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Innovation and knowledge transfer

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Sustainable agri-food systems

Generalitat de Catalunya
Departament d'Acció Climàtica, Alimentació i Agenda Rural

RuralCat

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Minister for Climate Action, Food and Rural Agenda (DACC)

The DACC works to make the Catalan agri-food system sustainable and transformative, based on the circular bioeconomy.

Moving towards a sustainable, economically viable, socially just and environmentally friendly agri-food system is precisely the aim of the Ministry for Climate Action, Food and the Rural Agenda (DACC); a vision fully aligned with European policies such as the European Green Deal and the Farm to Fork strategy and with the United Nations Sustainable Development Goals (SDGs).

Explicit recognition of the relationship between the system of food production, marketing and consumption with health, the environment and consumer awareness, among other areas, is key to implementing actions that comprehensively respond to the current challenges and demands of the agri-food sector and society in general. Only through good governance, empathy and synergies can we provide the necessary responses.

The DACC works to make the Catalan agri-food system sustainable and transformative, based on the circular bioeconomy. Focused on mitigating and adapting to the climate emergency and on preserving and restoring the resources on which the food system depends, while at the same time being dynamic and value-generating. Our own agri-food system rooted in the region that guarantees territorial cohesion and reinforces Catalonia's food self-esteem. But this agri-food system must also be fair and equitable. Socially sustainable and accessible to all, with a fair and equitable distribution of value among all agents in the food value chain. An agri-food system that promotes the health of the soil, water, air, plants, animals, sea and people.

And, precisely because of this, the DACC has been working along these lines for some time. Before the European Commission published the "From Farm to Fork" strategy, the Catalan Food Council was already working on drawing up the Strategic Food Plan for Catalonia (PEAC), a government tool for defining the country's food strategy (2021-2026), which should serve to lay the foundations for the Catalan National Agreement on Food.

Moreover, the DACC has long been promoting its Strategy on FLW prevention: Working for better use of food. Fighting against food loss and waste. More recently, the approval of the new Food Losses and Waste Prevention Act in Catalonia has established a regulatory framework to prevent food losses and waste and to increase food recovery along the food chain, from primary production to the final consumer.

The DACC, with the participation of other government ministries, is also leading the process of drafting the Bioeconomy Strategy of Catalonia 2030, an opportunity for the agricultural, forestry and fisheries sector to improve its competitiveness and sustainability and at the same time establish links with other economic, environmental and social sectors.

At the same time, the DACC is working on the strategy for the development of sustainable agricultural production; driving the Programme for the promotion of organic agri-food production; developing the Cultivated Biodiversity Action Plan for and draf-ting the Sustainable Livestock Plan.

Finally, I would like to mention the European COVID-19 recovery funds, a new instrument that offers us an opportunity to accelerate the transformation that we began several years ago and that will enable us to take a huge leap forward in moving towards a sustainable, robust and resilient agri-food system.

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TRANSFORMING THE FOOD SYSTEM in response to the climate emergency

Agricultural landscape of Gallecs, in El Vallès Oriental. The reddish colours correspond to clay-enriched soil horizons. Photo: Oscar Martìn.

01. Introduction

The COVID-19 crisis has shown us that agriculture is an essential activity. But agriculture not only guarantees our food supply (which must be healthy and nutritious), it also plays a key role in the conservation of landscapes, in the management of our territories and in public health. Indeed, we know that the expansion of industrial agriculture on a global scale is one of the most important drivers of change in land degradation, biodiversity loss, soil erosion, water pollution and greenhouse gas emissions. And, along with the transformation of agricultural activity towards industrialisation, its intensification and internationalisation, we have experienced the industrialisation and internationalisation of the entire food system and everything is inextricably linked. Therefore, per capita production of vegetable oils and animal protein has doubled since 1961, two raw materials that are very characteristic of the nutritional transition that has taken place over the last four decades on a global scale. The results are felt not only by ecosystems, but also by people, both individually and socially, starting with farmers all the way through to consumers. Many farmers have had to abandon farming, and those who have been able to continue have been forced to compete within economies of scale in order to survive leading to increased levels of debt. Consumers have shifted their diets towards unbalanced food consumption patterns with products that are high in sugar, animal protein and are ultra-processed. The result is almost two billion people overweight, two billion with micronutrient deficiencies (vitamins such as B12, and minerals such as iron or calcium, with one in three women of reproductive age suffering from iron deficiency) and almost 700 million malnourished.

For all these reasons, there is a widely accepted link between agriculture and several of the Sustainable Development Goals (SDGs) adopted in 2015 under the 2030 agenda[1]. The current climate emergency and the pandemic have opened up a whole new area of debate and scientific research related to agriculture and food. In August 2019, the United Nations Intergovernmental Panel on Climate Change (IPCC) presented a report on land and climate change called: "Climate change and land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (SRCCL)". In this report, agriculture and food security (security understood in terms of availability, access and use of food, not food hygiene) play a key role. It was drafted over three years. The process involved 107 experts from all over the world, more than 7,000 scientific publications were reviewed and more than 28,000 comments from external reviewers were responded to. This complicated and laborious process endorses the thoroughness of the published report.

One of the most important contributions of this report is its comprehensive and systemic approach to climate change, incorporating both the science of adaptation and mitigation, as well as that of complexity. This approach allows us to assess, on the one hand, the different possible strategies for both adaptation and mitigation, and, at the same time, it allows us to assess the relationship between climate change and other problems, particularly health (human and planetary), poverty, equity and justice. Indeed, the perspective of complex systems, in the case of the food system, analyses land and agriculture in their multiple social and ecological dimensions. Thus, it approaches land degradation from a food security perspective, and considers the relationships between land degradation processes and poverty. This comprehensive and systemic approach helps us to identify synergies and the commitments that are needed to select those strategies that may be most efficient in the fight against climate change, in this case for the agriculture and food sector.

02. We find ourselves in an emergency situation.

While we are increasingly accustomed to the concept of a climate emergency, the results of the SRCCL report and other international studies related to food and agriculture warn of the serious emergency we find ourselves in regarding the state of land and food security on a global scale, and its relation to climate change. For example, 25% of ice-free land is undergoing processes of degradation due to human activity. This represents between 1 and 6 billion hectares of degraded land with an increase of 5-10 million hectares per year, and a degradation rate 10-100 times higher than the regenerative capacity of the soil. Soil degradation also contributes to climate change through greenhouse gas (GHG) emissions and reduced carbon sequestration capacity. Among the main factors in land degradation are poor agricultural practices and the growing trend towards urbanisation.

Moreover, drylands already account for 45% of the earth's surface, home to 2 billion people who are seeing how their habitats are being degraded and can no longer be used for their most important activity: food. Since 1961, drylands have been increasing by 1% a year globally.

Another significant fact that highlights the role of food production in climate change is the amount of land used for agriculture and livestock. Crop production accounts for 12% of ice-free land, and different forms of pasture (improved and unimproved) make up 37% of the total land used globally. In other words, approximately 49% of the ice-free soil is used for food production worldwide.

> The SRCCL report takes a comprehensive and multidisciplinary look at the fight against climate change in agriculture and food.

In this context, it is important to note that, despite all this, exchanges and flows between the land and the atmosphere, through land-climate interactions, allow soils to sequester 30% of total GHG emissions each year. Hence the relevance of land management in agricultural and livestock practices in relation to climate change mitigation. It is important to understand that land can emit CO_2 but also sequester it, and that this will depend on the way we manage it, in particular in terms of agricultural and livestock management. Proper management will also help facilitate adaptation to climate change, making it one of the most effective strategies in the fight against climate change.

03. Food system: from production to consumption and its relation to climate change

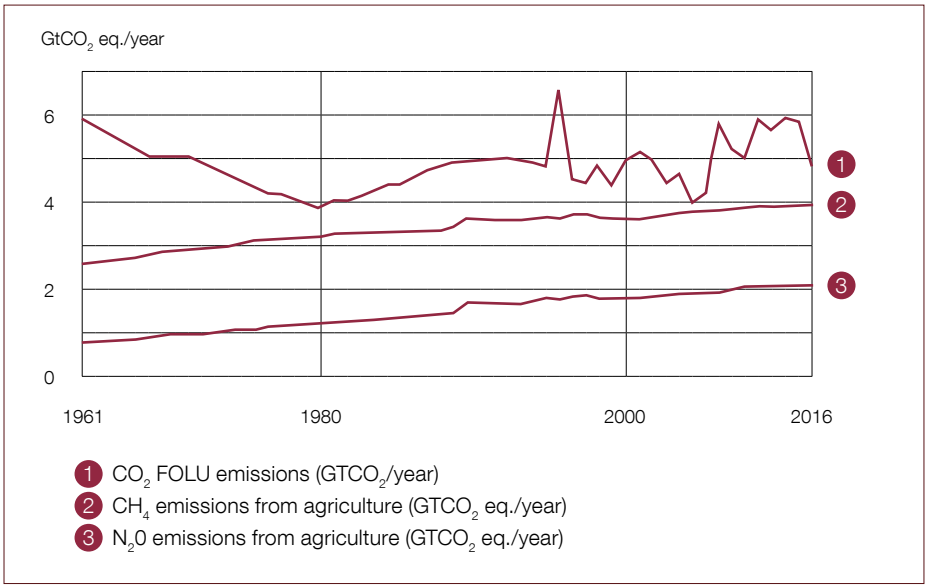
Food systems, in the context of climate change, have a dual relationship with climate change: first, they are among the sectors most affected by this change, which endangers not only the livelihoods of millions of people,

[1]In particular its relationship with SDG2 (Hunger), SDG3 (Health and well-being), SDG5 (Gender equality), SDG12 (Responsible consumption and production), SDG13 (Climate action) and SDG15 (Life on land), among others.

but food security itself on a global scale. Second, food production and consumption account for about one third of total greenhouse gas (GHG) emissions (between 21-37%). Of these GHGs, approximately 13% is attributed to agriculture; 12% to associated land use changes, and 5-10% to other off-farm elements and processes. In this article, we will focus only on emissions, and in fact this major contribution of food systems to climate change suggests that it is not all negative, and that through changes in food systems there is considerable scope for mitigation. Therefore, this is the only sector that has the capacity not only to stop being a net emitter, but also to achieve net carbon sequestration, mainly through changes in land management.

The emission of different GHGs are associated with food systems, including the three most prevalent gases: carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). In terms of agriculture (including livestock farming), the largest emissions are of N_2O from the use of inorganic fertilisers, and of CH_4 emitted by ruminants and rice cultivation. CO_2 emissions are mainly associated with deforestation and land-use change, mainly for the production of pasture and industrial monocultures (oil palm) or monocultures for animal feed (soya). A look at the food system shows us how emissions from agriculture and livestock are closely related to changes in our pattern of food consumption and preparation: diet and waste. Both are of particular importance, especially when it comes to establishing possible mitigation strategies. For example, the exponential increase in the consumption of animal protein over the last 40 years means not only an increase in emissions associated with food production (both due to the cultivation of feed grains and due to direct emissions or the increase in agricultural areas set aside for pasture and cereals), but also an increase in health problems associated with unbalanced diets. Moreover, given that 30% of the food produced is never consumed, food waste accounts for 8-10% of total GHG emissions.

> We find ourselves in a severe situation regarding the state of land and food security on a global scale.



Evolution of emissions from agriculture, forestry and other land uses. Source: IPCC, 2019.

04. Mitigation and adaptation strategies: synergies and commitments

The main conclusion of the IPCC's SRCCL in relation to climate change mitigation and adaptation in food systems is the need to address joint strategies from the perspective of both food production and food consumption and transport. From the production side, the main group of strategies proposed are aimed at changes in management with the main purpose of increasing the organic matter in soil, reducing erosion and improving livestock management. From the point of view of mitigation, this enables not only the reduction of emissions from crops and livestock by promoting sustainable production systems, but also the ability to sequester carbon in soil and biomass, and thus contribute to mitigation. It also helps reduce evapotranspiration (and thus the need for water) and land degradation, which contributes to adaptation.

