Irish and European public consultations, ZWAI in its role as an environmental NGO has given presentations and made submissions on:

1. How the European Union has addressed the problem of plastic waste (March 2019);
2. On Single-Use Plastic Packaging by the food industry (November 2019);
3. Feedback to the European Commission in response to a public consultation on the proposed revision of the EU Regulation on Shipments of Waste (January 2022);
4. Feedback to the European Commission in response to a public consultation on protecting, sustainably managing and restoring EU soils, including comments on the proposed updating of the 2006 EU Thematic Strategy on Soil (February 2022);
5. Feedback to the European Commission in response to a public consultation on revision of the EU plant and forest reproductive material legislation (March 2022);
6. Providing feedback to the European Commission on the waste-related environmental performance of Ireland and certain other EU Member States, and the probability of their achieving the 2025 recycling targets and

the 2035 landfill target, with observations on the Early Warning Report System (August 2022);

7. On transforming the construction industry so that it could become climate neutral (instead of its present position as a major emitter of greenhouse gases and toxicants); and,

8. Several submissions on the separation, recovery and reuse of the phosphorus and nitrogen content of wastewater (2019 to 2022).

ZWAI is primarily concerned with the very serious issue of the misuse of key and critical natural resources, and the problems of discarded substances, materials and goods, whether from domestic, commercial or industrial sources, how these become “waste”, and how such “waste” may be prevented by re-design along ecological principles. These same ecological principles can be applied to the many ways in which we abstract and use water as a resource, and also to the equivalent volumes of wastewater produced as a consequence of these uses.

We believe that at a time of increasing scarcity of certain resources, including, for example contaminant-free phosphate rock as a raw material for fertiliser production, and the shortage of other resources, for example natural gas for the production of synthetic nitrogenous fertilisers, it is more essential than ever to ensure that raw materials are not wasted, but are used wisely and efficiently

ZWAI is represented on the Irish Government’s Waste Forum and Water Forum (An Fóram Uisce) by one of our Directors, ZWAI is a member of the Irish Environmental Network and the Environmental Pillar, and is funded by the Department of Communications, Climate Action and the Environment through the **Irish Environmental Network**.

In 2019 ZWAI became a full member of the **European Environment Bureau** (EEB); and we participate in the **Waste Working Group** of the EEB. Through the EEB, we contribute to the development of European Union policy on waste and the Circular Economy. In November 2021, the EEB established a **Task Force on the Built Environment**; and ZWAI was accepted as a member of this new group, and we continue to contribute to discussions on the sustainability of construction materials, on buildings and on the built environment.

Zero Waste Alliance Ireland (ZWAI) is very pleased to have the opportunity to provide feedback to the European Commission on this important matter, and we have undertaken some research to provide the Commission with reasonably detailed and evidence-based comments. We trust that the observations in this submission will be considered as a relevant and a positive contribution to EU strategies and measures which would aim to achieve a “zero waste society”.

3. THE FOOD WASTE PROBLEM, THE CURRENT INITIATIVE BY THE EUROPEAN COMMISSION, AND OUR RESPONSES TO THE PROPOSED POLICY OPTIONS

All Member States of the EU generate food waste, at all levels of society, and this waste creates significant environmental problems, as well as providing an indication of how inefficiently we use valuable resources. Discarding much of the raw materials which could be used to produce food, discarding the food itself, and failing to use food residues and left-overs, are further indications that human societies do not value the Earth's diminishing resources.

It is well known that the production, storage, transport and processing of food, and the disposal of food waste, cause environmental and climate impacts (such as GHG emissions, and effects on land use, biodiversity, water use and eutrophication) within the EU. Also, the production of food in other countries, but subsequently imported to the EU, can lead to significant global environmental and climate impacts. Reduction of food waste means that less food must be produced, and hopefully less food waste for disposal, resulting in lower environmental and climate damage.

> "*About 1.3 billion tonnes of food are wasted every year worldwide. In other words, about a third of all the food produced does not end up where it is intended to end up - on our plates.*
>
> *According to an FAO study, food waste in Europe and North America amounts to between 280 and 300 kilograms per head per year – an unpleasant chain of wastefulness starting at the fields and the farmyard, continuing through processing and trading, and finishing up in our kitchens. Ninety-five to 115 kilograms per head per year of food are thrown out in households including many food items that are perfectly edible and could be consumed".*[1]

This enormous wastage exists at the same time as one billion people in the world are suffering and dying from hunger.

With up to 20% of all food produced in the EU ending up as food waste and 89 million tonnes of food waste generated annually, equivalent to 179 kg per capita (including both edible and inedible parts), food waste is one of the largest sources of inefficiency in the agri-food chain; and this inefficiency causes depletion of increasingly limited natural resources, such as land, water and biodiversity, on which the food system depends. Furthermore, along the food supply chain, food waste contributes 8-10% of total global greenhouse gas emissions. It also creates pressure on the natural environment by wasting chemicals and fertiliser, generating pollution and harm. Finally, food waste raises serious ethical

[1] Position Paper on Food Losses and Waste. Slow Food, 2021. Section 1, Introduction, page 3.

considerations, both as a symbol of the environmental destruction caused by society and as a symbol of injustice that so much food is thrown away while many people cannot afford a meal.

Despite political commitments (e.g., the UN Sustainable Development Goals (SDG) Target 12.3) and legal guidance (for example by the implementation of Directive 2008/98/EC), Member States' responses to food waste have been uneven and are not sufficient to address the risk of prolonged environmental damage, and the consequent economic impacts for consumers, enterprises and society as a whole. The variation in efforts across Member States in the reduction of food waste generation indicates a need for more coordinated and uniform measures at EU level to drive the progress at the breadth and pace required to achieve SDG target 12.3. Moreover, reduction of food waste is needed to achieve climate neutrality in the EU by 2050, including the intermediate target of an at least 55% net reduction in greenhouse gas emissions by 2030.

3.1 The European Commission's Proposals for Food Waste Reduction Targets

Setting an EU-wide target, as proposed by the Commission,[2] should improve the coordination of national food waste prevention policies, and should also help to identify and scale-up effective strategies and initiatives both within and across Member States, and hopefully accelerate a reduction of food waste in the EU.

All EU Member States have subscribed to the United Nations Sustainable Development Agenda 2030, which includes a target (Sustainable Development Goal (SDG) 12.3) 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. However, much more needs to be done to achieve this target.

The 2018 revision of the **Waste Framework Directive**[3] has prescribed new obligations for Member States in the area of food waste prevention (such as the adoption of national food waste prevention programmes, and requirements for monitoring and reporting on food waste quantities). These are further supported by additional Commission actions implemented as part of the Circular Economy Action Plan[4], such as the establishment of a multi-stakeholder platform (EU Platform on Food Losses and Food Waste[5]) and the adoption of guidelines to

[2] European Commission Inception Impact Assessment of a Proposed Food Waste Reduction Target, Ares document (2021) 5979432, 01 October 2021.

[3] Directive (EU) 2018/851 of 30 May 2018 amending the original Waste Framework Directive 2008/98/EC.

[4] COM/2015/0614 final and https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

[5] https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en

facilitate food donation and the use of former foodstuffs and by-products from the food chain in animal feed production. While these actions might appear to have partly addressed the problem of food waste, they have not been implemented consistently throughout the EU, with (in some cases) ineffective results.

Zero Waste Alliance Ireland therefore fully supports the European Commission's current objective of introducing a legally binding target, in order to ensure that Member States take ambitious action to reduce food waste in their respective territories.

The result of a food waste reduction target would be to achieve reduction of food waste along the food supply chain and thus to contribute towards reaching the UN Sustainable Development Goal Target 12.3 to halve per capita food waste at retail and consumer level by 2030 and reduce food losses along the food supply chain. This will help to deliver on commitments under the Farm to Fork Strategy, and will help to shape a food system that is more sustainable and resource efficient. It will also contribute to a more competitive, low-carbon economy with less harmful impacts on the environment and climate as well as increased resilience of food systems, while offering economic savings for farmers, food business operators and consumers and supporting social cohesion (more recovery and redistribution of food surplus).

