THE EU'S FARM TO FORK STRATEGY: MISSING LINKS FOR TRANSFORMATION

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Abstract
The Farm-to-Fork strategy, launched in May 2020, is the first attempt at a European-wide approach to food systems of this scale. The strategy sets ambitious targets and aims to create a 'fair, healthy, and environmentally friendly food system'. Yet, within the bounds of its own regulatory and legislative context (including the Green Deal, the Circular Economy Action Plan and the new Biodiversity Strategy 2030), the strategy falls short of recognizing key links in and between the food system. This review posits that the strategy and its targets do not adequately consider the importance of transforming agricultural practices for environmental outcomes; of agricultural practices for nutrition outcomes; nor the links between how we value nutrition along the supply chain, from farm to fork.

Keywords
food systems; food security; Green Deal; European Union; nutrition; agriculture.

Introduction

The Farm-to-Fork (F2F) strategy, launched on the 20th May 2020 is a first attempt at a European-wide approach to food systems [1]. The F2F strategy makes bold commitments and outlines actions to accelerate the achievement of a sustainable food system across Europe. The urgency of implementing the EU's vision for sustainable, resilient food systems was clear even in the earliest stages of the COVID crisis, which highlighted challenges and risks relating to food safety, traceability, and availability. The F2F strategy is encapsulated in the wider European Green Deal [2], launched in December 2019.

The European Green Deal is a roadmap to guide Europe towards becoming 'the first climate-neutral continent' – an ambition that is only conceivable thanks to the cross-border agreements facilitated by the Union's common institutions. The Green Deal has three main objectives for a new growth strategy: zero emissions of GHG by 2050; decoupling economic growth from resource use; and leaving no person nor place behind. It sends a strong and clear message: the EU is on the path to transforming its economic and commercial landscapes. However, the Green Deal cannot be achieved without the implementation of several interconnected strategies including the new Circular Economy Action Plan [3], Biodiversity Strategy 2030 [4], and the F2F strategy.

The F2F strategy's aim 'for a fair, healthy and environmentally-friendly food system' through an approach that renews 'how Europeans value food sustainability', can be unpacked by considering concepts of food system, food and nutrition security, interdependence and value.
The FAO (2018) defines a food system as one encompassing:

> "*the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry or fisheries, and parts of the broader economic, societal and natural environments in which they are embedded*" [5].

Until this year, the commonly accepted conceptualisation of food and nutrition security encompassed just four components: *availability, access, utilisation, and stability*. On the 25th June 2020, the High Level Panel of Experts[1] (HLPE) produced their 15th report on food security and nutrition for the Committee on World Food Security [6]. In this report, two components were added to the concept of food security: *agency and sustainability*.

[1] The High Level Panel of Experts on Food Security and Nutrition, a science-policy interface of the UN Committee on World Food Security (CFS), was created in October 2009 as an essential element of the CFS reform.

> Agency*: capacity of individuals or groups to make their own decisions about what foods they eat, what foods they produce, how that food is produced, processed and distributed within food systems, and their ability to engage in processes that shape food system policies and governance.*
>
> Sustainability*: long-term ability of food systems to provide food security and nutrition in a way that does not compromise the economic, social and environmental bases that generate food security and nutrition for future generations.*

These additional concepts, along with the FAO (2018) definition of a food system and its interlinkages, provide space for considering the intricate interdependencies between the food system's components; and emphasise the need for policies that appreciate the interconnectedness of different systems and sectors to achieve 'regenerative, productive and resilient food systems'. Further, the definition of 'agency' acknowledges individuals as citizens (e.g. recognising a group's agency), rather than as consumers only, thus providing space for interdependencies at structural, spatial, and temporal levels to be considered (e.g. future generation's welfare) [7].

Further, the HLPE report highlights the need for a rights-based approach to underpin this framework, and 'widen our understanding of food security and to adopt a food systems framework'. Action Aid (2019) argue that a just transition must include a food system that not only benefits 'nature and the climate but also ensures the right to food for all' [8]. The F2F suggests alignment with these concepts in its aim for a 'fair' system to be achieved through a 'just transition'.

Although the strategy represents a starting point – a roadmap for future legislation – its vision will define the outcomes and thus the F2F aim to renew 'how Europeans value food systems' is crucial. Indeed, the fundamental values associated with food systems will influence the approach and methods chosen, which 'define the logic of the appraisal process and influence the output' [7]. Meaning, if the value of sustainability is measured within a market based approach then the tendency will be to measure value based on individual preference, as a consumer. On the other hand, a justice-driven approach will tend to consider value from the perspective of an individual's values as part of a community, or as a citizen [7]. The former focusses on improved efficiency, technological innovation, free trade, and pricing mechanisms, whereas the latter provides space for interdependencies [9, 10].
For policy makers, such interdependence can mean facing the fragile balance of trade-offs between differing structural and temporal objectives, such as between short-term agricultural development or long-term environmental preservation, or competition for the use of natural resources. Further, interdependence means decisions made by one agent can affect another's choices, which can lead to conflict over the use of natural resources [7, 11]. Yet, an efficient sustainable food system needs policy coherence across these different objectives (including health and agriculture) [12], as fragmented governance can lead to policy inertia and threaten progress [6]. Further, Benton & Baily (2019) argue that a sustainable food system is one that reframes efficiency so that it means food systems deliver profits, healthy diets, and a healthy planet, rather than trade, yield (increasing), and price (decreasing) policies [13].

In theory, the F2F strategy aligns with these concepts and approaches to achieving a 'fair, healthy, and environmentally-friendly food system', but the depth of the systems approach is unclear. It recognises the need to ensure 'agency' of individuals through initiatives to empower individuals (referred to interchangeably as consumers and citizens) and aims for a 'just transition'. Yet the inter-linkages between the stages and components of the food system are not always explicit.
This article aims to gain further insight into the F2F strategy by providing an overview of the strategy and its intended and potential environmental, social, economic and policy impacts. Then, in the context of the above conceptualisation of an efficient, coherent and sustainable food system, section II considers F2F's approach to agriculture and nutrition. Specifically, the article considers how these components of the food system might be redesigned to align with the new conceptualisation of food security.

Methods
This article was informed by a review of grey literature, including key policy documents and data relating to the European Green Deal, namely the F2F strategy, the Action Plans for the Circular Economy 2015 and 2020, and the Biodiversity Strategy 2030. Analyses were based on three main frameworks. First, as described in the

introduction, the analyses relies on the new Sustainable Food System Framework developed in the HLPE's 15th report Food security and nutrition: building a global narrative towards 2030. Second, the FAO framework for sustainable food systems [5] was the foundation for the critical analysis of the F2F approach. This definition allows for the interlinkages between the food systems various components to be considered at policy level. Third, based on concepts of policy coherence for development – for which the EU is the only region in the world to have a legal commitment in this regard, enshrined in the Treaty on the Functioning of the European Union – which can be considered achieved when policy actions across sectors and stakeholders are actively aligned towards meeting agreed objectives [12].