The strategies aimed at increasing organic matter include the importance of crop associations and rotations, which depend on the cultural and agroclimatic context; mixed production systems; silvo-pastoral agroforestry systems, or the use of indigenous breeds and efficient pastures according to the carrying capacity of specific territories. A key element for achieving this is diversification (e.g. mixed systems, diversity of species and varieties) and, in particular, the promotion of biodiversity and agrobiodiversity. In our current situation, however, this is a major challenge after several decades of promoting a production model based on monoculture and the extraction of organic matter from the land prompted by the continued use of inorganic fertilisers. A key part of this equation is local and traditional knowledge. Knowledge that should serve as a starting point for developing new agri-food models adapted to the current socio-economic context in conjunction with scientific knowledge (and other forms of know-

ledge that may be useful). It is worth stressing here the urgency of recovering the traditional knowledge that has been lost in recent decades in Catalonia, Spain and Europe, in a context in which the guardians of this knowledge have grown old and in which this knowledge is perceived by society as a "throwback". Working towards the recovery and use of traditional knowledge is not only a technical challenge, but also an epistemological and cultural challenge. In recent decades, even centuries, our society has been built on the supremacy of scientific and positivist knowledge and the disregard of other types of knowledge, which within the agricultural field, includes knowledge that has fed us sustainably for centuries. However, the focus is not on exploitation, but on collaboration and the generation of synergies with nature; in other words, on co-evolution. Of particular relevance within this traditional knowledge is that of local varieties and breeds, the result of co-evolution between producers and ecosystems, which are less productive but more robust in the face of extreme climatic conditions and less fertile soils. In rotations, legumes play a fundamental role in increasing soil fertility, which would also offer a solution to the change in diet proposed in this and other international reports, which promote the important role of legumes as a protein substitute. It is worth noting that 80% of the legumes consumed in Spain are imported, which gives us an idea of the potential demand that exists if agricultural and trade policies make the climate emergency a central issue.

Indeed, an important part of the strategies must be implemented through changes in demand. First, by drastically reducing the avoidable portion of food waste, and second, by promoting sustainable and healthy diets. Both offer results in terms of mitigation (mainly CH_4 and N_2O reduction, and carbon sequestration), adaptation (reduction in the demand for land as a scarce resource due to population growth) and health (reduction of malnutrition). In relation to waste, the law in Catalonia is very advanced and was approved with a broad consensus and with the participation of civil society (Law 3/2020).

Reducing waste, a key element, can be achieved by increasing the efficiency of food distribution and preservation up to the point of sale, and by reducing waste in the home. In Catalonia, 53% of total waste is domestic. There are many reasons for this, but one is low food prices, the result of several decades of agri-food policies that were aimed precisely at providing access to cheap food in cities. The dilemma this poses, and which would require specific policies, is how to guarantee access to food for the poor if prices increase. Self-managed alternatives can be found here in Catalonia based on the development of agro-ecological food networks between producers and consumers from vulnerable social groups, such as the Food Bank of Nou Barris, Alterbanc. Let's not forget that it is the poorest people who suffer most from obesity, because cheap food is less healthy and less sustainable. This situation needs to be reversed as a matter of social and environmental justice. In relation to our diet, in Catalonia we have it relatively easy, since the Mediterranean diet is one of the most efficient diets in terms of mitigation and offers great health benefits. It is important to stress once again that an increase in diversity in production correlates positively with an increase in dietary diversity, and that local seeds have a better nutritional profile than the more productive improved varieties, though more research is needed. Adaptation through dietary diversification implies a reduction in vulnerability to climate change by not depending on the harvest of the five key crops that feed the majority of the population today and by promoting a reduction in the amount of land needed for food production. This, however, would require major changes in current policies.

> Food systems have considerable scope for mitigation.

> Joint strategies are needed from the perspective of both food production and food consumption and transport.

One of the more controversial areas is that of local consumption. Here the scientific consensus is not definitive regarding emissions, especially since the studies have been conducted under very different conditions. However, it is argued that local consumption does reduce vulnerability to fluctuations in the global market, particularly important in Europe, which imports 50% of the food it consumes. Here, peri-urban agriculture would play a pivotal role.

05. New governance models

It is clear at this point that a change in production and consumption patterns as suggested above is not something that can be done overnight, but requires parallel transformations in the governance of food systems, with ambitious goals, confronting already well-established dynamics of functioning and power, and implementing a transition programme in which, as in all transformations, we know that there will be winners and losers.

It is clear that, given the complexity of the issue, a multi-scale, multi-actor and multi-sectoral governance of food systems is needed. In this regard, coordination is required at the local, regional, national and global levels; encouraging the participation of all actors involved in food systems, and recognising that agriculture and food are not only a

Organically grown food at a local market. Photo: DACC.

matter of agriculture, land and environment, but also of health, social welfare, education, equality, consumption and trade. Among the different governance models discussed to enable food systems to cope with the desired transformations, the most noteworthy are those based on adaptive management strategies, in which results are evaluated and new actions are implemented as progress is made, and where strategies can be changed if there is no perceived progress towards the set objectives. In other words, policies need to be more flexible and it should be clear that there are no universal solutions, but that each context, defined by its physical, ecological, social and cultural conditions, requires specific strategies.

Among the specific policy strategies outlined in the report, land access policies are of particular relevance. It could not be otherwise when the main form of land use is food production. The situation around the world varies hugely, but it is a fact that in Catalonia one of the main barriers for young people who want to go into agriculture and livestock farming is access to land. Actions that can facilitate this access would be a first step towards climate change adaptation and mitigation. Indeed, whenever we are asked, we always state the following: the main strategy for mitigating and adapting to climate change is to halt rural depopulation and enable the inhabitants of these areas to live a dignified life through agricultural activity; the transition to sustainable production models must be encouraged, good living conditions in these areas must be guaranteed and access to basic services must be made possible.

A multi-scale, multi-actor and multi-sectoral governance of food systems is needed

Further reading

Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems https://www.ipcc.ch/srccl.

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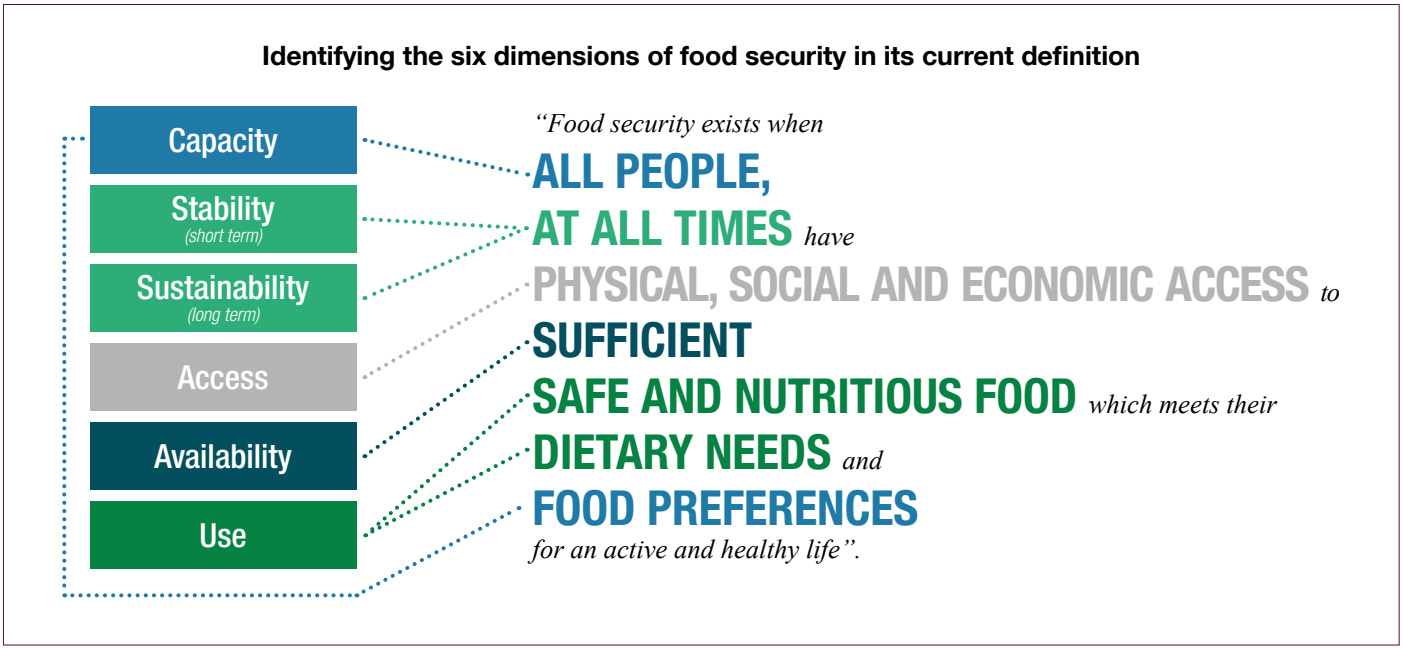
DIET, a key issue in moving towards healthy and sustainable food systems



The six dimensions of food security. Source: HLPE, 2020.

01. Is the current food system sustainable?

Sustainable food systems are those that deliver food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised. They meet all three dimensions of sustainability: economic (they are profitable throughout); social (they have broad-based benefits for society), and environmental (they have a positive or neutral impact on the environment) (FAO, 2018).

Therefore, for today's global food system to become sustainable, two main challenges must be overcome. On the one hand, to provide sufficient food, both in quantity and quality, for the world's growing population, to ensure the health and nutrition of all, and therefore to combat all forms of malnutrition. On the other, slowing the degradation of the planet's environmental and natural resources to ensure a secure future for present and future generations (FAO and WHO, 2019).

According to the experts, the type of diet is the factor with the greatest potential for enabling the food system to overcome these major challenges due to its potential to optimise and improve human and planetary health (Willett et al., 2019). However, a poor diet also has negative impacts on both human health and the health of the planet.

01.01 The health of people

Currently, more than 820 million people do not have access to enough food to enjoy a healthy diet. There are even more people who have access to sufficient food but who have poor dietary habits or eat more food than recommended (EAT, 2019). Despite the downward trend in the number of people affected by hunger in recent decades, the last few years have seen a change and this number has increased again for the third year in a row (HLPE, 2020).

As a result, the population suffering from all forms of malnutrition has been growing steadily in recent years. Meanwhile, the number of overweight and obese people has increased at an alarming rate, to the point of being considered a global pandemic (FAO and WHO, 2019).

In addition, the global economic impact of malnutrition in all its forms is estimated at $3.5 trillion annually, with

overweight and obesity alone accounting for about $500 billion annually (FAO and WHO, 2015).

01.02 The health of the planet

Food is responsible for 20-35% of greenhouse gas emissions. It is also a major contributor to the climate emergency due to the devastating consequences of land use, deforestation and biodiversity loss. Seventy per cent of freshwater depletion is attributed to agriculture (FAO, 2017).

Not all forms of nutrition, understood as diets or dietary patterns, have the same impact. Thanks to techniques such as life cycle analysis, researchers have identified the foods that have the greatest environmental impact. Within current dietary patterns, these foods include red meat, such as intensively produced beef, and processed foods, which are consumed in greater quantities and frequencies in Western societies and especially in more urbanised areas (Springmann et al., 2018; Willett et al., 2019).

In addition, one third of the food produced for human consumption worldwide is lost or wasted along the food chain (Gustavsson et al., 2011), which generates a negative impact both environmentally and socially, and economically because all the resources that have been invested in this food end up being wasted. These impacts grow as food is wasted further down the food chain, such as through household consumption (FAO, 2014).

02. How should we act according to the experts?

For the above reasons, there is an urgent need to radically transform current food systems into healthy and sustainable food systems. The *EAT-Lancet Commission*, a group of experts from the world of public health, agriculture, political science and environmental sustainability, has called it *The Great Food Transformation* (EAT, 2019). They argue that there is sufficient scientific evidence to immediately apply a holistic approach to the food system, considering its complexity. Thus, all policies that affect food and the planet, such as those related to agriculture, food security, health and trade, need to be changed (Springmann et al., 2018); Willett et al., 2019; HLPE, 2020).

> Food has great potential to optimise and improve human and planetary health.

> The global transition towards healthy and sustainable diets, reducing food losses and waste and improving the sustainability of food production techniques are three key issues that need to be addressed immediately and simultaneously.

> Sustainable healthy diets are those that promote all dimensions of individuals' health and well-being; have low environmental pressure and impact; are accessible, affordable, safe and equitable and are culturally acceptable.

In order to comply with the Paris Agreement and achieve the Sustainable Development Goals (SDGs), the EAT-Lancet commission proposes three key issues that need to be addressed immediately and simultaneously: the global transition towards healthy and sustainable diets, reducing food losses and waste and improving the sustainability of food production techniques.

03. What are sustainable healthy diets?

According to FAO and WHO, "sustainable healthy diets are dietary patterns that promote all dimensions of individual's health and well-being; have low environmental pressure and impact; are accessible, affordable, safe and equitable and are culturally acceptable. The aims of sustainable healthy diets are to achieve optimal growth and development of all individuals and support functioning and physical, mental, and social well-being at all life stages for present and future generations; contribute to preventing all forms of malnutrition [...] and reducing the risk of diet-related non-communicable diseases; and support the preservation of biodiversity and planetary health" (FAO and WHO, 2019).