While the Commission's proposal will define the level of reduction for different stages of the food supply chain, each Member State will be able to choose the most effective measures taking into account its specific national situation. These actions could include, amongst others:

- ✓ improving knowledge and awareness on levels and impacts of food waste;
- ✓ influencing attitudes and behaviours that lead to food waste and encourage uptake of food waste prevention measures along the food chain, from production through consumption;
- ✓ encouraging change in the food value chain toward less wasteful practices. Such measures could include amongst others: ensuring cooperation between actors of the food supply chain, voluntary agreements, education, awareness raising and other measures to elicit behavioural change, support for donation of unsold food, support for valorisation of food no longer destined for human consumption and its inedible parts as high value-added products (feed, biomaterials), without compromising human or animal health; assessment of the effectiveness of food waste prevention initiatives to facilitate uptake of evidence-based solutions.

3.2 Policy Options Suggested by the European Commission, and ZWAI Responses to these Options

The European Commission's inception impact assessment of a proposed food waste reduction target (Ares (2021) 5979432, 01 October 2021) proposed a two-stage approach to the development and selection of policy options to reduce food waste.

Step 1 considers the following policy options for the scope and the way in which the targets are measured, expressed and set:

(i) Scope:

Option S1 - target covering the whole food supply chain, from farm gate to final consumer; or,

Option S2 - target covering only selected stages of the food supply chain (for example SDG Target 12.3 sets targets at retail and consumer levels).

(ii) Expression:

Option E1 - target expressed as % of food waste reduction from the amount of food waste in the baseline year (2020) to target year (2030); or,

Option E2 - targets expressed as absolute amounts, i.e. in kilograms per capita per year to be achieved by 2030 (per country).

(iii) The way in which targets would be set for Member States:

Option T1 - the same target level for all Member States;

Option T2 – target level differentiated by Member State; or,

Option T3 – collective target on EU level – based on MS contributions

In step 2, the European Commission intends to make a comparison of the expected environmental, economic and social costs and benefits of the baseline scenario and following options:

Option 1 (basic): to reduce food waste in the EU by 15-25%;

Option 2 (medium): to reduce food waste in the EU by 25-35%; or,

Option 3 (advanced): to reduce food waste in the EU by 40-50%.

It is very good that the commission has set out so clearly the different options available, and has requested stakeholders' observations on the targets and their implementation.

Having considered the above options, in the context of our view that the reduction of food waste must be part of a broader transformation of the way in which our societies and countries produce, distribute and use food materials, ZWAI advocates the following policy approach and options:

Step 1 (i) Scope:

It is our clear and strong submission that **Option S1** should be the preferred option, with food waste reduction targets, covering the whole food supply chain, from farm gate through transportation, processing, packaging and distribution to the final consumer; and without any delay in implementation. Binding targets should be set for the entire food supply chain, to address the food waste occurring at the primary production level and the early stages of the supply chain.

It is also our submission that mandatory Member State reporting should be extended to include food left unharvested and ploughed back into agricultural lands, which we understand is excluded under the current delegated decision.

We have seen this waste occur in Ireland, and we understand that this loss of unharvested crops has been a serious issue in Britain,[6] where the results of "*Brexit"* have led to a shortage of temporarily immigrant farm workers because of the British Government's reluctance to issue visas to workers from some EU Member States, combined with the effects of drought.

According to the news item in the Guardian dated 15 August 2022 (see footnote), as much as GB£60m of food has been wasted on farms because of a labour shortage; with this information being attributed to the National Farmers' Union (NFU), which reported that at least GB£22m of fruit and vegetables had been wasted so far this year. The NFU said 40% of respondents to a survey of its members said they had suffered crop losses as a result of labour shortages, with farms 14% short of the size of the workforce they needed on average.[7]

And, while some food crops are unharvested in Britain, the Commission will be well aware of the impending disaster caused by damage to food growing areas in Ukraine where farmers have been unable to harvest crops because of shelling by Russian military forces, or by some agricultural lands being rendered dangerous to harvest because of the presence of landmines deposited by the Russian army when it was in control of these areas.

According to the WWF's recent report "*Driven to waste: the global impact of food loss and waste on farms"*,[8] which shows the most comprehensive review of data on primary production food loss and waste to date, about 150 million tons of food

[6] https://www.theguardian.com/environment/2022/aug/15/pounds-60m-in-uk-crops-left-to-rot-lack-of-workers-nfu-farming

[7] https://www.theguardian.com/environment/2022/aug/15/pounds-60m-in-uk-crops-left-to-rot-lack-of-workers-nfu-farming

[8] Driven to waste: The Global Impact of Food Loss and Waste on Farms. WWF-UK (2021)

is wasted on European farms (14.6% of total production). We understand that there is currently no data available in the EU on these types of food waste, and we therefore urge that the Commission and Member States should collect data to use as a baseline. This information will be particularly important to prevent food waste occurring at the retail and manufacturing levels to be displaced to the primary production level.

Step 1 (ii) Expression

It is our strong submission that **Option E2** should be the preferred option, with targets expressed as absolute amounts, i.e., in kilograms per capita per year to be achieved by 2030.

This is a much better option than expressing the target as a percentage of food waste reduction from the amount of food waste in the baseline year (2020) to target year (2030). Although we acknowledge the need for the EU to reach the 50% food waste reduction target across the supply chain by 2030, it should be reached through a kilograms per capita target that member states have to reach. Such a measure would make the target fairer for countries which have already started reducing food loss and waste, while expressing the target in terms of percentages would have an unequal effect among Member States.

Step 1 (iii) The way in which targets would be set for Member States

It is our strong submission that **Option T3** should be the preferred option, i.e., a collective target at EU level, based on Member States' contributions. Member states should reach the same kilograms per capita target, provided that reaching this target will contribute to reaching a 50% reduction target by 2030.

We also suggest that the targets should be fairly divided among each of the sectors of the food supply chain, according to which sector is contributing the most. The mechanism should ensure that those sectors which have the most significant impact should be mandated to take the greatest effort to achieve their allocated targets.

Step 2 Target to be Achieved

In step 2, it is our strong submission that **Option 3** should be the preferred option, i.e., to reduce food waste in the EU by 40-50%. But we would prefer to see the Commission and the EU go further, and advocate a food waste reduction target of **at least 50%**.

The European Parliament has stated that the 50% target to be reached by 2030 should be maintained, in line with SDG goal 12.3, adopted in 2015. It is our submission that the adoption of an "*at least 50%"* food waste reduction target should assist in the aim of reducing GHG emissions by 55% by 2030.

4. FURTHER OBSERVATIONS ON FOOD WASTE REDUCTION TARGETS (AS PART OF THE WFD REVISION)

Target 12.3 of the UN Sustainable Development Goals commits the European Union (EU) and its Member States to meeting the food loss and waste reduction goals. In order to support Member States to achieve this target, a holistic approach is needed to tackle food waste without compromising food safety, with appropriate actions taken at each stage of the food supply chain, with the involvement of all key players from the public and private sectors.

The revision of the EU Waste Framework Directive (WFD) is an opportunity to set both mandatory and voluntary targets that could improve public participation in food waste reduction agreements and in setting reduction targets for businesses over a certain size. The revision of the WFD is also an opportunity to lay out policy actions that would allow Member States within the EU to contribute to the goal of halving per capita global food waste at the retail and consumer levels and reduce food losses along supply chains.

4.1 Current Assessment of Food Waste Along the Supply Chain

An unacceptably high proportion of food is lost along the supply chain before it even reaches the consumer. It becomes imperative to reduce food losses and waste in order to improve food security, especially that of vulnerable groups, and decreasing the environmental footprint of food production activities. Considerable reduction of food loss is possible through the identification of these critical loss points and taking appropriate countermeasures. To this end, data collection efforts at the EU level will be required from Member States to develop evidence-based, targeted interventions. With this data, identifying the most effective anti-food waste measures that could be implemented at certain entry points of the production and supply chain would be made easier.

4.2 A Policy Perspective on Food Waste Reduction

Prioritising food waste reduction as a policy measure under the Food Waste Reduction Targets should be split into mandatory and voluntary measures. The following suggestions are just some of the measures that can be adopted within the revised WFD.

1. As a first step, mandatory regulatory measures that focus on preventing food waste occurring in the first place need to be implemented. The revision of the WFD could explore the mandatory imposition of bans and taxes on Member States who send food waste above a certain threshold to landfills and incineration.