To inform trend analyses, data were sourced from the Eurostat database: (https://ec.europa.eu/eurostat/data/database). Latest available data were used where possible. Because the EU is an aggregate of countries yet is not static (e.g. expansion or withdrawal of members), some datasets retroactively apply a constant membership definition (and are hence subject to revision) but others describe a different population at different times. This leads to the 'EU Changing Composition' aggregation. Because not all data is aggregated for the newly composed EU (EU27, excluding the UK), for consistency, the EU Changing

Composition aggregation (as of June 2020) was used throughout. For Figure 1 data were used from 2005 only due to missing data for some years (2001 and 2004). Simple linear trend analyses, data was extrapolated to understand Business as Usual (BAU) and F2F target trajectories towards 2030. For Table 2, data were sourced from the 2016 report by the European Community Supported Agriculture (CSA) Research Group: Overview of Community Supported Agriculture in Europe.

The data used for Map 1 are sourced from Eurostat and based on the indicator 'overweight'. The indicator reflects the share of overweight within the population based on their body mass index (BMI). BMI is defined as the weight in kilos divided by the square of the height in meters. People aged 18 years or over are considered obese with a BMI equal or greater than 30. Other categories are: underweight (BMI less than 18.5), normal weight (BMI between 18.5 and less than 25), and pre-obese (BMI between 25 and less than 30). The category overweight (BMI equal or greater than 25) combines the two categories pre-obese and obese.

Map 2 data were sourced from Eurostat based on the indicator 'estimated soil erosion by water - % of area affected by severe erosion rate'. The indicator, expressed as a percentage of the total non-artificial erosive area in the country, estimates the soil loss by water erosion processes (rain splash, sheetwash and rills) and gives an indication of the area under risk of being affected by a certain rate of soil erosion (severe soil loss, E > 10 tonnes/hectare/year). Where there is no area of land that is in risk of being subject to soil erosion by water of more than 10 tonnes per hectare, a country will have a zero value. Soil erosion may still be occurring in areas of those countries, but at a rate of less than 10 tonnes per hectare.

Limitations

Missing data limited the potential for historic trends, and of a comprehensive comparative analysis (e.g. number of CSAs in member states). Further, the indicators used to establish levels of overweight, or environmental degradation are useful as proxies only, and only reflect a small slice of the nutritional or planetary health stories.

I. Overview

a. An ambitious opportunity

The F2F strategy is a first attempt at developing a European-wide approach to creating sustainable food systems, which in itself is ambitious considering the diversity of institutional, geographic and demographic contexts across the EU member states. It allows 27 countries to act collectively and in harmony towards a 'fair, healthy, and environmentally-friendly food system' based on three main components:

1. Building the food chain that works for consumers, producers, climate and the environment
2. Enabling the transition
3. Promoting the global transition

The EU is uniquely positioned to leverage its institutional capacity to support progress towards sustainable food systems. Although other regional powers exist (e.g. APEC, ASEAN, EAEU, MERCOSUR, etc.) these tend to be concentrated on trade and economics and lack the common institutional foundation and frameworks within which the European Union operates. The EU institutions provide a judicial system to hold members accountable, and a space to harmonise decisions across member states. This is crucial for decisions relating to environmental

challenges, as each country's boundaries do not reflect the boundaries of the ecosystems within which they operate.
Further, the EU provides a space for shared knowledge, and collaborate in cross-country research and development. F2F promises to continue in this line, identifying Research and Innovation as 'key drivers' in accelerating a just transition to sustainable food systems, with EUR1 billion to be spent this year for the Green Deal priorities under Horizon 2020. Horizon 2020 was the EU's largest research and innovation programme to date, with around EUR 80 billion available every seven years to support the implementation of the Innovation Union [14], representing roughly 27% of total EU funding for R&D over a seven year period (see appendix 2). Between 2014 and 2016, 65% of these financial contributions were related to sustainability (surpassing its 60% target) and 28% were related to climate challenges (falling short of its 35% target) [15]. Horizon Europe (H2020's successor) proposes to spend EUR 10 billion on sectors relating to food systems, such as the bioeconomy and nature-based solutions to agri-food, representing 10% of Horizon Europe's budget until 2027 [16].

The strategy addresses sensitive issues, clearly acknowledging the risks and concerns expressed by the Union's citizens. For example, it acknowledges - without vilifying – the specific role of retailers and processers, and marketing, namely in influencing consumer's dietary choices and the shaping of the food supply chain. Further, when the potential for biotechnology (including GMOs) is raised, the Commission is quick to add that these may play a role only if they are 'safe for consumers and the environment while bringing benefits for society as a whole'.

The strategy's targets are ambitious, particularly considering the current trends and trajectories. These include to:

- reduce the overall use and risk of chemical pesticides by 50% and the use of more hazardous pesticides by 50% by 2030.
- enhance provisions on integrated pest management and promote greater use of safe alternative ways of protecting harvests from pests and diseases.
- reduce nutrient losses by at least 50%, while ensuring that there is no deterioration in soil fertility, with a view to reducing the use of fertilisers by at least 20% by 2030.
- achieve at least 25% of the EU's agricultural land under organic farming by 2030
- revise animal welfare legislation

The ambitious nature of these targets can be exemplified by the fact that the EU would need to increase by nearly 2.5 times its current rate of growth to achieve the target of 25% of agricultural land under organic farming.

Figure 1 below shows the EU's trend in a business as usual approach vs the trajectory required to achieve the target. In the BAU scenario, just 10.3% of EU agricultural land would be under organic production by 2030. This target prompts member states to double the speed of growth from 5% between 2005 and 2018 to an 11% annual growth rate between now and 2030, to reach the 25% F2F target (see appendix 1).