03.01 Global recommendations for sustainable healthy diets

People's diets shape the demand for agricultural products and can therefore be considered the main factors shaping sustainable food production and distribution systems. For this reason, universal healthy and sustainable dietary models for all people and the planet have been designed to guide the global transformation of the food system (EAT, 2019) and enable the stable and healthy development of life on the planet (Springmann et al., 2018).

According to the experts, to achieve this transformation, consumption of fruits, vegetables, nuts and legumes will have to double, and the consumption of foods such as red meat and sugar will have to be reduced by more than 50% globally (EAT, 2019); FAO and WHO, 2019). These diets, in addition to being sustainable, are healthy, since the consumption of plant-based products and

the reduction of processed foods and red meat are associated with a reduction in different forms of malnutrition and related diseases such as diabetes, overweight, obesity and cardiovascular disease (Willett et al., 2019).

03.02 How should this transition be promoted?

Although the planetary health diet is consistent with many traditional eating patterns, it does not imply that the global population should eat exactly the same food, nor does it prescribe an exact diet. Instead, the planetary health diet outlines empirical food groups and ranges of food intakes, which combined in a diet, would optimise human health. Local interpretation and adaptation is necessary and should reflect the culture, geography and demography of the population and individuals. (EAT, 2019); FAO and WHO, 2019).

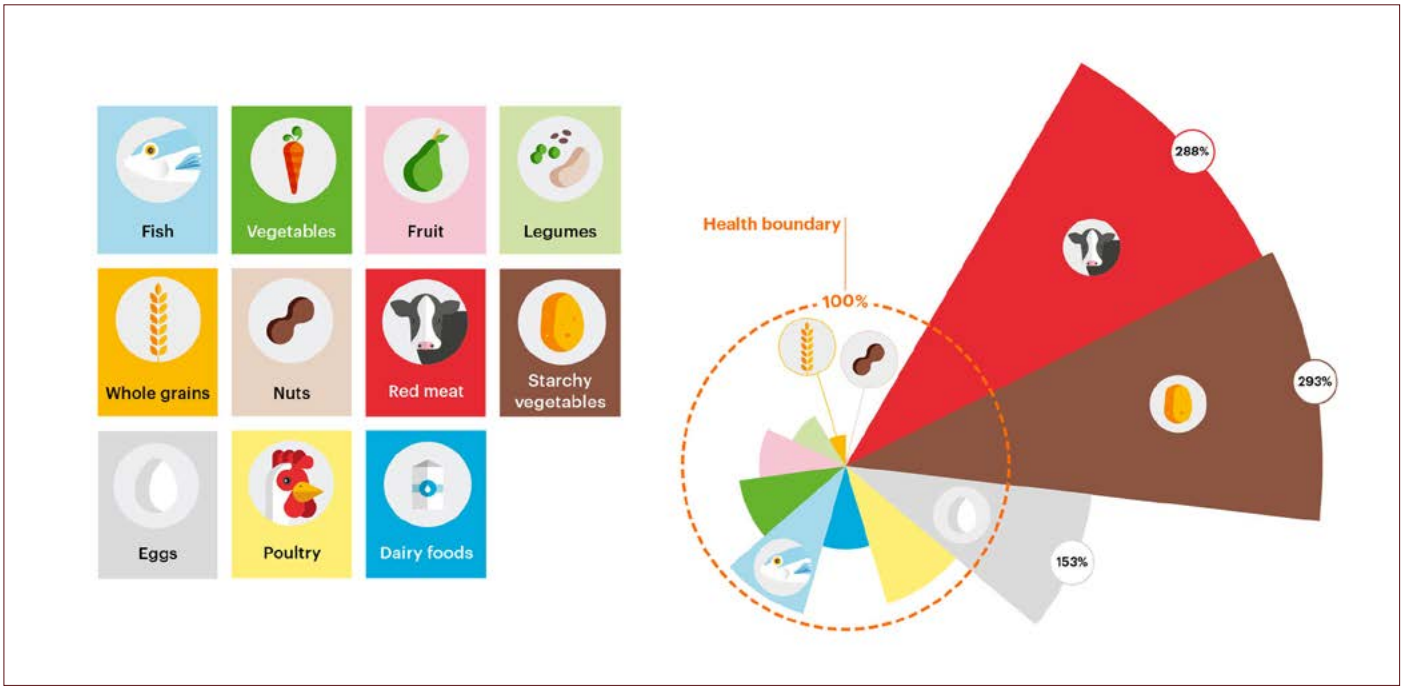
According to *The Lancet,* global consumption of red meat, starchy vegetables (such as potatoes) and eggs exceeds the daily intake recommendations by 288%, 293% and 153% respectively. By contrast, consumption of the other food groups remains below the recommended levels. However, there is no single pattern and there are differences between regions. North America is a clear example of over-consumption of red meat, eggs and starchy vegetables. On the other hand, sub-Saharan Africa and South East Asia only exceed the intake of the latter group. And, in the case of less industrialised regions, consumption of red meat and animal derivatives is well below the recommendations (EAT, 2019).

Experts recommend immediate action in westernised areas such as the United States and Europe. First, a reduction in the consumption of red meat and processed foods should be encouraged, replaced in part with plant-based proteins such as legumes combined with whole grains. In addition, the consumption of fruit, vegetables and nuts should be doubled. Meanwhile, this would allow less industrialised areas such as sub-Saharan African countries to increase red meat consumption from current consumption levels, if deemed necessary. Though this should only be to recommended levels to cover the nutritional requirements of the population, especially in terms of iron and protein (FAO & Biodiversity International, 2010).

03.03 Cultural and territorial aspects of sustainable healthy diets

To ensure sustainable healthy diets are maintained, it is essential to take into account the role of cultures, economies and environments regarding food in each region. There are a multitude of factors that influence our diets and eating habits. There are also many tools and methodologies that can help to analyse these in order for the transition to be more effective. To this end, the FAO and WHO recommend the following (FAO and WHO, 2019):

- Include modules, adapted to the different ethnicities and cultures living in the same region, in the nutritional guidelines.
- Show foods as desirable and palatable in promotional campaigns so that people will choose them.
- Carry out preliminary studies to identify the foods with the highest



Global consumption of the main food groups with reference to recommendations on universal sustainable healthy diets, which ensure a stable life for humans and the planet. Source: EAT, 2019.

nutritional content and lowest environmental impact according to their price to adapt recommendations to different population groups according to their purchasing power.
- Monitor the actions and policies being implemented to see if they are having the desired effect and, if not, to adapt them.

03.04 And the Mediterranean diet?

Fortunately, not everything has to be invented, since there are territorial diets that are healthy and sustainable, such as the Mediterranean diet. This diet is based on a high consumption of plant-based foods and a moderate consumption of animal-based foods. It is renowned and recommended worldwide for its health benefits, especially in preventing cardiovascular diseases. Multiple studies indicate that it also has a lower ecological footprint than other Western diets (FAO and WHO, 2019).

Although the Mediterranean diet has been losing followers in recent years, this trend can be reversed by promoting changes in eating habits, as demonstrated by the success of the New Nordic diet. This diet is considered a young diet, having been promoted by the governments of the Nordic countries since 2005, both for its health and environmental benefits, with great success among young people (FAO and WHO, 2019).

03.05 Other challenges to promoting sustainable healthy diets: food safety and food loss and waste

Both food safety, understood as food that is not harmful, and food losses and waste are aspects that should be considered when promoting sustainable healthy diets.

Contaminated food cause more than 200 acute and chronic diseases worldwide, the magnitude of which is equal to that of HIV, malaria and tuberculosis (FAO and WHO, 2019a). These can be caused by bacteria, viruses, fungi or parasites as well as by chemicals from food contamination, processing and packaging, and by some naturally occurring toxins. In non-industrialised countries, there have been new outbreaks of diseases from contaminated food in recent years. Most of these foods are precisely the ones recommended to prevent malnutrition and cardiovascular disease (EAT, 2019). It also appears that the climate crisis could lead to an increase in outbreaks of these types of diseases (FAO and WHO, 2019).

To ensure sustainable healthy diets are maintained, it is essential to take into account the role of cultures, economies and environments regarding food in each region.

Both food safety, understood as food that is not harmful, and food losses and waste are important aspects that should be considered when promoting sustainable healthy diets.

People should be made aware that increasing the consumption of fruit and vegetables without implementing loss and waste prevention actions can aggravate this problem and have a negative impact on the environment. The main reason for this is that plant-based products such as cereals, vegetables, fruits and starchy vegetables account for 85% of global food losses and waste along the food chain (FAO, 2013). Meanwhile, losses and waste could be reduced by increasing the consumption of animal and processed foods, which, according to FAO (2013), produce less waste and loss compared to those of plant origin. However, the latter option would have negative repercussions for both human and planetary health (EAT, 2019; FAO and WHO, 2019).

04. Final reflections

The near future does not look bright with a predicted increase in the world's population by 2050, and the westernisation of its consumption patterns (UN, 2017; EAT, 2019).

However, there is enough scientific evidence to allow us to immediately to achieve the Sustainable Development Goals. One avenue of action is the global transition to sustainable healthy diets. Experts recommend that in industrialised countries like ours we should eat more fruit, vegetables, whole grains and nuts, and less processed foods and red meat. Nutritional recommendations should encourage the consumption of local and seasonal foods, preferably agro-ecological, to promote resilience and the local economy (HLPE, 2020). To ensure healthy diets are well received and accepted, they must be culturally, economically and socially acceptable to the entire population.

Sustainability criteria (economic, social and environmental) should be included in the nutritional guidelines of each country or region. In Catalonia, the guide *Petits canvis per a menjar millor* (Small changes to eat better) (ASPCAT, 2019) is a good example. This transition can also be accelerated by adding sustainability criteria in public procurement for spaces such as school canteens (Lassen et al., 2019), hospitals (Sonnino and McWilliams, 2011) or work settings.

To ensure the health of people and the planet, a radical transformation towards sustainable food systems is required that guarantees the right to food (EAT, 2019; HLPE, 2020). This

requires policies designed and implemented from a food security and food systems approach, as recommended by the High Level Panel of Experts on Food Security and Nutrition (HPLE) in its latest report (HLPE, 2020). That is, policies that consider the complexity of food systems and their interrelationship with other sectors and systems, and policies that address specific issues and contexts (HLPE, 2014); Springmann et al., 2018; FAO and WHO, 2019).

As mentioned above, the impact of the current global food system on the environment, social and economic inequality, and the rapid process of westernisation of diets are reasons enough to initiate the transformation of food systems. Added to this are the effects of the current COVID-19 global pandemic, which has already had a profound impact, worsened the situation worldwide and made this transformation even more critical. This transformation will improve the resilience of food systems and we help us to progress towards achieving SDG 2 (End hunger, achieve food security and improved nutrition, and promote sustainable agriculture). We will also be closer to guaranteeing the right to sustainable healthy food for all (HLPE, 2020).

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TOWARDS A COMMON FOOD POLICY in the European Union

Fruit being sold at a local market. Photo: DACC.

01. Background: the European General Food Law Regulation

The food crises of the 1990s undermined consumer confidence in food production, the consequences of which still linger today. Following this crisis of confidence, in 2002 the General Food Law Regulation was adopted to renew the regulatory framework and ensure coverage of the entire food chain: production, processing and distribution.

This regulation has led to the establishing of control systems to enforce food safety, traceability and the withdrawal of unsafe food, in accordance with European regulations and their transposition into domestic legislation. It put down two cornerstones: first, the principle that food standards should be based on scientific knowledge and that they should protect the interests of consumers; and second it established the European Food Safety Authority as the main advisory body.

During the 21st century, improvements have been achieved in traceability that have afforded more guarantees to markets and more confidence to consumers; transparency and accountability have been improved among the agents of the chain; control systems have been consolidated in all parts of the food chain; and the reputation and competitiveness of European food products on world markets has improved, making the agri-food sector one of the strongest in the European economy.

02. Further challenges: towards a more comprehensive view

Since this Regulation was adopted, further challenges to achieving a policy ensuring the supply of safe, healthy, quality and affordable food to European consumers have arisen, and it has become clear that this regulatory framework alone is insufficient to meet them.