2. The Directive could also incorporate the mandatory measurement and reporting by food businesses across Member States of their food waste reduction measures, actions and assessment figures on an annual basis. This mandatorily submitted data would enable an assessment of measures that could further be taken to prevent food waste accumulation along the food supply chain.

3. The introduction of periodically increasing fines for businesses above a certain size for not following the food waste prevention hierarchy is another mandatory measure that could be explored within the revised WFD. This measure could be extended to include levies on retailers in direct proportion to the food waste levels of their suppliers.

4. At a voluntary level, promoting a dietary food lifestyle through campaigns and educational drives could play a significant role in reducing the environmental potential of food waste and loss in terms of greenhouse gas emissions and land use demand. Replacing a carbon-heavy meat-based diet, including beef and pork, with lean protein substituent can result in an immediate drop in the GHG emissions by 34%; however, dietary food-based adherence does not always mitigate the emissions.

4.3 Our Conclusions on the Subject of Targets

- ✓ Food waste reduction targets should include the whole food supply chain, from farm gate through transportation, processing, packaging and distribution to the final consumer; and without any delay in implementation;

- ✓ Binding targets should be set for the entire food supply chain, to address the food waste occurring at the primary production level and the early stages of the supply chain;

- ✓ Mandatory Member State reporting should be extended to include food left unharvested and ploughed back into agricultural lands;

- ✓ Food waste reduction targets should be expressed as absolute amounts, i.e., in kilograms per capita per year to be achieved by 2030;

- ✓ A collective target should be set at EU level, based on Member States' contributions;

- ✓ Member states should reach the same target, expressed as kilograms per capita per year, provided that reaching this target will contribute to achieving a 50% reduction target by 2030;

- ✓ Targets should be fairly divided among each of the sectors of the food supply chain, according to which sector is contributing the most;

- ✓ A food waste reduction target of **at least 50%** is strongly advocated;
- ✓ Revision of the WFD should include a requirement to take action at the source by limiting the generation of surplus food at each stage of the food supply chain as its primary focus;
- ✓ In the event of surplus food generation, measures to recover and redistribute the discarded food should be identified and outlined for Member States to follow, in line with the waste prevention hierarchy;
- ✓ The revision of the WFD needs to create an enabling policy environment that stimulates food waste prevention and reduction initiatives; and,
- ✓ Coordinated and integrated action plans across relevant public services needs to be achieved at each Member State level in order to tackle food waste effectively.

5. Other Relevant Issues and Policy Actions to Help Resolve the Food Waste Problem

5.1 Planetary Boundaries and the Contribution of Food Waste to Global Warming

The transition to a **circular economy** is pivotal for humanity to stay within a safe operating space for continued existence within planetary boundaries[9]. The planetary boundaries for climate change, biodiversity loss and the nitrogen/phosphorous cycle have already been breached [10]. Models predict that with continued greenhouse gas emissions, average global temperature increases of 3°C compared to pre-industrial levels are likely[11], while some models predict extreme increases of 5°C by 2100.[12] To avoid this catastrophic impact on society and on biodiversity, global warming must be kept below 1.5 °C.[13] The transition to a circular economy may help to prevent a worst-case scenario for climate change.

According to the international research coalition, "Project Drawdown", reducing food waste is the **most impactful solution to global warming**. Eliminating food loss and waste to the largest extent possible, at all stages from producer to final consumer, stands out as an urgent step towards more sustainable food systems. Food waste is also associated with significant economic costs, estimated to amount to around €143 billion in the EU. 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 discard unsold products; and households that throw away edible food for a variety of reasons including spoilage, lack of knowledge, over-purchase and confusion about best-before and use-by dates. An estimated 89 million tonnes of food are lost or wasted every year in the EU, which is equivalent to 20% of the total food produced or 173 to 179 kilogrammes per person. More than half of this total food waste in the EU (47 million tonnes)

[9] Geissdoerfer, M., Savaget, P., Bocken, N.M. and Hultink, E.J., 2017. The Circular Economy–A new sustainability paradigm?. Journal of cleaner production, 143, pp.757-768.

[10] Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J. and Nykvist, B., 2009. A safe operating space for humanity. nature, 461(7263), pp.472-475.

[11] Solomon, S., Manning, M., Marquis, M. and Qin, D., 2007. Climate change 2007-the physical science basis: Working group I contribution to the fourth assessment report of the IPCC (Vol. 4). Cambridge university press.

[12] Zhang, G., Zeng, G., Yang, X. and Jiang, Z., 2021. Future changes in extreme high temperature over China at 1.5 C–5 C global warming based on CMIP6 simulations. Advances in Atmospheric Sciences, 38(2), pp.253-267.

[13] Allen, M.R., Dube, O.P., Solecki, W., Aragón-Durand, F., Cramer, W., Humphreys, S., Kainuma, M., Kala, J., Mahowald, N., Mulugetta, Y. and Perez, R., 2018. Framing and context. Global warming of, 1(5).

is generated in households, with 70% of food waste arising from households, food services and retail.

Fighting against food waste is one of the key action strands laid down in the EU's Farm to Fork Strategy and reducing food waste has enormous potential for reducing the resources we use to produce the food we eat as well as the environmental and climate impact of food systems. It also has an important social dimension, helping to address challenges to food security.

SDG target 12.3 states that "*By 2030, 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."*

The European Health and Digital Executive Agency (HaDEA)[14] currently has an open call for grants for stakeholders to improve measurement of food waste and to help implement food waste prevention in their operations and organisations. Stakeholders in every sector, though in particular the hospitality and food services' sector, should aim to improve measurement of food waste and help implement food waste prevention in their operations and organisations. The sector includes restaurants, hotels and catering services (healthcare, education, canteens, transportation, etc) in both the public and private sphere. It is essential that every sector work together on implementing waste diversion tactics, such as with the use of composting machines (see below), and this should be mandated at policy level.

5.2 Changing Our Lifestyle – The Benefits of A Healthy Diet for a Healthy Planet

In January 2019, the EAT–Lancet Commission published an authoritative report on "*Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems".* The report could best be described as a healthy diet for a healthy planet, and was the subject of much discussion, including unfavourable criticism from organisations with an interest in maintaining the environmentally damaging form of industrial food production which has caused huge biodiversity loss and soil damage.

The report provides much evidence that, while food production systems have the potential to nurture human health and support environmental sustainability, our current food production trajectories threaten both. The EAT–Lancet Commission addresses the need to feed a growing global population a healthy diet while also defining sustainable food systems that will minimise damage to our planet; and it is our submission that the recommendations of the EAT-Lancet Commission, if implemented, would also have the effect of reducing food waste.

[14] https://hadea.ec.europa.eu/programmes/single-market-programme-food_en

The Commission quantitively describes a universal healthy reference diet, based on an increase in consumption of healthy foods (such as vegetables, fruits, whole grains, legumes, and nuts), and a decrease in consumption of unhealthy foods (such as red meat, sugar, and refined grains) that would provide major health benefits, and also increase the likelihood of attainment of the Sustainable Development Goals. This is set against the backdrop of defined scientific boundaries that would ensure a safe operating space within six Earth systems, towards sustaining a healthy planet.

The Lancet Commission identified food production as the largest pressure caused by humans on the environment, and recommended major changes to diets necessary to avoid reduced life expectancy and environmental degradation, including soil degradation. The dietary recommendations call for a **plant-based diet** consisting mostly of fruit, vegetables, whole grains, legumes, nuts, and unsaturated oils, a low to moderate amount of seafood and poultry, and **no or a low quantity of red meat, processed meat, added sugar, refined grains, and starchy vegetables**. The Lancet Commission showed that it is possible to feed a global population of nearly 10 billion people a healthy diet within the recommended food production boundaries by 2050. Food for these 10 billion humans must be provided **using no additional land**.