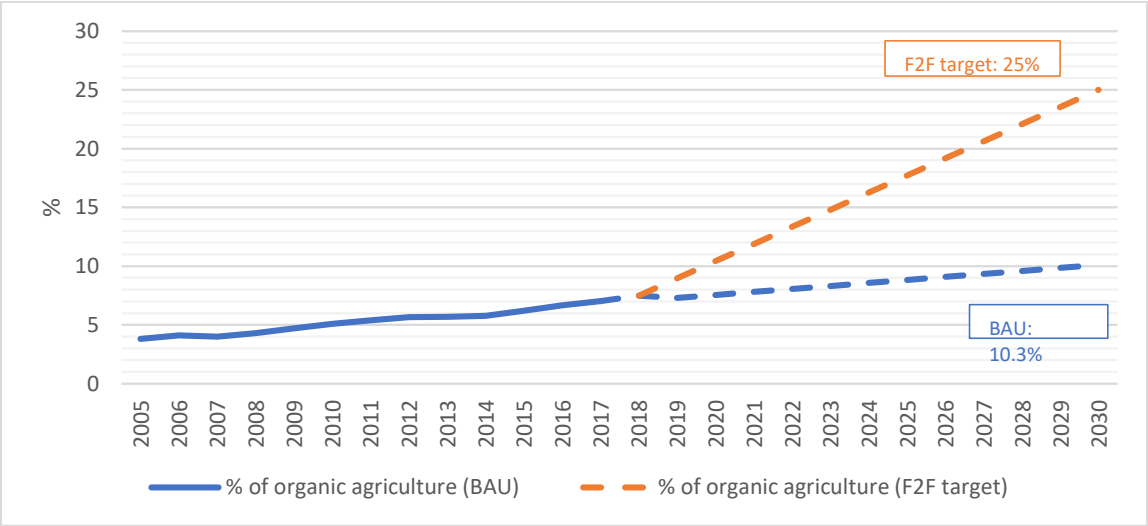


Fig. 1. Trend in agricultural land under organic farming in the EU 28 (2000 – 2030). *Source: Eurostat and author's calculations*

b. Impact

Globally, estimates suggest that moving towards sustainable food and agriculture systems could generate new economic value of more than EUR 1.8 trillion [17]. The agriculture, construction, and the food and drinks sectors in Europe - all highly dependent on nature - generate more than EUR 7 trillion per year. At the same time, in the EU, as of 2017, 950,000 deaths were associated with unhealthy diets [18]. Through F2F, the EU aims to leverage the economic potential of a transition towards more sustainable systems and reduce the health costs associated with unhealthy diets. The EU specifically promises the following impact:

Table 1. Economic, social, and environmental impacts of the Farm to Fork strategy. *Source: European Commission Farm to Fork Strategy*

Economic and social impact for farmers [19]	Economic impact of biodiversity [20]
• Higher returns for farmers and food producers by linking sustainable production methods to premium consumer demand • A stronger role in the supply chain • New business opportunities (e.g. plant protein sector or bioeconomy) • Lower costs through higher productivity and reduced inputs, led by innovation, technological and digital solutions. • Stronger connection with consumers • Additional export opportunities through new global markets	• Increased annual profits of the seafood industry by more than €49 billion by conserving marine stocks • Save the insurance industry around €50 billion annually through reducing flood damage losses by protecting coastal wetlands • Increased employment through directly and indirectly related jobs

These intended impacts align with the F2F and HLPE's objectives, particularly in increasing farmers' agency by ensuring a 'stronger role' and bargaining power in the supply chain. However, the stated impacts are largely focussed on the short-term goals and maintains a focus on 'lower costs through higher productivity' to be driven by technological solutions. Further, the concept of longer-term goals is limited to ensuring the EU's competitive capacity in transitioning and building resilience to future pandemics and diseases. Thus, the F2F strategy diverges from the concept of sustainability by overemphasising short-term economic goals.

Transitioning to a food systems approach will also have an impact on national policymaking approaches, as policymakers will need to collaborate with stakeholders from a variety of backgrounds and across different institutional levels. The HPLE report 2020 identify four key policy shifts required to achieve sustainable food systems:

1. Recognise the need for radical transformation of food systems
2. View food and nutrition security as a system interconnected with other systems and sectors
3. Focus on hunger and all forms of malnutrition
4. Recognise food and nutrition security as context specific and requiring diverse solutions.

The report also emphasises the importance of coherent governance and research, including investing in public research. This can mean creating inter-governmental working groups or committees and engaging in participatory planning processes. The Dutch government, for example, is leading the way by institutionalising this systemic approach in their Ministry of agriculture, nature, and food quality, which is currently experimenting with 'circularity in agricultural production' [21]. Further data relating to the needs of individuals and communities and the environmental context, need to be created or improved upon, particularly for transparency purposes. Specifically, as outlined in the F2F strategy, spatial data can play a key role in informing effective decisions for agricultural production. Aligning with global standards and agreements, such as incorporating the UN's SEEA into national accounting systems can also help leverage momentum and garner political support and investment.
Policy makers will also need to consider programmes and initiatives that encourage systemic, transformative (albeit incremental) shifts. Introducing or strengthening the right to food at national level may provide the basis for this transformational shift and needs to be enshrined in national legislation. The rights-based approach, for

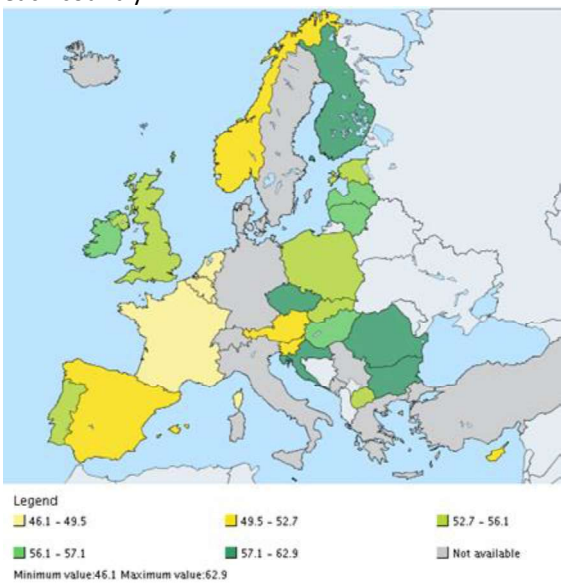
example, might mean providing nature with rights of its own, both legislatively and/or in institutional decision-making processes [22].

Further, in dealing with an EU-wide approach, the importance of context-specific solutions is clear in the differing needs, legislative set-ups, and ecoregion types across the member states. For example, supporting shorter food supply chains would look quite different depending on the country context. The table below highlights the significant range in terms of the number of 'community supported agriculture' (CSA) groups across 21 countries in Europe. CSA is defined as "a direct partnership between a group of consumers and producer(s) whereby the risks, responsibilities and rewards of farming activities are shared through long-term agreements. Generally operating on a small and local scale, CSA aims at providing quality food produced in an agroecological way." It is considered as one way of categorising local food markets by the European Parliamentary Research Service. Countries such as Serbia, Ireland and Greece may need policies to support awareness and behavioural change whereas places like France and Belgium may benefit from policies that support broader access through improved infrastructure.