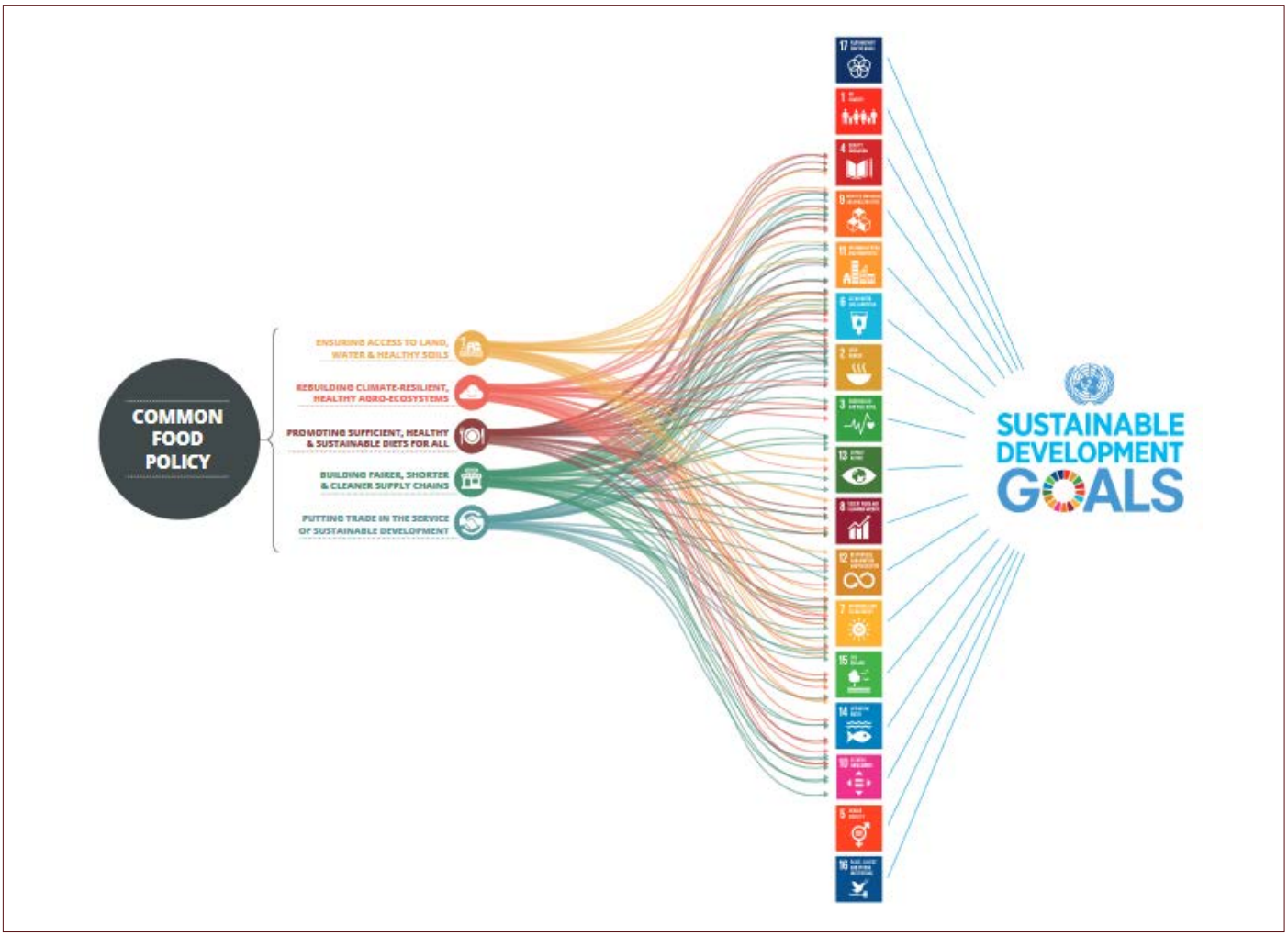
These challenges are mainly related to the environmental and socio-economic sustainability of the agri-food system, and include elements such as climate change, scarcity of resources and the necessary energy transition towards clean and renewable sources, the slowdown in agricultural productivity, the growing concentration of the supply

The various areas, disciplines and policies that have an impact on food must to be geared towards minimising negative impacts and reinforcing the potential of the European food system.

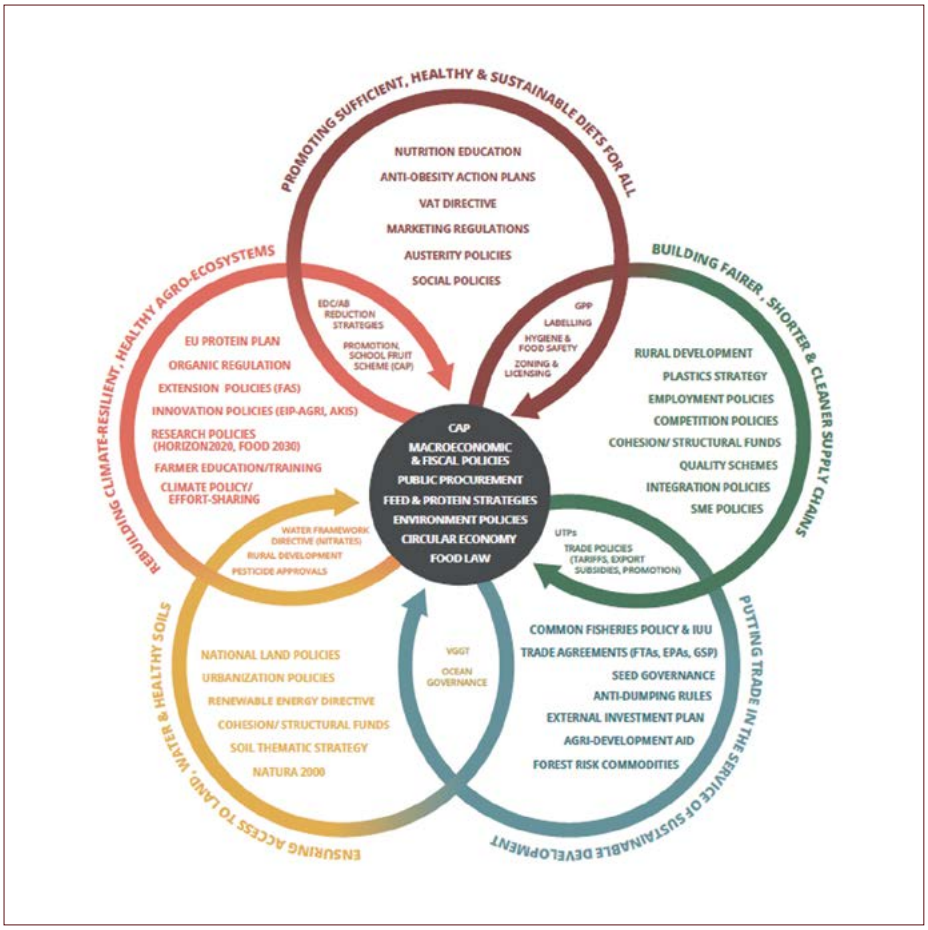
and distribution chain, food waste, price volatility, demographic evolution with sharp imbalances, changes in eating habits and growing resistance to antibiotics and phytosanitary products, among others.

The evolution of EU agri-food policies have clearly shown that we are not fully sustainable in any of the three major dimensions: economic, social and environmental. In Europe, millions of farms have disappeared and rural structures have been weakened, with depopulation and processes of erosion or forestation. The emergence of large-scale monocultures and intensive livestock farming has led to socio-economic dependency relationships and, at the same time, has reduced biodiversity and contributed to nitrate pollution in aquifers. In the case of fisheries policies and policies for the sustainability of marine and ocean resources, the result also points to negative environmental impacts and difficulties for the continuity of the artisanal fishing fleet.

Faced with these multiple and diverse challenges, medium- and long-term scenarios (2030-2050) must be created that provide a global vision for designing policies, which are increasingly interrelated. A strategy is needed that acts as an umbrella for the different policy areas, promotes synergies and avoids conflicts between them: agriculture, livestock and fisheries, environment, health, trade, research and innovation, and rural development. These policies and areas have been managed separately in the past, but now need to be aligned with a view to the present and the future. Failure to do so would come at a huge cost to our society. In recent years, innovative initiatives and projects have been launched in multiple disciplines and more comprehensive approaches are being pursued. But the challenge is above all one of governance.



How a common food policy can help achieve the SDGs. Source: IPES-Food, 2019.



Alignment and intersections of multi-sectoral policy tools under a common food policy. Source: IPES-Food, 2019.

The 2030 Agenda contributes significantly to the design of a sustainable food policy with a comprehensive vision.

03. Proposals for a European Food Policy

Moving towards an integrated food policy at the European level means coordinating and aligning actions between different policies and levels of governance, from the European to the local level, to reverse negative environmental, socio-economic and health impacts. The Common Agricultural and Fisheries Policies and current food legislation have so far demonstrated their limitations in achieving these objectives.

The cross-cutting and cross-border challenges of the EU's food systems can only be addressed under the leadership of a common food policy that guides the transition towards environmentally and socio-economically sustainable food systems, with sectoral policies that protect the single market and the equitable development of the different European territories through effective multi-level governance and a regional perspective.

The study "Towards a Common Food Policy for the EU. The policy reform and realignment that is required to build sustainable food systems in Europe" by the IPES FOOD (*International Panel of Experts on Sustainable Food Systems*) sets out 5 major objectives for a future food policy:

- Ensuring access to land, water and healthy soils.
- Rebuilding climate-resilient, healthy agro-ecosystems.
- Promoting sufficient, healthy and sustainable diets for all.
- Building fairer, shorter and cleaner supply chains.
- Putting trade in the service of sustainable development.

In a similar vein, the report "Feeding on future. For a productive, sustainable, resilient, healthy, responsible and universal food system in Catalonia" by the Advisory Board for Sustainable Development of Catalonia stresses the importance of integrating all policies with effects on food security and sets out 8 major goals.

04. New European Commission, new proposals

The new European Commission appointed after the 2019 European elections has put the European Green Deal on the table to replace the 2020 Strategy, which is intended to be *"a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use"*. This new comprehensive strategy aims to meet the SDGs of the 2030 Agenda and foresees the importance of citizen participation at all levels of governance: *"A new pact is needed to bring together citizens in all their diversity, with national, regional, local authorities, civil society and industry working closely with the EU's institutions and consultative bodies".*

The European Green Deal sets out lines of action that directly influence the field of food production, such as the Climate Law, the Farm to Fork Strategy, the Biodiversity Strategy or the Circular economy action plan, as well as the provisions for the internal mar-

ket, for research and innovation and for the digital agenda. It is also worth noting that when the new Commissioners Janusz Wojciechowski for Agriculture and Stella Kyriakides for Health presented their goals, they did so in a joint event to make this comprehensive view of food policy evident.

Horizontal coordination mechanisms will be necessary, and at the European level it will be necessary to move towards multi-level governance that takes into account state, regional and local authorities.

With the emergence of the COVID-19 crisis, the Commission's priority has been to reinforce investment to tackle the socio-economic crisis, but at the same time it has reaffirmed its commitment to the objectives of the Green Deal. In this regard, the aim is also to strengthen European leadership on a global scale with measures on climate, the environment, consumer protection and workers' rights, so that they have an impact both on the internal market and on trade relations on world markets, with the aim of better positioning European products and operators.

04.01 From Farm to Fork and Biodiversity: twin strategies

On the same day, 20 May 2020, the European Commission published the Farm to Fork Strategy and the Biodiversity Strategy, explaining the interrelationship between the two. In the context of the recovery from the COVID-19 pandemic, these two strategies aim to strengthen the resilience of European society against future pandemics and challenges such as climate change, forest fires or food insecurity, by supporting more sustainable practices for agriculture, livestock, fisheries and aquaculture and to protect biodiversity.

The Farm to Fork Strategy *"is at the heart of the Green Deal. It addresses comprehensively the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies and a healthy planet".* The strategy is also central to the Commission's agenda to achieve the SDGs. The aim is to achieve food systems that can *"deliver food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations is not compromised".* Based on this declaration of intent, the Strategy lists the specific objectives and lines of action for the coming years, highlighting the key role of producers in achieving the objectives and, therefore, the need to ensure a decent income for farmers and fishermen, to promote new business models, to improve value chains and to achieve fairer and more efficient food systems. Some of the main actions proposed by the Strategy are:

- Proposal for a legislative framework for sustainable food systems,
- European Food Security Observatory,
- Revision of the Sustainable Use of Pesticides Directive to significantly reduce use
- Reduction of the use of fertilisers, promotion of precise application techniques for fertilisers and of sustainable agriculture, recycling of organic waste such as organic fertiliser,
- Transformation towards sustainable livestock systems, reduction of antibiotic use and revision of animal welfare legislation,
- Strengthen plant health surveillance,
- Facilitate the registration of seeds and ensure accessibility to local and traditional varieties,
- Promotion of organic production,
- Sustainable fish and seafood production,
- Clarification of competition rules to favour the organisation and cooperation of producers and strengthen their position in the supply chain,
- Code of conduct for responsible business and marketing practices,
- Mandatory origin labelling of milk and sustainable food labelling (also for imported food),
- Binding food waste reduction targets, and
- Promotion of Agricultural Innovation and Knowledge Systems and creation of the Farm Sustainability Data Network (based on the Farm Accounting Data Network).