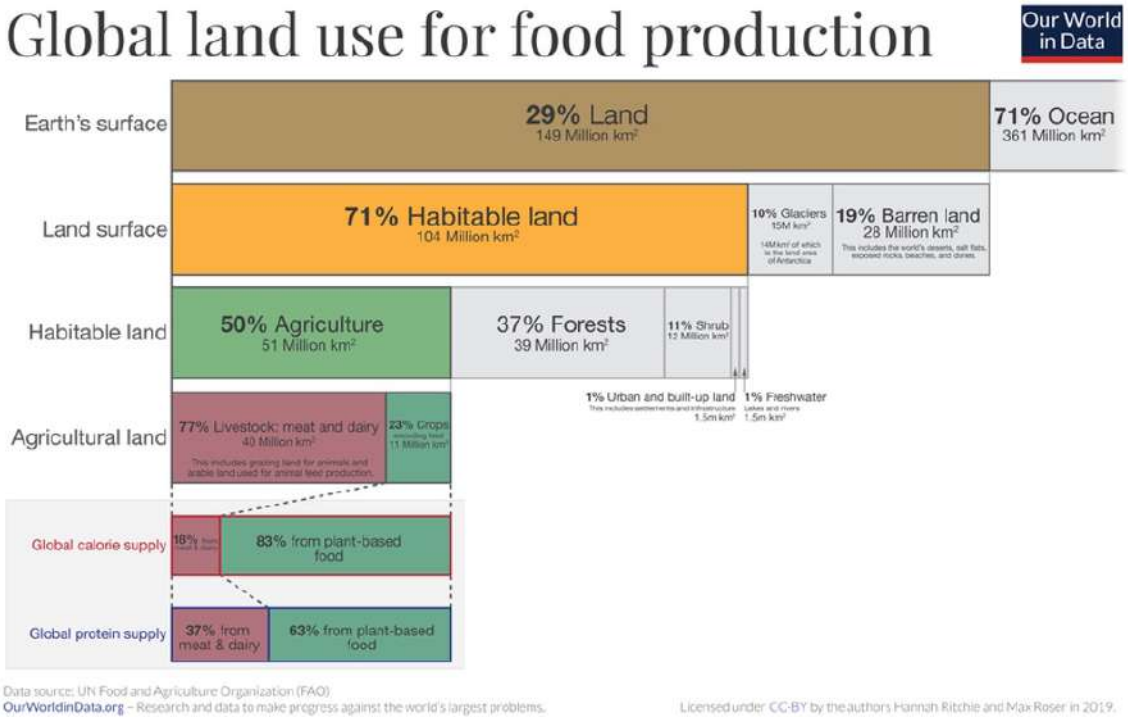


Figure 5.2: Our World In Data. Note the large proportion (77%) of land devoted to producing just 18% of global calorie supply.

At current the current human population of 7.9 billion, replacing meat and dairy production with plant-based food production would result in less cropland required for the same total calorie production, while freeing up a significant proportion of global agricultural land.

This extra land could instead be converted to natural or semi-natural habitats to support soil health, carbon sequestration and biodiversity. The establishment of field margins through EU incentives may be a practical strategy to help achieve this. In Ireland, replacement of meat and dairy agricultural land with forest could help achieve the aims of the EU Green Deal targets for 2030, Farm to Fork strategy and EU Biodiversity Strategy.

It is our recommendation and that the following key messages from the EAT–Lancet Commission report would benefit not only people, human health and ecosystems, but would also benefit the soil globally, as more land could be released from intensive production of meat.

Meat production is a major source of food waste, as only a proportion of each livestock animal killed is actually made into human food, with a significant amount of unwanted or discarded material being transformed into waste, to be used as a co-fuel in cement production, or is incinerated. Growing specific crops for animal feed, is also a source of food waste, as not all of the crop is used; and the proportion which is used is converted very inefficiently into meat for human consumption.

"1. Unhealthy and unsustainably produced food poses a global risk to people and the planet. More than 820 million people have insufficient food and many more consume an unhealthy diet that contributes to premature death and morbidity. Moreover, global food production is the largest pressure caused by humans on Earth, threatening local ecosystems and the stability of the Earth system.

2. Current dietary trends, combined with projected population growth to about 10 billion by 2050, will exacerbate risks to people and planet. The global burden of non-communicable diseases is predicted to worsen and the effects of food production on greenhouse-gas emissions, nitrogen and phosphorus pollution, biodiversity loss, and water and land use will reduce the stability of the Earth system.

3. Transformation to healthy diets from sustainable food systems is necessary to achieve the UN Sustainable Development Goals and the Paris Agreement, and scientific targets for healthy diets and sustainable food production are needed to guide a Great Food Transformation.

4. Healthy diets have an appropriate caloric intake and consist of a diversity of plant-based foods, low amounts of animal source foods, unsaturated rather than saturated fats, and small amounts of refined grains, highly processed foods, and added sugars.

5. *Transformation to healthy diets by 2050 will require substantial dietary shifts, including a greater than 50% reduction in global consumption of unhealthy foods, such as red meat and sugar, and a greater than 100% increase in consumption of healthy foods, such as nuts, fruits, vegetables, and legumes. However, the changes needed differ greatly by region.*

6. *Dietary changes from current diets to healthy diets are likely to substantially benefit human health, averting about 10·8–11·6 million deaths per year, a reduction of 19·0–23·6%.*

7. *With food production causing major global environmental risks, sustainable food production needs to operate within the safe operating space for food systems at all scales on Earth. Therefore, sustainable food production for about 10 billion people should use no additional land, safeguard existing biodiversity, reduce consumptive water use and manage water responsibly, substantially reduce nitrogen and phosphorus pollution, produce zero carbon dioxide emissions, and cause no further increase in methane and nitrous oxide emissions.*

8. *Transformation to sustainable food production by 2050 will require at least a 75% reduction of yield gaps, global redistribution of nitrogen and phosphorus fertiliser use, recycling of phosphorus, radical improvements in efficiency of fertiliser and water use, rapid implementation of agricultural mitigation options to reduce greenhouse-gas emissions, adoption of land management practices that shift agriculture from a carbon source to sink, and a fundamental shift in production priorities.*

9. *The scientific targets for healthy diets from sustainable food systems are intertwined with all UN Sustainable Development Goals. For example, achieving these targets will depend on providing high-quality primary health care that integrates family planning and education on healthy diets. These targets and the Sustainable Development Goals on freshwater, climate, land, oceans, and biodiversity will be achieved through strong commitment to global partnerships and actions.*

10. *Achieving healthy diets from sustainable food systems for everyone will require substantial shifts towards healthy dietary patterns, large reductions in food losses and waste, and major improvements in food production practices. This universal goal for all humans is within reach but will require adoption of scientific targets by all sectors to stimulate a range of actions from individuals and organisations working in all sectors and at all scales."*

5.3 Changing Ireland's Agricultural and Food Production System

A report by agricultural scientist, James O'Donovan, entitled "*Transition to an Irish Vegan Agricultural System"*,[15] highlights major inefficiencies in the global agricultural system, in which 77% of total agricultural land is used to support livestock, producing only 18% of the global calorie supply.

This excellent and very detailed report advocates a transition from meat and dairy production in Ireland to a vegan agricultural system, pointing out that at present (2019), in Ireland, 97% of agricultural land is used for meat and dairy production. In the EU, in 2019, between 69% (€28.5 billion) and 79% (€32.6 billion) of the Common Agricultural Policy (CAP) direct payments were for livestock rearing.

The report recommends all small farms should be converted from animal agriculture to payment for ecosystem services, in total 43,600 small farms. This would potentially free up 0.46 Mha of land for restoration of native forestry, grasslands and wetlands; and these recommendations, if implemented, would directly benefit soil health. While James O'Donovan's report does not specifically address the need to reduce food waste, it is clear from his recommendations that the transition he recommends would result in a very significant reduction in the quantities of waste resulting from the slaughter of farm animals for food, and would also reduce the amounts of waste arising during the production of animal feed, significant amounts of which are wasted during the lengthy process from growing feed crops, through transportation, compounding of the feed, further transportation, and feeding this material to animals on Irish farms.

James O'Donovan's report concludes that:

> *"The most effective way for agriculture to change will come from changes in consumer behaviour supported by legal and policy supports for plant based agriculture from national governments and Global Agreements. In Europe and Ireland the CAP needs to change to stop subsidising meat and dairy production and instead support ecosystem services or plant based agricultural systems. A transition to a vegan agricultural system will enable us to:*
>
> - ✓ *stop agriculture from consuming more forests, grasslands and other ecosystems;*
> - ✓ *eliminate pesticides and antibiotics from agriculture;*
> - ✓ *gradually restore ecosystems and biodiversity and thereby reverse climate change;*
> - ✓ *boost the productivity of farms as plant based agriculture is much more efficient;*

[15] James O'Donovan, 2019. "Transition to an Irish Vegan Agricultural System". 96pp.