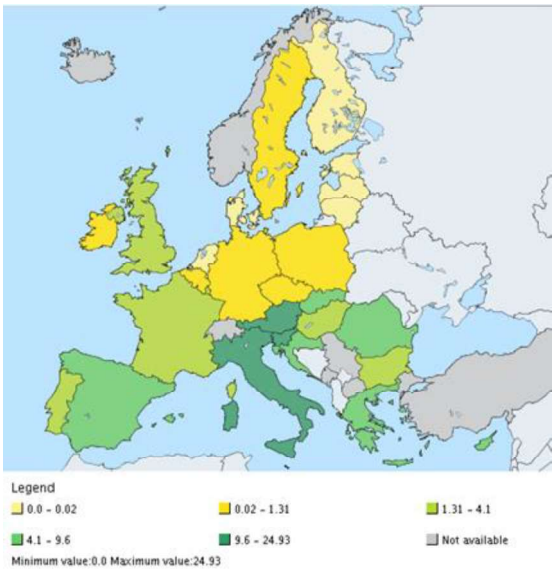
Table 2. Number of local food markets in 21 European cities. *Source: European CSA Research Group (2016): Overview* of Community *Supported Agriculture in Europe, available online: https://www.accesstoland.eu/IMG/pdf/overview-of-community-supported-agriculture-in-europe-f.pdf*

Country	Number of CSA groups	Country	Number of CSA groups
1. France	2000	12. Croatia	20
2. Belgium	138	13. Romania	15
3. Italy	104	14. Hungary	12
4. Germany	92	15. Sweden	12
5. United Kingdom	80	16. Finland	10
6. Spain	75	17. Slovakia	10
7. Switzerland	60	18. Poland	8
8. Netherlands	47	19. Greece	7
9. Norway	35	20. Ireland	7
10. Austria	26	21. Serbia	2
11. Czech Republic	23		

The same applies for nutrition-related policies where the percentage of population overweight, for example, varies significantly from one country to the next as shown in Map 1, below. Map 2 further highlights this point by showing the diversity in terms of soil erosion across EU member states, which should influence agricultural and environmental policies in each country.



Map 1. Percentage of overweight adults across EU member States. *Source: Eurostat, % of population aged 18 or over, 2017*



Map 2. Percentage of soil erosion by water pf total non-artificial erosive area.
Source: Eurostat, % of area affected by severe erosion rate

Finally, for an efficient sustainable food system, policy coherence needs to be applied across different sectors (including nutrition and agriculture). Hawkes (2017) [12] argues that to create policy coherence, the question 'coherence for what?' must be answered. In this case, the response is: a fair, healthy, and environmentally friendly food system. Benton & Baily (2019) argue that a sustainable food system is one that reframes efficiency; and develops policies that aim for food systems to deliver profits, healthy diets, and a healthy planet, rather than trade, yield (increasing), and price (decreasing) policies [13]. Further, the new Circular Economy Action Plan focusses on 'eco-design', highlighting that 80% of environmental impacts are determined at the design phase, underlining the importance of considering sustainability and health outcomes in the earliest stages of the system in question [3].

Based on these intended impacts and the four key policy shifts required, and in line with a just transition, the following section explores in greater detail what these transformations might look like for two components of the food system: agriculture and nutrition.

II. 'Redesigning' agriculture for nature and nutrition

Making food production sustainable means moving beyond current agricultural practices to transformative practices that consider long-term changes and future generations. The F2F strategy proposes solutions focussed on reducing carbon emissions and increasing yields, rather than systemic alternatives that encompass broader goals such as ecosystem health. A sustainable approach to 'designing' healthy and environmentally sound food might start at the agricultural production stage. This would need to consider what food is being produced and how it is being produced to achieve both environmental and nutrition objectives. In this approach, agriculture can be considered as part of the landscape, an activity that is 'growing nature' [23], that produces nutritious food and allows biodiversity to thrive, rather than treating nature as an asset only. This requires a shift in how we think about agriculture and its primary stakeholders (farmers). Together, these considerations would align with a food system that comprehensively bolster agency and sustainability.
Similarly, useful and necessary measures to help consumers navigate a confusing food landscape are outlined in the F2F strategy but the strategy focusses more on the consumption side of nutrition and good health than it does on the production or design stage. The F2F strategy aims to empower consumers to make informed decisions for healthy diets, to support accountability, avoid greenwashing and tackle food fraud. Measures include a harmonised and mandatory 'front-of pack' labelling (e.g. on nutrition and environment, and potentially animal welfare); and engaging with the private sector to seek commitment to reformulate food products in line with healthy and sustainable diets, and to adapt marketing and advertising strategies to consider the needs of the most vulnerable. This is the first time such comprehensive measures will be taken at a regional scale and

will significantly increase a consumer's agency. But failing to consider agriculture in the 'design' stage of the food system for nutrition and health, limits the individual's agency for example to consider the food system in terms of how food is produced and processed, in line with the objectives of empowering citizens and bolstering their agency. Finally, it's important to note that for a just transition, the burden of change should not be disproportionately be placed on the consumer which may happen if policies overemphasise efforts relating to the consumption component of the food system.

The following sections consider what it might mean to 'design' sustainable food systems, from measurements to practices and research to processing in the F2F context.

a. Agricultural productivity, nature as a stakeholder, and farmers as custodians

One way of 'redesigning' agricultural production is by re-evaluating the way we measure and value the components of the food system and its stakeholders.

First, rather than measuring agricultural productivity in terms of yield outputs, measurements could focus on system productivity, valuing public health and sustainability over availability of cheap and large amounts of food. Agricultural productivity is currently measured largely based on yield output and trade factors. Benton and Bailey (2019) [13] highlight the inefficiency of current food systems by estimating efficiency levels of - at most - 41% (on an energy basis) efficient if the efficiency is based on the amount of food grown to feed people. They outline how the current understanding of efficient agricultural systems are at odds with today's reality and point to the 'paradox of productivity' in the rising waste at every step of the value chain, the public health impacts and environmental degradation of our current food systems. Indeed, the agricultural production stage of the food process produces 9 million tons of food waste on farms (i.e. food loss) [24].Thus, the authors propose moving away from the classic Total Factor Productivity (TFP) measurement of efficient food production, based on labour, capital, land and chemicals to consider the Total System Productivity (TSP). They do this by building off the concept of 'Total Resource Productivity', which includes natural capital, and further capture healthcare costs associated with agriculture, such as air pollution or dietary-related ill health and waste-disposal costs. Further, rather than measuring yield as a primary output measure productivity would be measured based on the number of people undernourished. This approach aligns with the EU's aim to 'renew' how Europeans value food sustainability and systems, yet such transformation is absent from the F2F strategy.

Second, another way of shifting the paradigm towards agriculture practices based on the needs and context of its ecosystem, is to consider nature as a stakeholder with rights of its own [22]. This requires rethinking how we value the environment, going beyond the perception of nature as a set of distinct and separate "goods and services". Reducing nature to a fragmented set of privatised and monetised commodities considers nature as something to consume rather than considering key spiritual, cultural, or social values which constitute the fabric of societies across the world. The World Wildlife Fund 2016 Report promotes progress made by the by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services in reconsidering how we value nature which 'takes valuing nature beyond simply assigning a dollar figure and recognizes other knowledge systems, for example those of local communities and indigenous peoples' [25]. The EU has already pioneered in the sphere: in October 2017, for the first time, the rights of nature were institutionalised at regional level, when the EU Economic and Social Committee (EESC) voted to adopt Opinion Nat/712. However, individual countries around the world have gone even further, recognising these rights in the constitution (e.g. Ecuador in 2008), and providing legal guardians to represent nature. Although challenges would arise from the varying institutional and legislative contexts across member states, taking this approach has the potential to expedite the EU's leadership in terms of transformative action for sustainable systems.