In parallel, the objective of the Biodiversity Strategy is to protect and restore biodiversity and well-functioning ecosystems to build our society's resilience to future threats. It also stresses that biodiversity is a critical element for economic recovery from the COVID-19 crisis insofar as half of Europe's GDP depends on nature and the services it provides, on which 3 key sectors depend: construction, agriculture and fisheries, and food and beverages. It notes that biodiversity is essential to ensure food security in Europe and at the same time recognises the vital role of farmers in preserving biodiversity. Thereafter, the Commission explicitly states that the Biodiversity Strategy *"will work in tandem with the new Farm to Fork Strategy and the new Common Agricultural Policy (CAP)".* When detailing the actions included in the Strategy, synergies with the Farm to Fork Strategy are evident: its sets the thresholds for reducing pesticides and fertilisers and increasing the area used for organic farming, the revision of pollinator protection regulations, the approval of a European Soil Strategy to protect fertile soils, reduce erosion and increase soil organic matter and an action plan for the conservation of fishery resources and the protection of marine ecosystems.

04.02 Resources for a European food policy

In parallel to the presentation of the strategies, on 27 May 2020 the European Commission presented the COVID-19 Crisis Recovery Plan with the new Next Generation EU fund, which will raise resources from the financial markets, and the revised proposal for the Multiannual Financial Framework (MFF).

Under the heading for Natural Resources with 355 billion euros, the CAP will be the main instrument through which policies and funds will be implemented, taking into account the Strategic Plans that must be presented by Member States. In its proposal, the European Commission establishes, through the new instrument, an additional allocation of 15 billion euros to the budget foreseen for the MFF to support rural areas in the necessary structural changes set out in the European Green Deal and especially those set out in the Farm to Fork and Biodiversity strategies.

Meanwhile, through the Horizon Europe programme, strengthen with a further 94 billion euros from the new instrument, funds will be channelled to R&D&I and to boost the green and digital transition, under the paradigm of the circular economy. The Commission also identifies the agri-food sector as one of the 14 priority industrial ecosystems for recovery to which structural funds will be allocated, in addition to the Invest programme to mobilise private investment, also reinforced by the Next Generation EU fund.

05. Conclusions

The food sector is key to economic development, due to the wealth generated directly by the primary sector and food production and processing and due to all the indirect activity it generates in the restaurant and tourism sectors, the processing of raw materials, etc. And it is undoubtedly interconnected with environmental and social sustainability.

Today, especially in view of the vulnerability highlighted by the COVID-19 crisis, food is once again a priority for citizens as a basic and vital need, and it is taking on an increasingly broad dimension. Therefore, food policies must help to guarantee the health of individuals through healthy, safe and quality food, to preserve the environment, the landscape and biodiversity, to maintain a gastronomic culture and sustainable consumption patterns, and to ensure a cohesive territory with social justice, both from the point of view of guaranteeing access to food for all and guaranteeing decent incomes for producers and those along the entire value chain.

> With the Catalan Food Council as a reference, we must promote the design and governance of a Catalan food policy in line with the European framework.

In order to respond to these demands, we need to move towards a governance model that enables the necessary coordination and alignment between all policies that have an impact on food. European policies are starting to lay the foundations through the Green Deal and the Farm to Fork and Biodiversity strategies, as well as through tools from European funds and programmes. But this new model will only be successful if it takes into account all administrative levels and adopts a regional perspective, which is the level at which there is the greatest capacity to adapt policies to the territorial diversity of natural and socio-economic ecosystems.

In Catalonia, we have begun to make progress in this direction. We have laid the foundations through the Catalan Food Council, which involves different government departments, representatives from producers to consumers and experts from different disciplines, with the aim of contributing to building a new food policy for the country based on local food production and sustainable management of the environment. Together with the framework of the Law on Agricultural Areas and with fisheries, forestry, agri-food and rural development policies, we must ensure the preservation of the country's natural resources and food sovereignty for present and future generations.

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FEEDING ON FUTURE

The Advisory Council for Sustainable Development (CADS) report on a safe and sustainable food system for Catalonia

Feeding on future. Photo: CADS.

01. Introduction

In March 2018, the Advisory Council for Sustainable Development (CADS) approved the report "Feeding on future", in which it highlights the need to transform the food system to increase food security and sustainability through the integration of cross-departmental and cross-sectoral policies and actions.

The proposals made by CADS in this report are aligned with the UN resolution *Transforming our World: the 2030 Agenda for Sustainable Development,* the global plan of action that brings together the economic, social and environmental dimensions of human development. This roadmap has 17 Sustainable Development Goals (SDGs) and 169 targets to be achieved by 2030. SDG 2 aims to "end hunger, achieve food security and improved nutrition, and promote sustainable agriculture". The interconnections between the different SDGs require us to address them in a comprehensive and indivisible way, and, therefore, to develop actions that take them all into account.

Since the adoption of this report by the CADS, a lot has happened. The most

significant event, without a doubt, has been the outbreak of the COVID-19 pandemic, which has highlighted our fragility and the need to work on the resilience of the system. This disease has sadly caused the loss of thousands of human lives, but has also generated severe social and economic impacts, especially for the most vulnerable populations.

Although there has not been a shortage of food in Catalonia, the loss of jobs has led to a large increase in demand from food donors. The productive sector has also been affected by the consequences of border closures and the difficulty of hiring temporary workers, as well as changes in some distribution channels, which have made it difficult for them to sell their products, which are sometimes highly perishable.

We need to ensure that everyone at all times has access to sufficient and healthy food, in other words, to guarantee food security without leaving anyone behind.

If in the current context of climate change, resource depletion, biodiversity loss and increasing inequalities it was already necessary to strengthen the resilience of the food system and increase security and sustainability, the COVID-19 crisis has shown that this is essential.

The report "Feeding on future", in which the CADS offers recommendations for a productive, sustainable, resilient, healthy, responsible and universally accessible food system, is more relevant than ever. This article sets out the main ideas of the CADS to ensure that everyone at all times has access to sufficient and healthy food, in other words, to guarantee food security without leaving anyone behind.

02. The CADS report "Feeding on future"

02.01 The challenge of food security

The CADS report "Feeding on future" aims to analyse the challenges and propose recommendations to ensure in the medium and long term that the population of Catalonia has physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

This study by the CADS is based on the four dimensions that make up food security:

- Availability of sufficient food, of appropriate quality and with sufficient diversity, provided by the domestic market or through imports,
- Physical and economic access to the resources necessary for nutritious food,
- Use of food for a nutritionally adequate and safe diet from a health point of view, and
- Stability, avoiding risks to food availability, access or proper utilisation from sudden shocks or cyclical events, or from natural, market or political causes.

The study looked at both availability, stability and supply, and also access, use and consumption. The "Feeding on future" report therefore sets out the challenges and recommendations for securing food supplies and for ensuring proper nutrition.

02.02 Challenges to ensuring the food supply

In Catalonia, the current degree of food self-sufficiency (i.e. the percentage of food produced out of the total consumed by the population) is not known exactly, but the best estimate is a degree of agricultural self-sufficiency of 40% (Reguant, 2016). Although it would be necessary to carry out a detailed study to determine this value more precisely, the data points to a potential weakness in the degree of self-sufficiency of Catalan agriculture.

It is also the case that the number of agricultural holdings is decreasing: between 1999 and 2013, the number of farms decreased from 72,067 to 57,298. It is worth noting, however, that they have increased in size, as shown in table 1. A comparison of the agricultural censuses of 1999 and 2009 (the last two available) shows that the number

Number of farms									
Hectares	<1	1-2	2-5	5-10	10-20	20-50	50-100	+100	**Total**
1999	10,463	9,537	15,968	12,715	10,657	8,656	2,665	1,345	72,006
2009	1,772	8,654	14,409	11,063	9,612	8,756	3,003	1,578	58,847
2013	1,507	9,273	15,397	9,618	8,605	8,177	3,067	1,657	57,299

Table 1. *Number of agricultural holdings, by size, in hectares of Utilised Agricultural Area (1999-2013). Source: Idescat. The data for the years 1999 and 2009 has been prepared by the authors using data from the agricultural census, while the data for 2013 has been prepared using the INE Survey on the structure of agricultural holdings.*

Organic rice cultivation in Riet Vell in the Ebro delta. Photo: JCCirera (Riet Vell).

of farms with more than 20 hectares in utilised agricultural area (UAA) has increased, while there has been a significant decrease in the number of smaller farms. Therefore, although the number of farms has declined, their size has increased, which facilitates their competitiveness and efficiency. This trend is corroborated by the data obtained in the 2013 farm structure surveys.

In today's global environment, Catalonia should not lose its factors of production. Productive capacity must be maintained and access to land for new producers must be facilitated, with more efforts made to improve the competitiveness of farms. This necessarily involves an increase in the added value of the production of these farms, but also a reduction in the fragmentation of these production units, allowing them to increase their possibilities for innovation, competitiveness and bargaining power. The protection and efficient use of productive resources are also key to continuing to guarantee food production in Catalonia. On the one hand, the land and the services offered by ecosystems, such as pollination or fishery resources, must be maintained and, if possible, improved. Moving towards more sustainable production methods must also mean improving the efficiency and circularity of energy, water and nutrient use. It is important to reinforce consumer information on the benefits of buying food produced with less pesticides which is local, seasonal or organic, or from sustainable fisheries.

In terms of basic resources, proper water management is essential in the face of today's context of climate change. Droughts, which are expected to become more frequent and longer-lasting, together with rising temperatures, will reduce the availability of water resources. But global change also brings with it the emergence of new pests and diseases, such as the outbreak of bird flu in early 2017, which could jeopardise our country's production capacity. In this regard, the alarming increase of antibiotic resistant bacteria due to their excessive and inappropriate use for both human and animal medicine also calls for urgent measures to reduce their use and to redesign the animal production system to mitigate the risk of disease.

Key CADS recommendations for ensuring the food supply.

- Strengthen the competitiveness and position of the primary sector in the production chain, promote the production of high value-added products

and protect agricultural land, especially that which is most fertile,
- Develop agricultural practices that improve soil fertility and reduce the use of pesticides and herbicides, especially those with higher toxicity for humans and wildlife (such as pollinators), more efficient use of energy and consumption of energy from renewable sources or sustainable management of fishery resources, and
- Promote climate change mitigation and adaptation strategies, develop a national antimicrobial resistance plan to reduce the use of antimicrobials, and redesign the animal production system to reduce the risk of disease.

02.03 Challenges for ensuring proper nutrition

According to the data available to the CADS, there is no structural malnutrition issue in Catalonia. In general, food consumption in Catalonia exceeds the needs of the population, while large quantities of food are wasted.

Catalonia must maintain the productive capacity of the food system, move towards more sustainable production methods and strengthen resilience to shocks.

At the same time, however, there are still families who find it difficult to access healthy, nutritious and sufficient food, and who have to make use of the food donation services of entities such as the Food Bank, many third (social) sector organisations and public administrations.