- ✓ *raise the efficiency of water and fertilizer use worldwide;*
- ✓ *reduce waste in food production and distribution as grains and legumes are much easier to store without deterioration.*

Globally switching to a whole food plant based diet has the potential to return millions of acres of land to wild habitat, to reverse rainforest destruction, to restore the health and volume of our freshwater rivers and lakes, to prevent further species extinctions, to eliminate billions of tons of pollutants (cow dung, carbon dioxide, methane, nitrous oxides, and ammonia), and to make a major contribution to stabilising and reversing climate change. Gradually as people become conscious of the ethical, environ- mental, economic, and health benefits then they will find the motivation to choose a plant based diet. When this happens is up to all of us. The faster we transition to a non-violent VAS (Vegan Agricultural System) the faster we can stem the haemorrhage of biodiversity loss and restore our health and the health of the planetary systems we depend on".

This report on the transformation of Irish agriculture summarises very well our own view of the situation, and what should be done at European level to create and implement the necessary changes to a more sustainable form of agriculture which would include a high level of soil and water protection, reduction of surface water and groundwater pollution, and reduction in the quantities of food waste being produced.

5.4 The Circular Economy Action Plan (CEAP)

Food waste has potential as a cornerstone of the circular economy. Currently food waste is an underused resource. Separate collection of biowaste will become mandatory by 2023 under the new Circular Economy legislation. The disposal of food waste in landfills is associated with groundwater pollution by leaching, and emissions of methane and other greenhouse gases.[16]

Additionally, we recommend the elimination of plastic food packaging where appropriate, to reduce contamination of food waste with plastic.

5.5 The European Green Deal and Farm to Fork Strategy

The New European Green Deal is promoting the recycling of nutrients from organic wastes into products that can be used as **soil improvers and fertilisers**, thereby reducing the use of mineral fertilisers. This strategy is in line with the Bioeconomy Strategy (COM/2018/673) to "*turn bio-waste, residues and discards into valuable resources and can create the innovations and incentives to help retailers and consumers cut food waste by 50% by 2030".* The reduction of food

[16] Kiran, E.U. and Liu, Y., 2015. Bioethanol production from mixed food waste by an effective enzymatic pretreatment. Fuel, 159, pp.463-469.

waste through these strategies would help reduce the total Municipal Solid Waste (MSW), as well as reducing environmental impacts.

5.6 Segregation at Source

Separation of food and other organic wastes from MSW is critical to ensure the high quality of the resulting compost. Improper separation will result in a lower quality compost with small glass and plastic fragments, with associated chemical and heavy metal contamination. Elimination of plastic packaging wherever possible should be a priority, to reduce reliance on petrochemicals and to facilitate the decomposition of food waste. Sources of heavy metals in MSW includes batteries, and other materials such as paints, electronics, ceramics, plastics, treated timber and inks/dyes. The heavy metal concentration of organic waste can increase through composting because of the reduction in total mass by the removal of water and carbon by microbial action.[17]

Residual food and other organic waste in MSW can be separated through screening. The resultant material is known as Mechanically Sorted Organic Residuals (MSOR). This fraction can be composted aerobically prior to landfilling to prevent excess methane emissions, or it can be used in the remediation of polluted industrial sites.[18] The separation of MSOR from MSW could help member states to reach statutory targets.

5.7 Raising Public Awareness of Food Waste Through Education

Most of the systemic challenges of eliminating food waste stem from certain mindsets and approaches that in turn come from the loss of the way in which we place a value on our food. For the majority of people in Western societies, access to food is so simple that there is an almost complete absence of concern about the increasing scarcity of food, nor sensitivity about poverty in Third World countries which is caused, to a significant extent, by excessive consumption in the West.

According to the Environmental Protection Agency (EPA), Ireland generates about 1.1 million tonnes of food waste per year, not including wasted food from primary production. An estimated 450.000 tonnes of food waste is produced in Ireland, every year, before the food reaches the consumer, which means that 40% of the food waste problem comes from food production. According to Mr Denis Naughten, former Irish Minister of Communications, Climate Action and

[17] Richard, T.L., 1992. Municipal solid waste composting: physical and biological processing. Biomass and bioenergy, 3(3-4), pp.163-180.

[18] Farrell, M. and Jones, D.L., 2009. Critical evaluation of municipal solid waste composting and potential compost markets. Bioresource technology, 100(19), pp.4301-4310.

Environment, apart from 40% of the food waste, 34% comes from the commercial sector and 25% from households.

Ireland is already making an effort toward minimizing food waste through the EPA-led National Waste Prevention Programme (NWPP). Nevertheless, it is our submission that at government level, more educational campaigns targeted at the public are vitally needed in order to raise awareness on the huge amount of food waste that is generated every year.

Household food waste is a global problem that is often dealt with by focusing on key behaviours leading to this overall waste stream. An important entry point to developing interventions is to understand food category-specific behavioural links to household food waste. Householders' perceptions of the safe consumption of food after the "best before" date have a significant negative association with all food waste categories.

Results reveal that overprovisioning leads to more waste of fruit and vegetables, dairy and frozen foods. Households' preference to consume the freshest possible food also results in more bread and bakery waste, and greater amounts of packaged food waste, compared to other food categories investigated. This submission therefore suggests a few key pointers to governmental action which may bring about much needed change.

5.8 Government Investment in Advertising

Social media, television and the press are the main sources of information and entertainment in everyday life. The inclusion of short advertising spots to raise awareness on food waste could have a significant effect. A good example could be a variety of high-quality ads promoted in numerous versions about the implications of food waste for our planet. Apart from the important messages that could be spread, adopting new habits could lead to significant changes, including new jobs and investments. Furthermore, food storage interventions offer a most promising way of reducing some categories of food waste, an action which could be popularized through the better and more frequent advertising of the benefits of making compost, and other alternative ways of consuming the leftovers.

5.9 Government Funding of Educational Programmes in Schools and Universities

Scientific research, the results and recommendations arising from such research, and the provision of tools to prevent and reduce food waste at schools, should be pursued with governmental funding and support.

Instruction and encouragement should begin at a young age; and that is one reason why it is imperative to start with efficient educational methods in schools. Creative and fun activities through educational programmes under the framework

of main studies or via summer schools and exchange programmes, which will boost a person's will and raise their sensitivity, are necessary.

In order for those actions to be implemented, research should firstly be carried out to determine the most appropriate course of action to be adopted on how to reduce food waste. Apart from the important findings that could arise, values and elements such as team spirit, dialogue and a sense of fair play would be enough to offer significant experiences and personal upgrades among students, teachers and employees.

5.10 Government Funding of Good Food Waste Practices for Hospitality Businesses

The simple practice of reducing the extravagantly large portions of food given by some restaurants could be a great start. Specific guidelines on food waste minimizing practices should be formulated and adopted by businesses. For example, Tesco has introduced a new application for store managers to alert local charities to surplus food that is available for collection at the end of the day. The same policy could be adopted by supermarkets, mini markets, restaurants and hotels in Ireland and in other EU Member States.

Among the tangible results, the Stop Wasting Food Movement has inspired the retail chain REMA 1000 to drop quantity discounts in the chain of more than 200 Danish stores. Quantity discount is seen as one of the reasons which sustains food waste, starting from private households, as it encourages consumers to buy more than they actually need. As stated, a drastic way to reduce the large quantities of food waste generated could be by eliminating incentives such as 1+1 coupons, where consumers can purchase two products for the price of one.

Government campaigns to demonstrate how individual food requirements can be calculated by households, to prevent excessive purchasing, could also have a part to play. Effective informational campaigns must have a practical approach and should use multiple communication channels. They should focus on the reasons for adopting a more sustainable lifestyle, as well as the health and economic benefits for individuals.

Government initiatives and funding should be used to increase public knowledge about the impacts of food waste, as well as food waste prevention measures among employees and employers both in the private and public sectors .