Third, the F2F strategy states that farming practices that 'remove CO2 from the atmosphere contribute to the climate neutrality objective and should be rewarded' - a good indication for farmers wanting to transition towards more sustainable practices. There are several strong elements in the strategy pointing to support for farmers and fishers, and on the essential nature of their work. In line with the idea of a just transition, supportive language is used through the document, namely to 'guarantee a decent income allowing them [farmers] to provide for their families and withstand crises of all kinds', to improve targeting of income support based on needs and outcomes, and to increase farmers' bargaining power by helping farmers and fishers to 'strengthen their position in the supply chain'. At the same time, F2F calls on farmers to 'transform production methods more quickly' and make best use of nature-based solutions and technological solutions. However, whilst support for reduced emissions is made clear, support for 'transforming' production methods is not made explicit. Further, the 'farmer'

is framed as being a producer of food only, rather than a custodian of nature. Although it is worth noting, at the strategy launch press conference, Timmerman lauded farmers and fishers as 'stewards' of our land and sea. Yet, farmers can support healthy soil, enhance biodiversity, wildlife, and provide nutritious and safe food. This is an essential and highly important role in society and support offered should tailor to the various responsibilities and subsequent interests of a custodian of the land or sea. Custodianship of land has been reflected legislatively in several countries around the world. For example, in 2014, providing rights to a river in New Zealand settled a 140-year old dispute between Maori tribes and the Crown. The river now has accountable, legal guardians — one from each disputing party [26]. Such an approach encourages participatory policymaking and leads to policies with structural, spatial, and temporal considerations — such as future generations and broader understandings of ownership [10]. It would bolster accountability and sustainability of the F2F strategy, by promoting participatory and interconnected approaches.

b. Agricultural practices: going beyond carbon emission solutions to 'growing nature'

The F2F target of reaching 25% organic farming in Europe is a significant step towards sustainability, potentially reducing damage to soils, wildlife and human health. Diverse and intraspecific ecosystems are at the basis of sustainable agricultural practices, which includes sustainable soil management to provide crops with the micro and macro-nutrients for a complete diet [27]. An agricultural practice that works in harmony with its eco-system must go beyond organic to include diversity at the 'output' and 'outcome' stages, meaning a diverse array of contextually appropriate crops and measures designed to increase food security and maximise ecosystems health.

The EU Biodiversity Strategy 2030 aims to 'bring nature back into our lives'. This should include bringing nature back into agriculture. Both agriculture and nature exist and prosper in complex systems; dynamic, chaotic, and interdependent, in which interactions are nonlinear. Neither can be understood, nor protected, by looking at component parts and policy and planning need to reflect this complexity. Applied to agriculture, this means practices should happen in harmony with local ecosystems, producing more nutrient-rich and flavourful food that promotes biodiversity growth in the region rather than depletes it.

Nature-based solutions (NBS) has emerged as one concept, present in multiple EU policy instruments, for practices that contribute to long-term health and well-being of people and planet [28]. For the EU Commission, such solutions 'bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions' [29]. The F2F strategy includes some NBS, such as a brief mention of agroecology, or as one of the 'transformational' practices that farmers can undertake to achieve F2F's goals. However, as mentioned previously, the F2F support mechanisms and targets tend to emphasise current agricultural practices rather than transformational ones. This is perhaps most visible in the absence of regenerative approach (to agriculture or other sectors) as a solution, despite this being a key component of the HLPE's conceptualisation of sustainability in food systems. NBS offer a diversity of solutions, from green urban infrastructures for improved health to bolstering coastal mangroves to reduce risks from natural disasters. In terms of agriculture, NBS include agroecological practices such as agroforestry, which can have profound positive effects for environmental, social and health goals. They can affect the environment by intercepting sunlight, reducing crop evapotranspiration, improving soil water-holding capacity and water infiltration, and enhancing carbon storage and biodiversity, and even lowering ambient temperatures. It fosters resilient livelihoods and communities, through alternative sources of income, increased availability of diversity of dietary needs, helps reduce air pollution (e.g. from dust) and provides a source of medicine [30]. Yet, depending on the underlying values, NBS will be more or less effective; if the F2F implementation is based narrowly on market driven approaches and cash flows, then this could undermine transformational progress namely by relying on 'weak sustainability' which allows for substitution of different forms of capital rather than long-termer approach which considers nature as non-substitutable [31]. To avoid this, policies can explicitly align objectives with the NBS goal of improve capacity to manage multiple objectives in complex socio-ecological systems. The F2F strategy would benefit from emphasising NBS and the interdependence of the food system's components, from agriculture and nature to agriculture and nutrition.

c. The links between agriculture and nutrition

The link between health outcomes and agriculture are absent from the strategy, yet, *what* is being produced – and *how* – will determine what is made available on the shelves for consumers. The drive for cheaper and more

abundant food since the 1950s has seen food systems become reliant on a handful of crops mainly to feed increasing livestock; and has forged agricultural practices designed for high-yielding, energy-dense commodities to the detriment of nutrient-rich fruits and vegetables. Currently, 76% of the world's crop calories now come from just eight crops - wheat, rice and maize (representing 50% of crop calories), sugar, barley, soy, palm and potato [13, 32]. This lack of diversity in agriculture has led to widespread environmental degradation, namely a 58% decline in abundance of species on the planet since the 1970s [25]; and to a growing malnutrition burden as food manufacturers formulate products derived from low cost high-calorie commodities which contributes to the growth of obesogenic processed foods [13]. Globally, healthcare costs from inadequate diets are estimated to exceed 5% of GDP (this is a conservative figure, as of 2013) [33]. Figure 2's panels A and B, below, demonstrate this incoherence in global food systems by highlighting the discrepancy between what is being produced (i.e. made available to consumers) in contrast with the recommended dietary intakes.