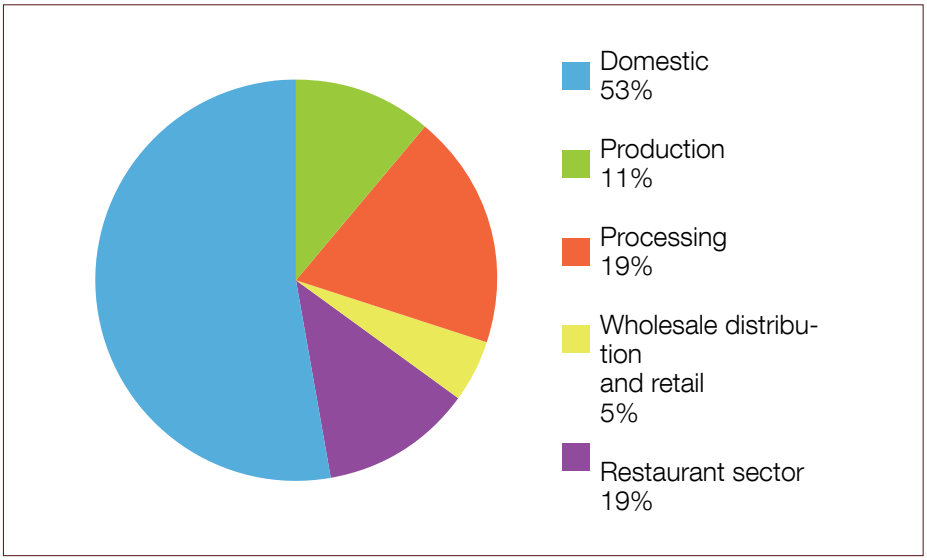
Meanwhile, since the 1960s, there has been a shift in eating habits with an increase in the consumption of more calories per capita, more meat and more processed products (Bosch, 2013). Currently, half the Catalan population aged 18-74 years is overweight, which is higher in the most disadvantaged social classes and among people who have only completed primary education or who have no education at all (Garcia, 2016). The consequence of this excess weight is an increased risk of metabolic diseases such as cardiovascular and respiratory diseases, diabetes and certain cancers. Reducing the incidence of these diseases requires a reduction in the intake of energy, saturated and trans fats, free sugars and salt, and an increase in the consumption of vegetables, legumes and fruits, more in line with our Mediterranean diet.

It should also be noted that in Catalonia more than 250 million kilos of food are thrown away every year by households, shops and restaurants. This is equivalent to the amount needed to feed 500,000 people (ARC, 2011).

For everyone to be able to enjoy proper nutrition, there must be no poverty. But this also requires proper education and information about food, and the recovery of the skills and culinary culture based on the Mediterranean diet.

	Recommended average per person per day	2016 consumption per person per day
Bread, pasta, rice and potatoes	300 g	184 g
Fresh fruit	500 g	272 g
Vegetables and greens	500 g	214 g
Meat	80 g	130 g
Fish	70 g	67 g
Eggs	45 g	22 g
Legumes	30 g	10 g
Pastry, chocolate and sugars	Occasional	53 g
Juices and soft drinks	Occasional	124 g

Table 2. *Comparison between recommended and actual intakes of the main food groups. Source: prepared by the authors based on data from the Ministry of Health (Healthy eating pyramid) and the Ministry for Climate Action, Food and the Rural Agenda (Consumption data for Catalonia).*



Distribution of food waste in the EU-28 at the various stages of the food chain (2012). Source: Stenmarck, 2016.

Key CADS recommendations for ensuring proper nutrition:

- Encourage healthier diets, in line with the Mediterranean tradition, by educating the general public regarding food and promoting our country's culinary culture and gastronomic heritage, and promoting food purchasing habits that are less intensive in the use of energy and other natural resources,
- Improve data and knowledge on food waste, increase social awareness and promote waste prevention and food recovery, and
- Promote stable employment in a labour market with decent wages and social benefits to reduce poverty, enhance cooking skills and adopt work-life balance measures, and develop measures to enable people on social benefits to participate fully as consumers in a normalised food system.

02.04 An integrated food strategy

In summary, the CADS concludes that the challenges for ensuring food security in our country in the medium and long term are:

1. Maintaining the productive capacity of the food system.
2. Moving towards more sustainable production methods.
3. Strengthening resilience to global change.
4. Promoting healthier diets in accordance with the tradition of the Mediterranean diet in our country.
5. Reducing food waste in order to provide more food for all, avoiding the unnecessary use of resources and reducing waste generation.
6. Ensuring that everyone has access to sufficient quantity and quality of food.

To meet all these challenges, measures are needed in areas as diverse as spatial planning, agricultural vocational training and consumer education, energy transformation to improve efficiency and the use of renewables, food processing and labelling, health promotion, employment promotion, local trade and international exchanges, gastronomic culture and that of the rural and marine environment, and the conservation of biodiversity, to name but a few.

So that everyone has access to proper nutrition, it is necessary to promote healthier diets, reduce food waste and promote stable employment with decent wages.

The CADS proposes making progress on the Catalan Agreement on Food Policy and developing it through an interdepartmental and intersectoral strategy.

For this reason, the CADS proposes making progress on the Catalan Agreement on Food Policy, agreed with all the stakeholders in the Catalan food system, and developing it through an interdepartmental and intersectoral strategy, with policies that integrate all these dimensions and well-defined and measurable lines of action.

02.05 Research, the key to the future food system

Basic research, technological innovation and also social and economic innovation must be the driving forces to successfully address all these challenges. Catalonia has leading research centres and universities in the agri-food sector. The Institute of Food and Agriculture Research and Technology (IRTA) is a key element, as are all the universities in Catalonia, each from their own area of expertise and from this broad vision of the food system.

The CADS recommends encouraging research and innovation practices in the sector by defining a research framework to move forward in all the proposed areas in order to find solutions for our country, but also to become pioneers in technological, economic and social innovation.

03. Conclusions

Transforming our food system to strengthen resilience and increase security and sustainability is more necessary than ever. The COVID-19 pandemic has highlighted our fragility, and the process of economic and social recovery must reinforce this transition towards a more inclusive, prosperous and planet-friendly model of production and consumption.

The report “Feeding on future” proposes a series of recommendations aimed at maintaining productive capacity, moving towards more sustainable production methods, strengthening resilience to global change, promoting healthier diets, reducing food waste and ensuring that everyone has access to sufficient quantity and quality of food.

To meet these challenges, we need to understand the complexity of the food system and to act in a cross-cutting manner on the various social, economic and environmental components that comprise it. The CADS therefore recommends that Catalonia develop and implement an integrated interdepartmental and intersectoral food strategy, with well-defined and measurable objectives and lines of action, within the framework of a Catalan Agreement on Food Policy.

This strategy should be accompanied

by a boost in research and technological, economic and social innovation practices that will allow progress to be made in all the proposed areas.

Following the publication of the "Feeding on future" report, two very relevant initiatives have emerged aimed at developing an integrated food strategy to move towards a more sustainable production and consumption model. On the one hand, the Ministry for Climate Action, Food and the Rural Agenda drew up, through a participatory process, a Strategic Food Plan for Catalonia, and on the other, in May 2020, the European Commission presented the Farm to fork strategy for a fair, healthy food system in balance with the planet, which will have to be implemented. This strategy is part of the Green Deal, the new Commission's roadmap for making the EU economy sustainable, and sets very ambitious targets for transforming the agri-food system, such as ensuring 25% of agricultural land is devoted to organic farming by 2030.

The CADS encourages further progress towards a productive, sustainable, resilient, healthy, responsible and universally accessible food system. In short, to continue working towards "feeding on the future".

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SUSTAINABLE AGRI-FOOD.
Options based on the Catalan context

Cereal field. Photo: DACC.

01. Introduction

According to the World Commission on Environment and Development (WCED), sustainable development is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". However, humankind undertaken precisely the opposite of sustainable development. The excessive use of fossil fuels (the planet's geological savings) has led to major economic growth. But growth, for no purpose other than growth itself, has become the greatest threat to finite non-renewable resources and to renewable resources that are being consumed beyond their capacity for renewal. As a result, the environment has suffered severe degradation, opening the door to anthropogenic climate change, a powerful destroyer of resources and well-being.

Today, the fundamental resources needed to satisfy our basic needs for life and well-being, primarily food, are under stress. In other words, agricultural land, forests, water, biodiversity and energy are approaching the infernal circle of deterioration and scarcity (erosion and loss of fertile soil, deforestation, water pollution, loss of biodiversity, environmental impacts of fossil fuels, etc.). In addition, Greenhouse Gas (GHG) emission reduction targets under the 2015 Paris Climate Change Agreement have shifted demand towards renewable resources and placed pressure on these same resources.

The great solar plant that is the Earth is the great receptacle that transforms

Renewable energies, the bioeconomy (food and others) and the defence of biodiversity are the three vectors that make up the front line in the fight against climate change and for a sustainable future.

solar energy into usable energy (heat or electricity). Photosynthesis is the production factory for renewable bioeconomy products (food, biofuels, wood, leather, textiles, bio-based chemicals, biofertilisers, pharmaceuticals, bioplastics, etc.). In turn, nature needs to be preserved and defended, and biodiversity is the great reservoir of opportunities for human development. In short, renewable energies, the bioeconomy (food and others) and the defence of biodiversity are the three vectors that make up the front line in the fight against climate change and for a sustainable future. It is on this front line that the most important tensions will arise.

02. Climate change and Agriculture

In this context, agriculture has become the main victim of climate change. Irregular rainfall patterns, more frequent droughts, extreme weather events, rising sea levels that flood fertile lands such as deltas, etc. are already occurring and intensifying. Indeed, the climate crisis will be most acutely manifested in the form of a food crisis. The successive cereal price crises of 2007, 2010 and 2012 are early warnings.

At the same time, however, agriculture and livestock farming are a cause of climate change. According to the Intergovernmental Panel on Climate Change (IPCC), the AFOLU sector (Agriculture, Forestry and Other Land Use) is responsible for 24% of global GHG emissions (fig. 1); 14% is due to agriculture, especially livestock farming, but the rest is caused by deforestation. It should be noted, however, that the direct GHG contribution of the AFOLU in Catalonia is 9% (fig. 2) because in Catalonia there is no deforestation, and most livestock is poultry or pigs, which emit fewer GHG emissions than ruminants.

Deforestation stems from the growing pressure of bioeconomic demand, primarily for food from a growing population with increasingly protein-rich diets. Since 1960, according to the FAO, the production of cereals, the world's staple food, has increased 3.5 times. And in the last thirty years, according to the same source, 178 million hectares have been deforested, the equivalent of 55.6 times the surface area of Catalonia. Demand is growing and resources are becoming increasingly scarce, so the necessary overexploitation of these resources creates a vicious circle.

This is a highly complex problem, and complex problems always have complex solutions, all of which are imperfect or insufficient. Easy solutions often formulated as axioms that do not need to be tested should be avoided. On the contrary, it is within this complexity and with the support of science that we will discover the possible ways forward.

03. The response from Europe

The European Green Deal is Europe's path to redressing environmental balances and fighting climate change. Of the set of proposals in the Green Deal, the Biodiversity Strategy and the Farm

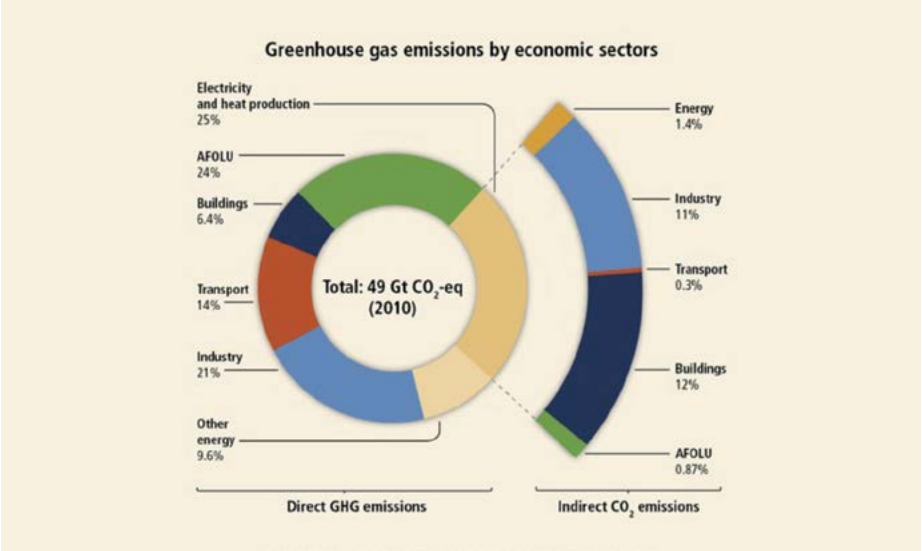

Figure 1. *Global GHG emissions by economic sector. Source: AR5 IPCC report*

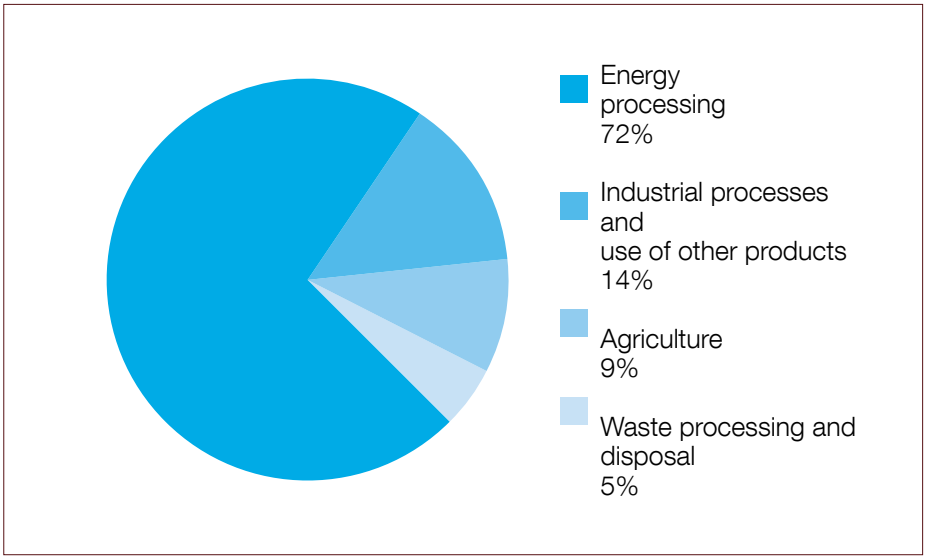

Figure 2. *GHG emissions in Catalonia by economic sector (2018). Source: Progress report on compliance with greenhouse gas emission reduction targets. Climate Change Office of Catalonia.*