Underlining specific targets for actions that are within their sphere of influence could be achieved by educating the public with new skills related to the evaluation of food quality, understanding food durability labels, proper food storage, food preservation options and purchase planning. Logistical improvements could be achieved by operations such as stock management tools, selling food products near expiry at lower cost, reservation requirements for meals that help predict

food quantities and meet consumer preferences, ordering flexibility in hospitals to avoid serving patients' food they do not want to eat.

5.11 Government or EU Funding for a High Level Expert Group

It is our submission that a very effective way to reduce and prevent food waste is by investment in resources and knowledge through the establishment of special teams of experts who should be funded by the state. Research activities for quantifying food waste and identifying its composition is a workload which should be examined by distinguished scientists and experts, aiming for efficient positive results.

Teagasc, the Agriculture and Food Development Authority, is the national body in Ireland which provides research, advisory and training services to the agriculture and food industry and rural communities. The authority provides an excellent range of services, particularly to the farming community; but it is regarded as being heavily influenced by companies involved in the international food materials industry. Despite excellent work being done to promote organic agriculture, Teagasc is also regarded as a less than effective champion of ecologically based or organic agriculture.

As we submitted at the beginning of this document, Zero Waste Alliance Ireland considers that the problem of reducing food waste needs to be addressed at multiple levels of policy, and in the context of lifestyles, the economy, and other issues. This is a wider range of policy issues then can be addressed by Teagasc as currently constituted.

We would therefore suggest as an example that, in each member state, a smaller version of "*Champions 12.3"* should be established. Champions 12.3 is a coalition of executives from governments, businesses, international organizations, research institutions, farmer groups, and civil society dedicated to inspiring ambition, mobilizing action, and accelerating progress toward achieving SDG Target 12.3 by 2030.

At the 2015 United Nations General Assembly, countries formally adopted a set of seventeen Sustainable Development Goals (SDGs) as part of the Post-2015 Development Agenda. SDG 12 seeks to "*ensure sustainable consumption and production patterns."* The third target under this goal (Target 12.3) calls for cutting in half per capita global food waste at the retail and consumer level, and reducing food losses along production and supply chains (including post-harvest losses) by 2030.

To help convert Target 12.3 into reality, the global multi-stakeholder summit "*No More Food to Waste"* proposed an expert group which would champion the cause of achieving SDG Target 12.3 -- or "*Champions 12.3".* During the United Nations General Assembly's Sustainable Development Summit in September 2015, the government of The Netherlands formally called for its formation.

5.12 A Tax or Levy on Food Waste ?

According to the Irish Environmental Protection Agency, 25% of food produced is wasted, and it is estimated that this accounts for around 8% to 10% of carbon emissions worldwide.

According to the United States FDA, 41 million tonnes of food waste were generated in 2017, and only 6.3% was diverted from landfills or incineration (having been composted or otherwise utilised).

The best way to change this behaviour is by financial means, and it is our submission that a levy should be introduced on food waste that is deemed recyclable or reusable, but which is instead not recycled or reused. This would effectively increase the cost of failing to properly deal with food waste and would provide a financial incentive for companies to recycle or properly reuse their food waste. This would require a list of specific food waste to be created.

Such a levy would encourage producer and sellers to recycle or properly reuse food waste, thus reducing the amount sent to landfill or incinerated. The levy could start off very small, and should rise over years in order to gradually push companies and the public toward the recycling and reusing of food waste. Such a levy could also be expanded to include all food waste, as prevention is the best approach to tackling it.

In addition to a levy on food waste, a legal requirement could be introduced to recycle a set percentage of recyclable or reusable food waste. This would require companies to declare their amount of food waste, and a list of the worst performers could be published annually in order to further incentivise them to reduce or reuse their food waste. Grants could assist companies to improve food processing and to reduce food waste, with fines for companies that don't achieve the required percentage. This approach would strongly encourage companies to properly process their food waste. Initially this required percentage would start small and only include some sectors of business. Over time it could be expanded to all sectors and the percentage of food waste required to be properly processed could be increased.

Another method of potentially reducing food waste would be to consider a tax on unhealthy foods. A similar tax was implemented in Ireland on sugar-sweetened drinks; the suppliers of these drinks being liable for the tax. If a similar tax were to be introduced on unhealthy foods and drinks then it would achieve a double goal of reducing the consumption of unhealthy foods and reducing the packaging waste from these products. A list of such unhealthy foods and drinks would need to be maintained in order to facilitate this. Regulation of the advertising of such unhealthy foods and drinks could also be considered with a view to reducing the consumption and waste of both.

6. COMPOSTING TO EFFECTIVELY UTILISE FOOD WASTE AND TO ASSIST IN THE REDUCTION OF UNUSABLE FOOD WASTE

While the reduction and eventual elimination of food waste must be the primary goal of European Union policy, consideration should also be given to the best way of addressing those quantities of discarded food which cannot be prevented.

It is ZWAI's submission that one way of meeting this goal is with the large-scale implementation of composting and anaerobic digestion, on both a national level and within the private sector in every EU member state.

6.1 Anaerobic Fermenting and Biogas Production

Anaerobic composting of waste may result in increased nitrogen mineralisation. Once applied to soils, increased nitrogen uptake by plants, and increased vegetable yield can be expected compared with aerobic composting. Additionally, anaerobic composting is associated with reduced heavy metal contamination and reduced health risks.[19] Anaerobic treatment of biowaste can produce biogas as a co-product.[20]

Other valuable products of anaerobic treatment of food waste include ethanol,[21] lactic acid, and microbial oil.[22] Biogas production has been slow to gain widespread use due to resistance of some organic wastes to breakdown, especially ligno-cellulosic agricultural wastes.[23] However, food waste is more nutrient dense and generally more easily decomposed. Pre-treatment of organic waste can improve breakdown in anaerobic composting.[24]

19 Shah, G.M., Tufail, N., Bakhat, H.F., Ahmad, I., Shahid, M., Hammad, H.M., Nasim, W., Waqar, A., Rizwan, M. and Dong, R., 2019. Composting of municipal solid waste by different methods improved the growth of vegetables and reduced the health risks of cadmium and lead. Environmental Science and Pollution Research, 26(6), pp.5463-5474.

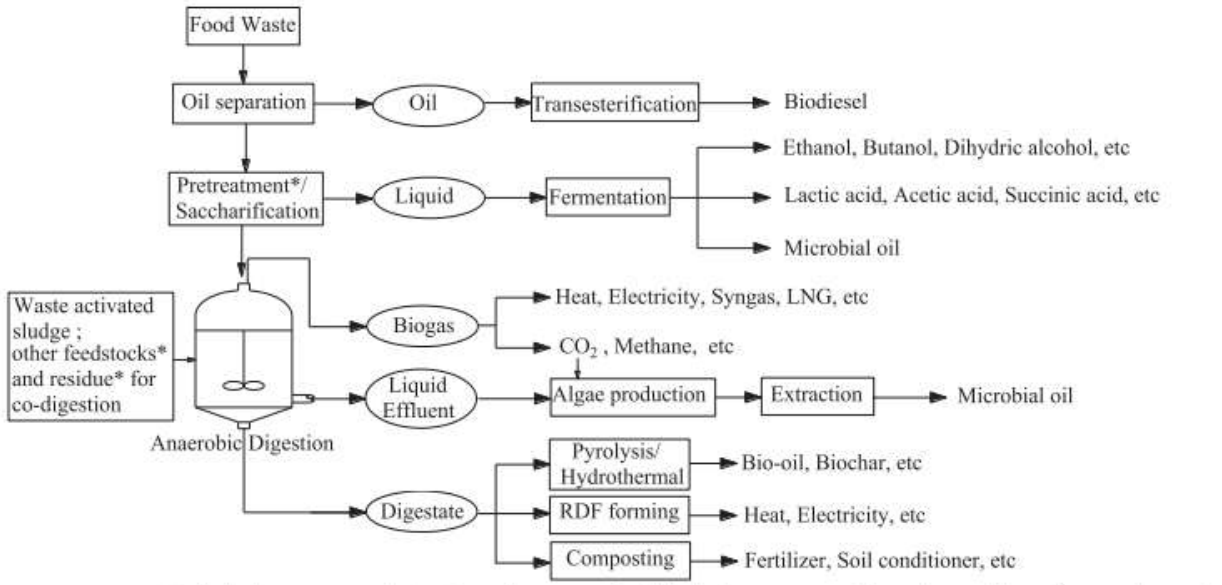
20 Bahreini, G., Nazari, L., Ho, D., Flannery, C.C., Elbeshbishy, E., Santoro, D. and Nakhla, G., 2020. Enzymatic pre-treatment for enhancement of primary sludge fermentation. Bioresource Technology, 305, p.123071.