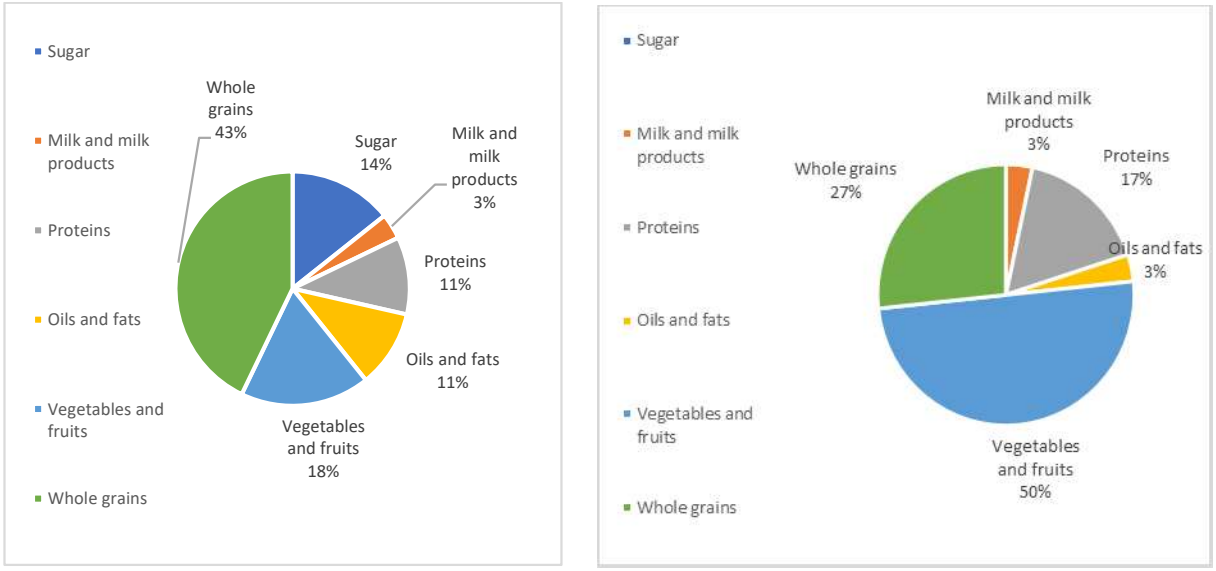


Fig. 2. What global food systems are producing vs nutritional requirements

Fig. 2a. Current production (2011 FAO data)

Fig. 2b. Recommended diet (based on Harvard Healthy Eating Plate model)

Source: KC KB, Dias GM, Veeramani A, Swanton CJ, Fraser D, Steinke D, et al. (2018) When too much isn't enough: Does current food production meet global nutritional needs? PLoS ONE 13(10): e0205683. https://doi.org/10.1371/journal.pone.0205683;

Unit of measurement: number of servings / person / day; inspired by Tim Benton's guest lecture for the Food System Academy (http://www.foodsystemsacademy.org.uk/videos/Tim-Benton.html)

By not considering the links between agriculture outputs and nutrition, initiatives stemming from the F2F strategy may continue in this line of emphasising quantity and affordability of food rather than quality. To overcome the overweight and obesity pandemic, the HLPE call on the agriculture sector to engage with the health and environmental sectors and ensure nutrition-driven and environmentally sustainable policies. Thus, the 'design' stage of a healthy diet needs to be explicitly considered from the agricultural production stage of the food system in order to ensure nutritional security for today's citizens as well as the future generations.

Further, the F2F strategy acknowledges that a resilient food system needs robust local food systems, and commits to '*reducing dependence on long-haul transportation*'. This is a small first step in supporting local food markets. Although empirical research is lacking in this area, links have been made between improved nutrition and access to local food markets due to the availability of fresher, more nutrient-dense and generally less processed foods than in supermarkets [34]. For improved nutrition to be linked with local markets, those markets need to be providing fresh, healthy food where consumers make different choices based on this newly available food. The F2F strategy somewhat addresses the issue of consumer choice by tackling issues such as nutrition labelling, but again, focuses largely on the consumption side rather than designing systems which incorporate local food markets. Shorter supply chains are mentioned just once in the strategy, despite the EU Parliament calling on the European Commission to '*propose the adoption of instruments to support and promote farmer-managed food supply chains, short supply chains and farmers' markets'* [35]. Although the definition of 'local food system' varies – it can include factors such as population density, accessibility, closeness of producer and

Consumer, etc. – common challenges and relevant policy measures have been identified. Indeed, several barriers to the development of short food supply chains exist, including the administrative and regulatory burden (especially for smallholder farmers) lack of knowledge and skills (e.g. entrepreneurial), and access to land (e.g. due to high prices) and bank loans can prevent young farmers from engaging, although they are more willing to engage in direct sales. Policy measures to resolve these issues could include adapting regulation, improving access to services, and enhancing knowledge transfer, advisory and training services [35]. Whilst the F2F strategy includes a focus on 'advisory services, data and knowledge sharing, and skills' no mention is made of how these will support shorter food supply chains. The strategy would benefit from making this explicit and including indicators on the number of local food markets available.

Finally, another structural opportunity missed for improved nutritional outcomes lies in the F2F's disproportionate focus on the environmental component of sustainable diets. For example, the strategy commits to making food procurement sustainable by reinforcing standards in canteen catering contracts, and reviewing the EU school scheme to 'enhance its contribution to sustainable food consumption and in particular to strengthen educational messages on the importance of healthy nutrition, sustainable food production and reducing food waste'. Promoting green procurement is an excellent goal gearing the EU member states towards transformation, particularly considering the EU institution public authorities' purchasing power represents 14% of the EU GDP, or roughly EUR 1.8 trillion [36]. Making institutional food procurement chains more sustainable should not only mean making them more environmentally sound, but also ensuring they provide the nutritious and safe food required. This is particularly relevant in the context of hospitals, care homes, and schools across Europe, where the provision of food can be motivated by price, rather than focussing on the nutritional value of food as part of the immune-boosting and healing processes. Most hospitals in Europe are still providing unhealthy and unappealing meals, rather than fresh, culturally appropriate and nutritious foods [37]. Yet, poor nutrition can impair the production and activity of immune cells and antibodies [38]; this is especially relevant in the context of a pandemic like COVID-19 which has highlighted the urgency of adequate nutrition for strong immune systems, particularly amongst society's more vulnerable communities (e.g. care homes) [39]. Sustainable food procurement for healthy diets could include measures to ensure locally sourced, diverse food as well as minimum nutritional requirements, in line with short food supply chain goals.

d. Nutrition research and guidelines

The EU Commission will 'seek commitments from food companies' relating to 'reformulating food products in line with guidelines for healthy sustainable diets' and will create nutrient profiles to help inform consumers. First, it is unclear which guidelines will be used to inform this crucial component of the strategy. Second, when nutrition is mentioned in the strategy, the focus is on improved diets through reducing fats, sugars, and salts, rather than increasing the diversity of nutritional intake and available healthy foods. Further, policy coherence and coordination relating to food and nutrition research and innovation is weak, and there is a lack of data and knowledge pertaining to investment amounts [40]. Yet, the F2F strategy makes no commitment to ensure prioritisation of research for nutrition – research that, for example, might link agricultural practices to nutritional outcomes. This could be partially addressed by improving the data, for example, by creating a central inventory of food and nutrition security research and innovation initiatives across member states [40].