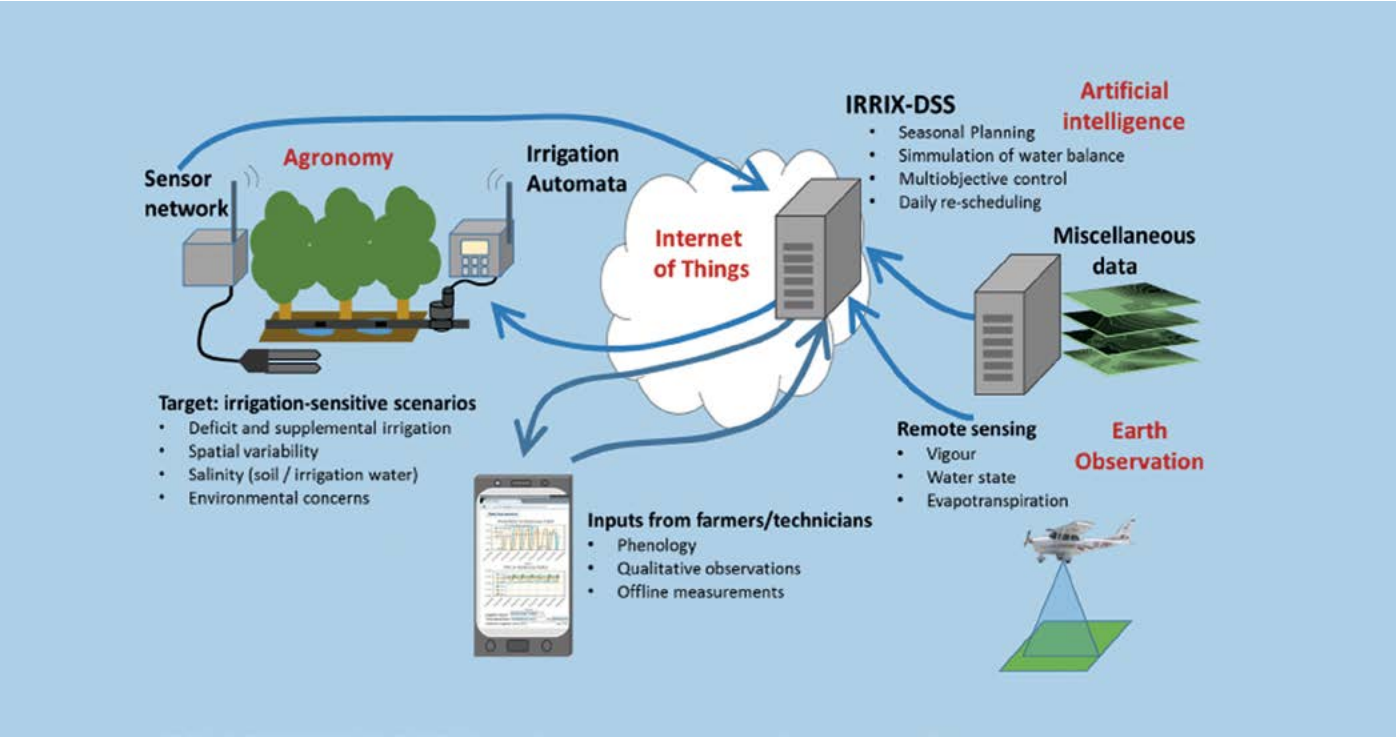

Figure 3. *Example of precision agriculture according to the IrriDesk platform. Source: IRTA.*

to Fork strategy are the ones that most directly affect agri-food. The two strategies are closely linked and together imply major changes in agricultural policies.

Some of the objectives, referring to the 2030 time horizon, that may have the greatest impact on agri-food are: expansion of protected areas to 30% of Europe's surface area, reforestation with 3 billion trees, 50% reduction in pesticide use and risk, at least 20% reduction in fertiliser use, 50% reduction in sales of antimicrobials used in farm animals and aquaculture, increased share of agricultural land set aside for organic farming to 25%, revision of animal welfare standards, and strategy and action to facilitate and increase carbon sequestration in agricultural soils.

This is an environmentally important set of measures, but in all cases, given the characteristics of today's agriculture, it entails losses in production capacity and, in general, higher costs. For example, reforestation will reduce agricultural land. Meanwhile, the expansion of protected areas will reduce production in the affected areas. As for organic farming, according to specific data from experiences in Catalonia, it reduces cereal production by 30% and fresh fruit by 50%; on the other hand, the production in vineyards is almost the same, but this year the reduced protection against diseases has caused extraordinary losses due to downy mildew. All of this while taking into account the growing pressure of food demand on a global scale and with climate change evermore active in the destruction and production of resources. In view of this, EU agriculture ministers have already warned of the risk that the sustainability of European agriculture will not be counterbalanced by unsustainable imports, which would be a huge contradiction and a mere externalisation of the problem.

04. Sustainable Intensification

In order to maintain the balance between growing demand and food supply, the FAO proposes what it calls “sustainable intensification”. Increased demand for food and other bioeconomy products cannot be based on deforestation. The main strategies within this conceptual framework are outlined below.

- Agroecology. This branch of science offers more environmentally friendly productive alternatives; it teaches us to make better use of resources (water, soil, energy), to recycle them, to diversify production systems by limiting monoculture and to take advantage of synergies between different crops and ways of producing them to increase their stability and resilience, and to use natural strategies to control pests and diseases (biological control, integrated pest management).
- Genetic improvement. Obtaining more productive and efficient plants or animals, which reduce the volume of potentially polluting waste, are more resistant to diseases or pests, etc. Biotechnologies offer largely unexplored opportunities.
- Precision agriculture. Where the plant is largely able to receive a supply of nutrition in a manner exactly in line with its needs, which minimises potentially polluting waste. To this end,

it uses the information provided by biosensors, remote sensing technologies (with drones, light aircraft or satellites) and big data and artificial intelligence processes (fig. 3).

- Irrigated. Irrigation in the Mediterranean area opens the door to modern and competitive agriculture: it enables new production options, multiplies production and thus avoids deforestation, brings production closer to the place of consumption, increases biological production as a carbon sink and avoids desertification, and is therefore a clear tool against climate change. It is also the best tool for rural development. A tool that is, however, dependent on the availability of water and an environmentally reasonable use of this resource. A resource, however, that is not destroyed and can be regenerated, a good argument for the reuse of wastewater.
- No agrofuels. Reducing or eliminating the use of first-generation biofuels as they occupy agricultural land, an essential resource to meet the food challenge. These are agrofuels (bioethanol or biodiesel) produced from food crops (maize, wheat, sugar cane, palm, oil seeds, sunflower, etc.) or non-food crops (e.g. camelina), but produced on agricultural land.
- Circular bioeconomy. The aim is to make better use of what we already use, and to make better use of what we do not yet use, by recycling, converting waste into a product and reusing it. Recycling must regain its role in economic culture.
- Combating food waste. According to the FAO, one third of potentially consumable food is spoiled or wasted along the food chain from the from the moment it is harvested or produced. Food waste must be reduced for food supply and ethical reasons. It is necessary to act throughout the chain, promote the circular bioeconomy, establish criteria and relax certain legislation that is conducive to it (marketing requirements, best-before dates, etc.).
- Plant-based diet. Encourage shifts in consumption towards healthier, but also less resource-intensive diets. A diet with a higher plant content is a diet that requires less soil and water resources, a good reason to encourage its consumption. And yet another good reason to promote the Mediterranean diet.
- New food alternatives. The world of algae is an underexplored resource with huge potential. Insects are a potential source of protein of great interest. And developments in cell cultured meat will offer a more efficient alternative to meat in relation to the resources used to produce it, an alternative that may occupy a growing market segment in the medium to long term.

In short, in the 21st century, agroecology, biotechnology and information and communication technologies could become useful allies for a highly productive agricultural system with minimal waste and minimal environmental impact. Finally, as a observation worth bearing in mind, if, as we say, science and technology must play a key role, promoting R&D must be a priority.

05. The Green Deal from the viewpoint of Catalonia

The Green Deal provides the guidelines for Catalonia's approach towards the goal of sustainability, as part of the joint effort from Europe. However, the implementation of the various European strategies must take into account the extraordinary diversity of Europe, and must therefore take account of regional particularities, from which conclusions may be drawn that are apparently contradictory to the overall objectives.

In relation to Catalonia, as well its unique characteristics as a Mediterranean region, it is worth mentioning certain paradoxes. Today, 32% of Catalonia's territory is protected within the Natura 2000 network. This is a very important contribution to the defence of European biodiversity, far superior to that of most European states and regions. One of the biodiversity strategy's European-wide objectives for 2030 is to ensure a protected area of 30%, a target that Catalonia has already surpassed. Therefore, extending the area of the Natura 2000 network in Catalonia should not be an objective, which is not to say that resources and efforts should not continue to be directed at improving the management of protected areas.

Another goal which should be approached from its own specific perspective in Catalonia is that of reforestation. Currently, 64% of the area of Catalonia is forest. However, it is largely extraordinarily dense forest, the result of neglect and forest fires, of unimaginable density in some cases and partly responsible for the decrease in the flow of our rivers. In short, two thirds of the territory of Catalonia is forest, which is barely or badly managed, unproductive and underutilised. In other words, we a have a huge tinderbox ready to spark the next fire leading to huge economic and personal cost. The aim here is precisely to strengthen the productive management of the forest, within the scope of resource renewal. This is the best way to protect it. By contrast, less dense forests segmented for crops and pasture promote biodiversity, as biodiversity is more intensively expressed in open spaces. Likewise, a forest shared with agriculture and livestock provides a richer and more diverse landscape, while radically reducing the risk of fire, preventing costs and damage.

In another sense, Catalonia is a country whose land is not conducive to agriculture; 50.5% of the land is on a gradient of over 20% and many counties receive insufficient rainfall, making it difficult to farm competitively. As a result, only 26% of the land is farmed. The per cap-

ita cultivated area is half that of Europe and the world. This means that Catalonia has a low rate of food self-sufficiency, between 40 and 45%.

The climate crisis will be most acutely manifested in the form of a food crisis.

We need food that is at the same time sustainable, sufficient and accessible to all.

These characteristics have shaped (if we oversimplify somewhat) the Catalan food system in two ways. On the one hand, there is a potentially competitive type of agriculture, basically made up of irrigation agriculture, dry farming in humid Catalonia and intensive livestock farming. On the other hand, there is struggling form of agriculture located in arid, non-irrigable areas, in mountains and in some peri-urban environments. It is an agriculture that resists adopting often imaginative added-value strategies and of diversified production. Potentially competitive agriculture accounts for almost 95% of Catalan agricultural production. However, the struggling form of agriculture plays a key role in the territorial balance, as it provides essential biosystemic services. Recognising this duality is essential in order to design appropriate strategies, which must be distinct in each case and yet mutually respectful.