21 Kiran, E.U. and Liu, Y., 2015. Bioethanol production from mixed food waste by an effective enzymatic pretreatment. Fuel, 159, pp.463-469.

22 Ren, Y., Yu, M., Wu, C., Wang, Q., Gao, M., Huang, Q. and Liu, Y., 2018. A comprehensive review on food waste anaerobic digestion: Research updates and tendencies. Bioresource technology, 247, pp.1069-1076.

23 Kainthola, J., Kalamdhad, A.S. and Goud, V.V., 2019. A review on enhanced biogas production from anaerobic digestion of lignocellulosic biomass by different enhancement techniques. Process Biochemistry, 84, pp.81-90.

24 Ariunbaatar, J., Panico, A., Esposito, G., Pirozzi, F. and Lens, P.N., 2014. Pretreatment methods to enhance anaerobic digestion of organic solid waste. Applied energy, 123, pp.143-156.



The biorefinery concept employs state of the art technologies to treat food waste and other organic wastes. Various useful end-products result.

6.2 Production of Biochar

Biochar is a carbon-rich material produced from the pyrolysis of organic matter (woody material, crop residuals, other organic wastes including food waste) at temperatures between 200°C and 1200°C in the absence of oxygen.[25] Biochar has multiple agronomic benefits when added to soil: improvements in water infiltration, water holding capacity, nutrient retention, nitrogen use efficiency, reductions in nutrient leaching, and erosion can be expected. [26] [27]

Biochar is generally resistant to breakdown by soil microbiota and therefore may persist in the soil for millennia. Charcoal presence in soil is used to confirm human activities dating back to the Neolithic and beyond.[28] Biochar contains 70 to 90%

[25] Spokas, K.A., Cantrell, K.B., Novak, J.M., Archer, D.W., Ippolito, J.A., Collins, H.P., Boateng, A.A., Lima, I.M., Lamb, M.C., McAloon, A.J. and Lentz, R.D., 2012. Biochar: a synthesis of its agronomic impact beyond carbon sequestration. Journal of environmental quality, 41(4), pp.973-989.

[26] Laird, D., Fleming, P., Wang, B., Horton, R. and Karlen, D., 2010. Biochar impact on nutrient leaching from a Midwestern agricultural soil. Geoderma, 158(3-4), pp.436-442.

[27] Blanco-Canqui, H., 2019. Biochar and water quality. Journal of Environmental Quality, 48(1), pp.2-15.

[28] Novák, J., Roleček, J., Dresler, P. and Hájek, M., 2019. Soil charcoal elucidates the role of humans in the development of landscape of extreme biodiversity. Land Degradation & Development, 30(13), pp.1607-1619.

stable carbon,[29] and though recalcitrance in soil may vary depending on composition,[30] its long-term carbon storage capabilities are beyond doubt.[31] This poses an opportunity for **long-term carbon sequestration** in soil and **valorisation of organic waste,** with great potential for use in **carbon farming**. Compared with purposefully grown biomass, biochar produced from waste food will result in overall lower carbon emissions.[32]

Biochar is attracting attention as a valuable end-product of bio-waste for soil improvement and carbon sequestration.

Life Cycle Analysis (LCA) can be used a method to determine the carbon sequestration potential of biochar. LCA literature on biochar has increased two-fold in the last five years, through Web of Science and Google Scholar analysis. An extensive review of LCA on biochar taking into account the pyrolysis process, greenhouse gas emissions, air pollution, health effects, environmental barriers, and economic aspects concluded that biochar has good carbon reduction

[29] Hammond, J., Shackley, S., Sohi, S. and Brownsort, P., 2011. Prospective life cycle carbon abatement for pyrolysis biochar systems in the UK. Energy policy, 39(5), pp.2646-2655.

[30] Enders, A., Hanley, K., Whitman, T., Joseph, S. and Lehmann, J., 2012. Characterization of biochars to evaluate recalcitrance and agronomic performance. Bioresource technology, 114, pp.644-653.

[31] Li, X., Wang, R., Shao, C., Li, D., Bai, S., Hou, N. and Zhao, X., 2022. Biochar and Hydrochar from Agricultural Residues for Soil Conditioning: Life Cycle Assessment and Microbially Mediated C and N Cycles. ACS Sustainable Chemistry & Engineering, 10(11), pp.3574-3583.

[32] Matuštík, J., Hnátková, T. and Kočí, V., 2020. Life cycle assessment of biochar-to-soil systems: A review. Journal of Cleaner Production, 259, p.120998.

potential in the management of agro-residues.[33] Biochar also has potential for wastewater treatment. Interaction between phosphorus and biochar surface results in the removal of P from wastewater with minimal environmental impact.[34]

6.3 Biochar and Compost Combination

The EU 7th FP project "FERTIPLUS" trialled the performance of organic soil amendments over three consecutive years under different agro-climatic conditions in Europe.[35] Field-scale applications of biochar, compost and biochar-blended compost were carried out. The study "*confirmed the potential of biochar to improve soil physical properties in three out of four trials and to achieve a long-lasting increase of soil C in all tested agro-climatic regions*".

In a plant growth experiment at University College Cork, Ireland, the addition of biochar and mature compost to soil showed mostly neutral effects, except for perennial ryegrass, which showed increased growth and yield.[36] The results suggest that biochar could be added to biowaste before composting.

The addition of biochar at the beginning of the composting process results in **co-composted biochar (COMBI)**.[37] Application of COMBI to contaminated soils results in reduced heavy metal availability to plants due to bio-sorbent effects. The addition of COMBI to soil may have enormous benefits in waste reduction, leaching and emission reduction, crop productivity and heavy metal contamination mitigation. These benefits suggest the great potential of MSW-derived COMBI for **carbon farming**. However, more research is needed in this area, as some studies suggest not all crop plants produce greater yield in response to COMBI application, though soil carbon, soil nutrient levels and greenhouse gas emission levels improve.[38]

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[33] Zhu, X., Labianca, C., He, M., Luo, Z., Wu, C., You, S. and Tsang, D.C., 2022. Life-cycle assessment of pyrolysis processes for sustainable production of biochar from agro-residues. Bioresource Technology, p.127601.

[34] Nobaharan, K., Bagheri Novair, S., Asgari Lajayer, B. and van Hullebusch, E.D., 2021. Phosphorus removal from wastewater: The potential use of biochar and the key controlling factors. Water, 13(4), p.517.

[35] Sánchez-Monedero, M.A., Cayuela, M.L., Sánchez-García, M., Vandecasteele, B., D'Hose, T., López, G., Martínez-Gaitán, C., Kuikman, P.J., Sinicco, T. and Mondini, C., 2019. Agronomic evaluation of biochar, compost and biochar-blended compost across different cropping systems: Perspective from the European project FERTIPLUS. Agronomy, 9(5), p.225.

[36] Hynes, E., 2021. Biochar as a plant growth substrate amendment.

[37] Antonangelo, J.A., Sun, X. and Zhang, H., 2021. The roles of co-composted biochar (COMBI) in improving soil quality, crop productivity, and toxic metal amelioration. Journal of Environmental Management, 277, p.111443.

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6.4 Aerobic Composting as a Method of Utilising Food Waste

Composting is the biological breakdown of organic matter aerobically to form a stable, humus-like end product. The breakdown is carried out by a diverse range of microbes, while significant heat is generated through aerobic respiration. This heat can be sufficient to eliminate pathogens. The addition of compost to soils is associated with significant benefits, especially in degraded urban soils. Improvements in bulk density, infiltration, and hydraulic conductivity have been reported.[39]

It is our submission that there is a lack of attention given to composting as a treatment option for organic waste, and especially food waste, in the Waste Framework Directive.

Properly composting food waste can significantly reduce the amount of methane released to atmosphere. Using conventional methods, composting generally takes between 6 and 24 months to produce compost that is ready to grow plants.