Further, commitments from retailers, distributors and other stakeholders need to be transparent and based on a solid evidence-base. Similarly, to the F2F's efforts to avoid greenwashing, consumers should be empowered with comprehensive information on the content of food. Nestle, for example, promotes the removal of over 40,000 tonnes of sugar since 2014 as part of its *Healthier Kids* [41] programme – but it is unclear whether the sugar removed was replaced with a healthy alternative, or with another sweetener, which might be equally as detrimental to healthy diets as sugar. To bolster efforts presented in the F2F strategy and empower consumers, transparency is needed regarding guidelines on healthy diets, which should be driven by public research and should go beyond the notion of reduced sugar, fat, and salt to consider access to diverse, nutrient-rich foods.

F2F emphasises the challenges relating to ultra-processed foods (accounting for 25% of all food purchased in the EU) which contribute significantly to the increasing number of overweight and obese citizens in Europe [42]. However, this is a missed opportunity to consider the food processing system in its entirety. The HLPE report states that sustainable food systems should support the supply of diverse, and *minimally processed* staple foods.

Beyond foods categorised as 'ultra-processed', current processing mechanisms to improve shelf life or make food items more appealing to customers can reduce their nutritional value by the time they reach the 'fork'. Yet, these are not categorised as 'ultra-processed'. For example, refined olive oil involves heavy-duty processing and strips the oil of many, if not most, of its valuable nutrients. It involves mechanical cooking and cleaning (average temperatures of 120 degrees Celsius), degumming (carried out at 60 degrees Celsius), refinement, bleaching (alters fatty acids), deodorising (temperatures of between 240 – 270 degrees Celsius), additives, 'winterisation' (cooled and filtered one more time), and hydrogenation. By the time, the oil has gone through this refinement process, it can lose substantial amounts of micronutrients [43]. Thus, rather than solely aiming to reduce the negative impact of obesogenic foods such as ultra-processed ones, a more ambitious strategy might have considered reviewing the processing of food to favour the maintenance of existing nutrients in food items.

Conclusions

The F2F strategy articulates an inspiring starting point for a coherent, harmonised and sustainable food system across the EU. The F2F strategy and its interconnected policies, offer an exciting opportunity to transform the European economic, social and environmental landscapes. EU member states could see an increase in organic land, biodiversity and a reduction of fraudulent activities and greenwashing relating to the food on the shelves. Farmers could see higher returns and improved bargaining power, and new business opportunities such as in bioeconomy or plant protein sectors could arise. Policies will have to adapt to achieve the goals in the F2F strategy. They will need to consider context-specific nature of each initiative, as well as duties towards future generations. Given the complex nature of the food system, interdependencies between sectors (e.g. health and agriculture) and across borders need to be addressed in policy and decision-making processes.

Whilst the F2F strategy aims for a system that promotes healthier and sustainable diets, it falls short in terms of aiming for a sustainable and efficient food system (as defined above), and in creating the links necessary for coherence, particularly between agriculture and nutrition. The F2F's overemphasis on the consumption sphere of the food system means the links between agriculture and nutritional outcomes have been missed, undermining the potential for the long-term shift in agricultural paradigms which are needed to achieve sustainable food systems. This overemphasis also risks disproportionately placing the burden of change on the consumer, rather than distributing it evenly across society. Further, the strategy's targets largely remain within the framework of the current food system, which aims for more and cheaper food, rather than suggesting structural changes such as short food supply chains, or reviewing concepts of food system efficiency. In the same vein, the strategy does not go far enough in its ambitions for sustainable agriculture, which should happen in harmony with local ecosystems, producing more nutrient-rich and flavourful food that promotes biodiversity growth in the region rather than depletes it. Finally, within the strategy, nature remains as an asset to be exploited, rather than an integral part of the ecosystem upon which we depend.

Further, the strategy promises to empower consumers with more readily available, transparent, and harmonised information on factors relating to environmental, nutrition and perhaps even animal welfare. Despite this, transparency was missing in the strategy on the research and guidelines that will guide these decisions. In addition, the objectives do not adequately provide citizens with the information required to make decisions on '*what foods are produced, how it's produced, processed, and distributed*', thus weakening efforts to ensure agency across food systems. Further, the strategy makes no commitment to ensuring prioritisation nor transparency of research for nutritional guidelines, and green procurement guidelines are narrowly focussed on environmental impacts rather than nutritional ones.

Finally, the implementation of the European Green Deal would benefit from research into transboundary natural resource management, which is absent from the F2F strategy. In light of growing demands on natural resources and the shared resources across EU member states' borders, policy and legislative changes relating to a just transition should integrate provisions for transboundary challenges and opportunities.

Conflict of interest

There are no conflicts to declare

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Reference

[1] European Commission. Farm to Fork Strategy: For a fair, healthy and environmentally-friendly food system. May 2020. [Online]. Available: https://ec.europa.eu/food/farm2fork_en#:~:text=The%20Farm%20to%20Fork%20Strategy%20is%20at%20the%20heart%20of,%2C%20healthy%20and%20environmentally%2Dfriendly.&text=The%20Farm%20to%20Fork%20Strategy%20aims%20to%20accelerate%20our%20transition,neutral%20or. [Accessed 20 May 2020].

[2] European Commission. A European Green Deal. December 2019. [Online]. Available: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en. [Accessed May 2020].

[3] European Commission. Circular Economy Action Plan: For a cleaner and more competitive Europe. March 2020. [Online].

[4] European Commission. Biodiversity Strategy 2030. May 2020. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590574123338&uri=CELEX:52020DC0380.

[5] Food and Agricultural Organisation (FAO). Sustainable food systems: Concept and framework. 2018. [Online]. Available: http://www.fao.org/3/ca2079en/CA2079EN.pdf. [Accessed June 2020].

[6] High Level Panel of Experts (HLPE). Food security and nutrition: building a global narrative towards 2030, Committee on World Food Security, Rome, 2020.

[7] Vatn A. An institutional analysis of methods for environmental appraisal. Ecological Economics 68 (2009), 2207–2215.

[8] Action Aid. Principles of a Just Transition for Agriculture. December 2019. [Online]. Available: https://actionaid.org/sites/default/files/publications/Principles%20for%20a%20just%20transition%20in%20agriculture_0.pdf. [Accessed June 2020].

[9] International Institute for Environment and Development (IIED). The value of valuing ecosystem services. 2012. [Online]. Available: https://www.iied.org/value-valuing-ecosystem-services . [Accessed March 2017].

[10] Bell K. Can the Capitalist Economic System Deliver Environmental Justice?. IOP Science 10 (2015), 125017.

[11] World Bank. World Development Report 2008. Washington, D.C., 2008.

[12] Hawkes C. Policy coherence across the food system for nutrition: from challenge to opportunity? 2017. [Online]. Available: https://ecdpm.org/great-insights/sustainable-food-systems/policy-coherence-across-food-system-nutrition-challenge-opportunity/. [Accessed May 2020]

[13] Benton T, Bailey R. The paradox of productivity: agricultural productivity promotes food system inefficiency. Global Sustainability, 2 (2019), 1-8.

[14] European Commission. What is Horizon 2020? [Online]. Available: https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020. [Accessed May 2020].

[15] European Commission. Horizon 2020 in Full Swing, Three Years On - Key facts and figures 2014-2016. 2018. [Online]. Available: https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/h2020_threeyearson_a4_horizontal_2018_web.pdf. [Accessed May 2020].

[16] European Commission. Horizon Europe - Investing to shape our future. August 2019. [Online]. Available: https://ec.europa.eu/info/files/horizon-europe-investing-shape-our-future_en. [Accessed July 2020].

[17] European Commission. Fact sheet: EU Delivering on the UN 2030 Agenda. [Online]. Available: https://ec.europa.eu/info/sites/info/files/factsheet-eu-delivering-2030-agenda-sustainable-development_en.pdf. [Accessed May 2020].

[18] European Commission. Fact Sheet - From Farm to Fork: Our food, our health, our planet, our future, 20 May 2020. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/fs_20_908. [Accessed May 2020].

[19] European Commission. Fact Sheet – EU Green Deal: Benefits for Farmers. 20 May 2020. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/fs_20_909. [Accessed May 2020].

[20] European Commission. Fact Sheet – Economic Impacts of Biodiversity. 20 May 2020. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/fs_20_907. [Accessed May 2020].

[21] Wageningen University. Circularity in Agricultural Production. 2018. [Online]. Available: https://www.wur.nl/upload_mm/7/5/5/14119893-7258-45e6-b4d0-e514a8b6316a_Circularity-in-agricultural-production-20122018.pdf. [Accessed June 2020].

[22] Boyd D. The Rights of Nature: A Legal Revolution that Could Save the World, Legato, U.S. dist.; Jaguar, Canadian dist., ISBN 978-1-77041-239-2, 2017.

[23] Barber D. The third plate: field notes on the future of food, New York: The Penguin Press., 2014.

[24] Fusions, Estimates of European Food Waste Levels, 2016. [Online]. Available: http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf. [Accessed June 2020].
[25] World Wildlife Fund (WWF). Living Planet Report 2016: Risk and resilience in a new era. World Wildlife Fund International, Gland, Switzerland, 2016.
[26] Cano Pecharroman L. Rights of Nature: Rivers That Can Stand in Court. Resources, 7 (2018), 13.
[27] Food and Agricultural Organisation (FAO). Healthy Soils are the Basis for Healthy Food Production. 2015. [Online]. Available: http://www.fao.org/3/a-i4405e.pdf . [Accessed May 2020].
[28] Davis M, Abhold K, Mederake L Knoblauch D. Nature-based solutions in European and national policy frameworks, 2018. [Online]. Available: https://www.ecologic.eu/15856. [Accessed June 2020].
[29] European Commission. Nature-Based Solutions. [Online]. Available: https://ec.europa.eu/research/environment/index.cfm?pg=nbs. [Accessed May 2020].
[30] Rosenstock T, Dawson IK, Aynekulu E, Chomba S, Degrande A, Fornace K, Jamnadass R, Kimaro A, Kindt R, Lamanna C, Malesu M, Mausch K, McMullin S, Murage P, Namoi N, Njenga M, Nyoka I, Valencia AMP, Sola P, Shephard K, Steward P. A Planetary Health Perspective on Agroforestry in Sub-Saharan Africa One Earth 1 (2019), 330-344.
[31] Nesshover C, Assmuth T, Irvine KN, Rusch GM, Waylen KA, Delbaere B, Haase D, Jones-Walters L, Keune H, Kovacs E, Krauze K, Kulvik M, Rey F, van Dijk J, Vistad OI, Wilkinson ME, Wittmer H. The science, policy and practice of nature-based solutions: An interdisciplinary perspective. Science of the Total Environment 579 (2017), 1215-1227.
[32] Bahadur K, Dias GM, Veeramani A, Swanton CJ, Fraser D, Steinke D, Lee E, Wittman H, Farber JM, Dunfield K, McCann K, Anand M, Campbell M, Rooney N, Raine NE, Van Acker R, Hannger R, Pascoal S. When too much isn't enough: Does current food production meet global nutritional needs? PLoS ONE 13 (2018), e0205683.
[33] Food and Agricultural Organisation (FAO). State of Food and Agriculture 2013: Food systems for better nutrition. 2013. [Online]. Available: http://www.fao.org/publications/sofa/ 2013/en/. [Accessed June 2020].
[34] Martinez S, Hand M, Da Pra M, Pollack S, Ralston K, Smith T, Vogel S, Shellye C, Lohr L, Low S, Newman C. Local Food Systems: Concepts, Impacts, and Issues. Economic Research Service Number 97, May 2010.
[35] Augere-Granier M. Short food supply chains and local food systems in the EU. European Parliament Research Service, PE 586.650, September 2016.
[36] European Commission. Environment - what is GPP? 2015. [Online]. Available: https://ec.europa.eu/environment/gpp/faq_en.htm. [Accessed May 2020].
[37] Cioci G, Olivan PH, Pinzauti I. Fresh, Healthy, and Sustainable Food: Best Practices in European Healthcare, Health Care Without Harm. December 2016. [Online]. Available: https://noharm-europe.org/sites/default/files/documents-files/4680/HCWHEurope_Food_Report_Dec2016.pdf. [Accessed May 2020].
[38] Harvard School of Public Health. The Nutrition Source: Nutrition and Immunity. [Online]. Available: https://www.hsph.harvard.edu/nutritionsource/nutrition-and-immunity/. [Accessed June 2020].
[39] World Health Organisation (WHO). Food and nutrition tips during self-quarantine online guide. 2020. [Online]. Available: https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/technical-guidance/food-and-nutrition-tips-during-self-quarantine. [Accessed June 2020].
[40] European Commission. European Research & Innovation for Food & Nutrition Security. Publications Office of the European Union, Luxembourg, 2016.
[41] Nestle. Nestle for Healthier Kids. [Online]. Available: https://www.nestle.com/csv/global-initiatives/healthier-kids/home. [Accessed 2020].
[42] European Commission. Towards a sustainable food system: Moving from food as a commodity to food as more of a common good. Publications office of the EU, Luxembourg, 2018.
[43] Kock Wai Ng T, Appukutty M, Shyam S, Tee Voon P, Selvaduray KR. Cooking Oils in: Bagchi D, Nari S, Sen C. Health and Sports, Nutrition and Enhanced Sports Performance (Second Edition) Muscle Building, Endurance, and Strength. Science Direct, 2018, pp 751-756
[44] European CSA Research Group, Overview of Community Supported Agriculture in Europe 2016. [Online]. Available: https://www.accesstoland.eu/IMG/pdf/overview-of-community-supported-agriculture-in-europe-f.pdf. [Accessed June 2020].