There are faster systems however, such as the composter being trialled as a pilot-scale research project by Zero Waste Alliance Ireland – this medium-scale composter (suitable for a shop, hotel, restaurant, hospital, school or canteen) has a heating element which keeps the food waste at the best temperature for microbial degradation, while at the same time the machine gently turns the developing compost so as to maintain aerobic conditions and the correct temperature for thermophilic micro-organisms which break down the food waste (Figures 6.4.1 and 6.4.2 below). This composter can produce a usable compost within 24 hours.

BioCoTech, a company based in Norway, produces a similar composter, utilising mesophilic and thermophilic microbes at temperatures of up to 80ºC. This firm claims that the microbes function under optimal conditions, can degrade cellulose and can produce an accelerated and continuous decomposition of organic material into compost powder, in some 24 to 72 hours (Figure 6.4.3 below).

A Swedish *Joraform* composter, owned and operated by the Cork Urban Soil Project,[40] operates with a slightly different system in which the compost is not heated, and therefore production takes some two or three weeks to produce the final compost. This machine has been successfully producing compost for a number of months; and the company which manufactures it (in Sweden) has a long history of manufacturing similar types of aerobic composters (Figures 6.4.4 and 6.4.5 below).

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[39] Kranz, C.N., McLaughlin, R.A., Johnson, A., Miller, G. and Heitman, J.L., 2020. The effects of compost incorporation on soil physical properties in urban soils–A concise review. Journal of Environmental Management, 261, p.110209.

[40] https://www.urbansoilproject.com/

Figure 6.4.1 **Interior of the aerobic composter being trialled on a pilot scale by Zero Waste Alliance Ireland, showing the rotating mixer which keeps the food waste aerated.**

Figure 6.4.2 **Sample of the compost produced by the Zero Waste Alliance Ireland composter; this machine, which incorporates a heating element, produces compost in 24 hours, utilising thermophilic micro-organisms.**

Figure 6.4.3 BioCoTech composter manufactured in Norway.

Figure 6.4.4 *Joraform* composter, at the Cork Urban Soil Project.

Maeko, a company committed to reducing Malaysia's food waste and based in Kuala Lumpur, has developed a machine which produces compost in an anaerobic environment in which the temperature and airflow are closely controlled. The machine crushes the waste and agitates it to speed up the process – resulting in a bio-organic compost that's ready to use within a day. The company has succeeded in eliminating the unpleasant smells normally associated with rotting food, the machine's ventilation system uses bio-enzyme filtration to eliminate odours as it breaks down all types of food waste, including bones and egg and seafood shells. The Maeko company has a range of industrial composters aimed at shops, restaurants, hotels, schools, as well as smaller machines intended for home use by consumers (Figure 6.4.6 below).

Figure 6.4.5 **Swedish *Joraform* aerobic composter, which takes 2 to 3 weeks to produce compost.**

Figure 6.4.6 **Maeko composter, which can produce compost in 24 hours.**

There are already existing solutions to the food waste crisis which are ready to be implemented by small and medium-sized enterprises (SMEs), in close-to-market conditions and at industrial or commercial scale. If there were more incentives for both public and private sectors to implement their use, food waste could be utilised more effectively, ultimately reducing greenhouse gas emissions.

By providing onsite composting solutions for all kinds of businesses and homes, composting machines can significantly contribute to "closing the loop" of sustainability, ensuring that waste food goes back into farms and gardens as fertilizer to grow more food. The resulting compost could be used for the large-scale introduction of community supported gardens, as well as compost donations to the agricultural sectors in member states, as well as fertiliser for public parks and gardens.

Dealing with the complex issue of food waste will require a range of policy and other interventions, including national strategies with strong grant schemes and incentives.

6.5 Conclusions on Composting

Reduction of food waste at source is key to the Circular Economy Action Plan. Furthermore, the separation of food waste from MSW is fundamental to reducing total MSW and dependence on landfilling as a treatment. The diversion of food waste from landfill already has positive environmental impacts, such as reduced methane emissions, reduced nutrient leaching and reduced groundwater pollution.

Additionally, the valorisation of food waste through composting is a treatment option that is under-represented in the Waste Framework Directive. Compost is a useful product for agricultural and urban soil improvement; and compost addition to agricultural soil is associated with improved water penetration and retention, as well as reduced synthetic fertiliser reliance.

Increased composting of food waste which cannot be prevented may help Member States to reach food waste reduction targets. Barriers to composting include heavy metal contamination, non-biodegradable plastic food packaging and complexities of separation at source.

The co-composting of food waste with biochar (COMBI) deserves more attention as a viable option for carbon sequestration, soil phosphorous retention, food security, greenhouse gas reduction, soil health improvement and reduction of reliance on synthetic fertilisers and pesticides, in line with the Farm to Fork strategy.

Great strides must be made in these areas if we are to remain within planetary boundaries and a safe operating space for humanity.

6.6 Food Waste as Animal Feed

Feeding animals, particularly those on farms, with food scraps or waste is an age-old practice. Some 30% of what is fed to livestock around the world today is either waste from food supply chains or by-products from growing and processing food. In the US, about 10% of surplus food is already being sent to feed animals, most coming from manufacturing or grocery stores.

But there is another 14.7 million tonnes of food waste in the US alone that could possible be used for animal feed. More circular systems that repurpose nutrients for feed can also help to reduce other major environmental impacts of producing feed crops like land, energy, and water use, while bolstering food security.

Unfortunately, swapping all this food waste back into the feed chain is not so simple – farmers need to consider what's healthiest for their livestock, it must be consistently available, cost-efficient, and we also need to understand the environmental impacts, benefits, and trade-offs of how that waste would get turned into animal feed.

In the United States, WWF, in partnership with Quantis, Penn State University, and with support and data sharing from several other farms, universities, and retailers, explored three different pathways of transforming food waste into feed for egg-laying hens and compared them to standard feed production.

All food-waste-to-feed ingredient production had a positive impact on land use as compared to the standard, meaning that using any of the waste options could help to avoid additional land conversion for growing feed crops. However, bakery meal was the only ingredient that had consistently positive environmental impact indicators and has the potential to be a positive alternative to conventional ingredients in a hen's diet.

The study revealed several new questions, such as what are the most beneficial uses of food waste that can't be repurposed for human consumption? How do those uses differ by the stages of production where food waste occurs, food category, or animal type?

In Ireland, and in Britain also, we have strong memories of animal waste being fed to ruminants, with the result that a major outbreak of Bovine Spongiform Encephalopathy occurred a few decades ago. Unless the precautions to prevent the outbreak or spread of any disease resulting from the feeding of food waste to farm livestock can show that the risk has been eliminated, we would not be in favour of this disposal route for unwanted food.

7. SUBMISSION CONCLUSIONS

The discarding of significant amounts of food at all stages of production, transport, distribution, retailing and consumption is a sad reflection of the inefficiency in our food systems; yet we tolerate this large-scale generation of food waste as if it were unavoidable. We hope that in this submission we have shown that, even if food waste cannot be completely prevented, it can be utilised by returning it to the soil in the form of a usable compost.

There is an increasing awareness that Europe's soils are at a high risk situation, mainly as a result of excessive application of agricultural synthetic fertilisers and chemicals. Thus, any method of restoring soils to their full functionality as ecosystems capable of growing food crops and other useful plants should be welcomed by the European Commission, and should be included as an aim or objective in the revised Waste Framework Directive.

It is our submission that one of the best ways to achieve this aim is by setting legally enforceable targets for food waste prevention, reduction and utilisation in environmentally sustainable ways. In our submission, we have suggested a number of methods by which this can be achieved, including composting aerobically as a way of returning to the soil organic matter which we take out of it when we grow food or eat farm animals which have grazed on those soils.

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Zero Waste Alliance Ireland

This submission was researched and written by five members of Zero Waste Alliance Ireland: Jack Coffey (member and researcher, who contributed the section on composting), Ioanna Votsku (member and researcher, who contributed the section on raising public awareness), Nazia N. Husain (member and researcher, who contributed the section on food waste reduction targets), Orla Coutin (researcher and membership secretary who contributed further information on composting and who kept other team members working to schedule), and Jack O'Sullivan (ZWAI founder member and Director), who added further policy analyses and edited the submission. The team also had the benefit of encouragement from Ollan Herr (Director and Chair of the Board of ZWAI).

24 August 2022