06. Critical points in the new scenario

The sustainability demands of the new scenario require a reorientation or reassessment of several productive options. As part of this transformation process, there must be a special focus on a number of critical points:

Meat and livestock cluster. In a medium to long-term scenario, the meat and livestock cluster finds itself in a perfect storm. Meat consumption is being questioned from several vectors, including the environment, while the vegetarian alternative is gaining importance and in the medium term cell-cultured meat may become a serious alternative (fig. 4). We are talking about the country's leading industry and a key tool for territorial balance. Intensive livestock farming has sustained the population and a living landscape in many regions of Catalonia. Any strategy will have to be extremely cautious not to dismantle balances forged over the years without an alternative for rebuilding them. No doubt, progress will be needed in environmentally advanced livestock management and careful monitoring of impacts. At the same time, plant-based production should be expanded and the public ecosystem services offered by agriculture in particularly difficult environments should be enhanced.

Irrigated. Given Catalonia's low level of food self-sufficiency and its expected reduction following the implementation of the Green Deal measures, an important strategic objective is to improve this degree of self-sufficiency. It may be argued that the shortfall in agricultural supply could be covered by a higher degree of dependence on foreign trade. However, apart from the domino effect it would have on the food industry, Catalonia cannot renounce its responsibility in helping to resolve the problem of global food security. To this end, the use of irrigation must be optimised within environmentally reasonable limits and the implementation of precision agriculture should be promoted with the support of technology.

Catalonia needs agriculture. Thirty percent of the irrigated area generates 70% of the production, but with modern irrigation and value-added productions the multiplier coefficient could be much higher. In the Torres de Segre area, the coefficient is above 20, and the multiplier coefficient of intensive vegetable farming is over 40. The facts speak for themselves: the two counties of the Lleida plain that have been irrigated since 1855 (Segrià and Pla d'Urgell) have had a demographic growth that is similar to the Catalan average; the population of these counties has never declined. Conversely, those without significant irrigation lost about 30-40% of the population (fig. 5).

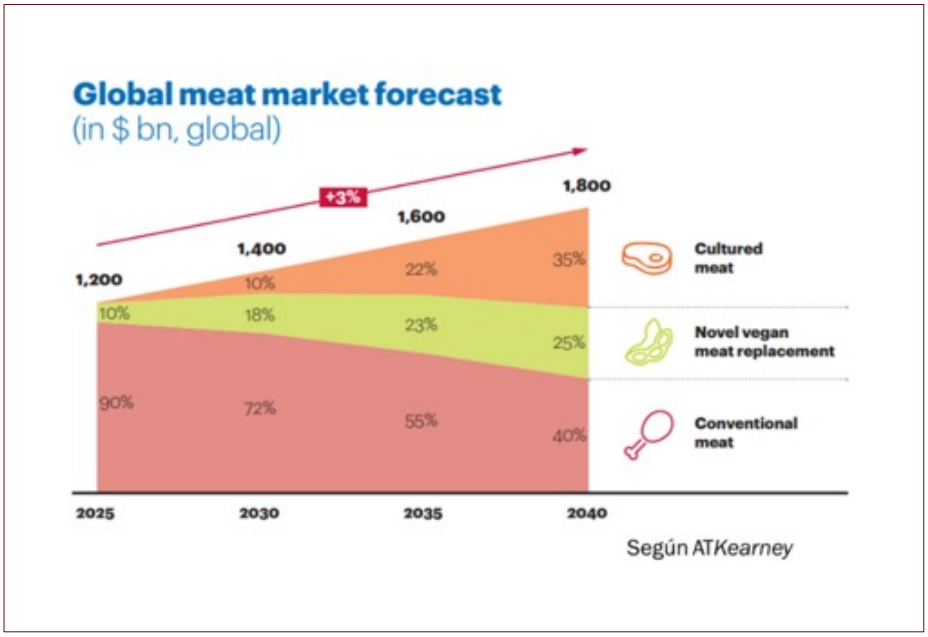

Figure 4. *Meat market forecast. Source: ATKearney.*

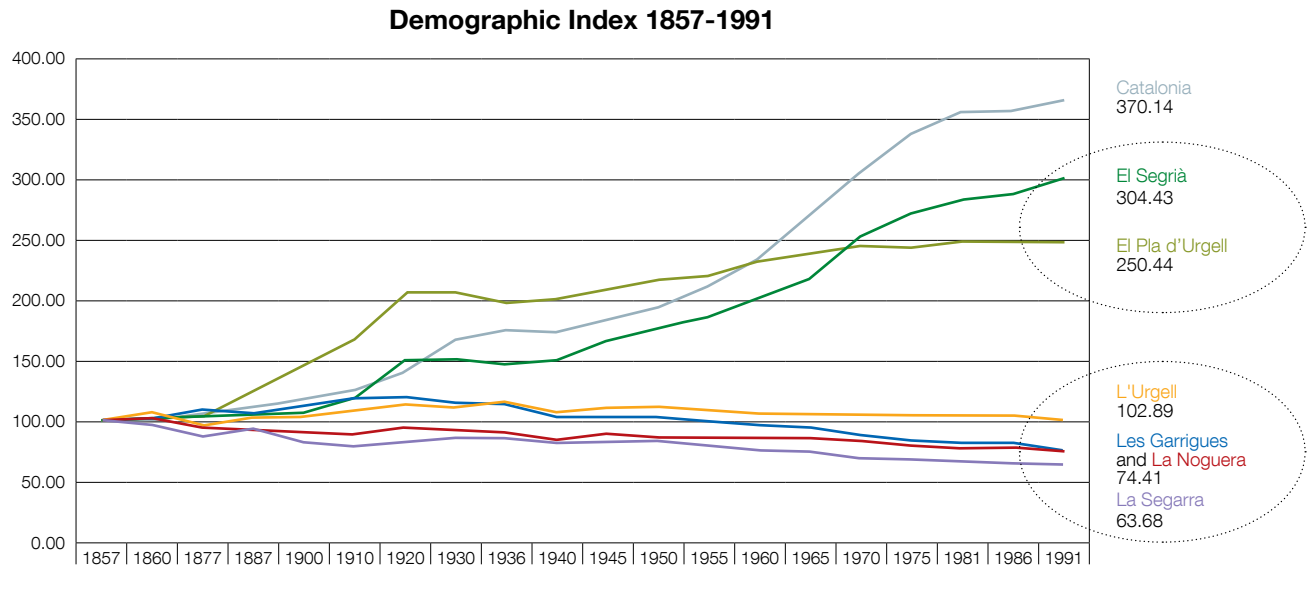

Figure 5. *Evolution of the population 1857-1991 in the counties of the Lleida plains. Source: Segarra-Garrigues Canal Study, a tool for the future.*

Renewable energies. Promoting renewable energies is a key energy transformation option. However, these energies must be not be developed in competition with agricultural land. Solar power companies demand the most productive lands in Catalonia, including irrigated land. The importance of renewable energy is clear, but food must undoubtedly come first in the order of priorities. Moreover, in cases where solar power is incompatible with agriculture, there are plenty of moors, scrublands and roofs, and farming cannot be carried out on moors, scrublands and roofs. Destroying an essential resource such as agricultural land, which is very scarce in Catalonia, in order to promote another resource would, in my opinion, be a major strategic mistake. Indeed, SPAs could host solar power since there is no incompatibility of use.

In summary, it is not easy to move towards a sustainable world, which we have previously put at risk. But action is urgent and unavoidable. Albert Einstein said that we should not pretend that things will change if we keep doing the same things. We must be open to change. We must learn to do different things. Nevertheless, we must take into account all the factors and demands involved and to cooperatively seek the best outcome.

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SUSTAINABLE AGRICULTURAL PRODUCTION IN CATALONIA (PAS). An opportunity for the agricultural sector

Sustainable Development Goals (SDG)

01. No poverty
02. Zero hunger
03. Good health and well-being
04. Quality education
05. Gender equality
06. Clean water and sanitation
07. Affordable and clean energy
08. Decent work and economic growth
09. Industry, innovation and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

THE GLOBAL GOALS FOR SUSTAINABLE DEVELOPMENT

Sustainable Development Goals (SDG). Source: DACC. Adapted from the United Nations.

01. Sustainability on the global, European and national agendas

The world is facing a period of constant change and evolution and the global community must address urgent challenges such as climate change and environmental degradation, or it will incur a huge ecological debt as a result of the overuse and depletion of natural resources that will affect future generations.

Global warming is not exclusively an environmental problem: it has an impact on many areas and is a major issue affecting biodiversity, the economic model, mobility, trade, food sovereignty, access to water and natural resources, infrastructure and health. As a result, it is increasingly influencing global, national and local policies.

Faced with this problem, in September 2015, countries from all over the world gathered at the United Nations General Assembly and signed the 2030 Agenda for Sustainable Development and the FAO (Food and Agriculture Organization of the United Nations) defined 17 Sustainable Development Goals (SDGs), to be achieved by 2030, which are aimed at the sustainable management and efficient use of natural resources on a global scale.

The European Green Deal is an integral part of the European Commission's strategy to implement the 2030 Agenda, which is nothing more than an Action Plan for Sustainable Development.

Among the lines of action of the Green Deal, the strategies that will most influence food production are the Farm to Fork Strategy and the Biodiversity Strategy.

In Catalonia, Law 16/2017, of 1 August, on climate change, establishes that climate change and the resulting impacts are the most important global challenge that human societies have ever faced and argues that this challenge requires a profound transformation of current energy and production models and a global commitment at the highest level. This same law also calls on the government to draw up a draft law to promote sustainable agriculture and livestock farming.

The new Law on Sustainable Agriculture, led by the Ministry for Climate Action, Food and the Rural Agenda (DACC), aims to intensify the efforts that have been made so far and promote the implementation of measures in agriculture aimed at mitigating and adapting to climate change and reducing vulnerability, greenhouse gas emissions, food waste and resource consumption. It will therefore be necessary to develop, among others strategies, those focusing on better water use, greater energy efficiency and the reduced use of fossil fuels to minimise greenhouse gas emissions; and on a decrease in the use of inorganic fertilisers, on the progressive use of fertilisers of organic origin, on establishing initiatives to prevent soil degradation and on the promotion of both functional and cultivated biodiversity.

European Green Deal Source: DACC. Adapted from "The European Green Deal".

02. The role of agriculture in food production and resource use

Projections of world population growth of up to 9.8 billion people by 2050 and of world GDP per capita growth have led to estimates on the need to increase food production by 60% over 2005-2007 production. Most likely, the way to address these growing needs of the population will be to increase crop productivity rather than expanding the area devoted to agriculture, to reduce wastage, and to substantially change the food supply. In other words, agriculture has a key role to play in responding to these new scenarios.

Meanwhile, on a global scale, current agricultural production is responsible for 26% of GHG emissions, the use of 50% of the habitable surface, the use of 70% of fresh water, 78% of eutrophication and for the loss of biodiversity (94% of the mass of mammals, excluding humans, are farmed mammals). In addition, some of these impacts are directly related to the three planetary boundaries that have been crossed to keep the Earth's system in a safe operating space: climate change, biodiversity loss and the nitrogen and phosphorus cycles (Rockström et al., 2009, Steffen et al., 2017).

In the case of Catalonia, according to the Third report on climate change in Catalonia (Martin Vide et al., 2016), agriculture is responsible for 33% of land use, 14% of GHG emissions and 45% of water pollution. The report of the Advisory Council for Sustainable Development "Feeding on future: for a productive, sustainable, resilient, healthy, responsible and universally accessible food system in Catalonia" of 2018 identifies the global challenges and how these challenges are interrelated with the local environment, and concludes the need for a sustainable food system in Catalonia.

If we take into account that food production is still a major consumer of water and energy and a source of pollutant emissions, responsible for about 11.3% of the EU's greenhouse gas emissions, and, at the same time, we want the economy to grow in a sustainable way, we need to consider a change in the way food is produced, transformed, consumed and distributed through a sustainable food system based on the principles of the circular economy. In this regard, the agricultural sector is of paramount importance for the well-being of people. Consumers also increasingly demand a form of food production that offers environmental benefits and is respectful of the natural environment.

Consequently, to meet the increased need for food, changes in production patterns will have to be accelerated: the transition to a sustainable production model and the achievement of the objectives of the Farm to Fork strategy, which is committed to the

production of food at affordable prices and which offers the added benefits to society of having been produced with environmental, health, social and ethical concerns in mind, and has made it possible to offer sustainable food to the market.

03. What is the current situation in Catalonia?

In Catalonia, 85.5% of the surface area is currently used for conventional production and 14.5% is regulated by voluntary and certified quality production systems, where the products obtained can be identified by the consumer. Of this amount, 7.5% is exploited under Organic Farming conditions and 7% under the Integrated Production system. The Organic and Integrated Production systems are subject to requirements that go beyond the conventional production system. Both are certified production systems, and farms wishing to obtain this certification must pass audits where compliance with the regulations governing these forms of productions is verified.

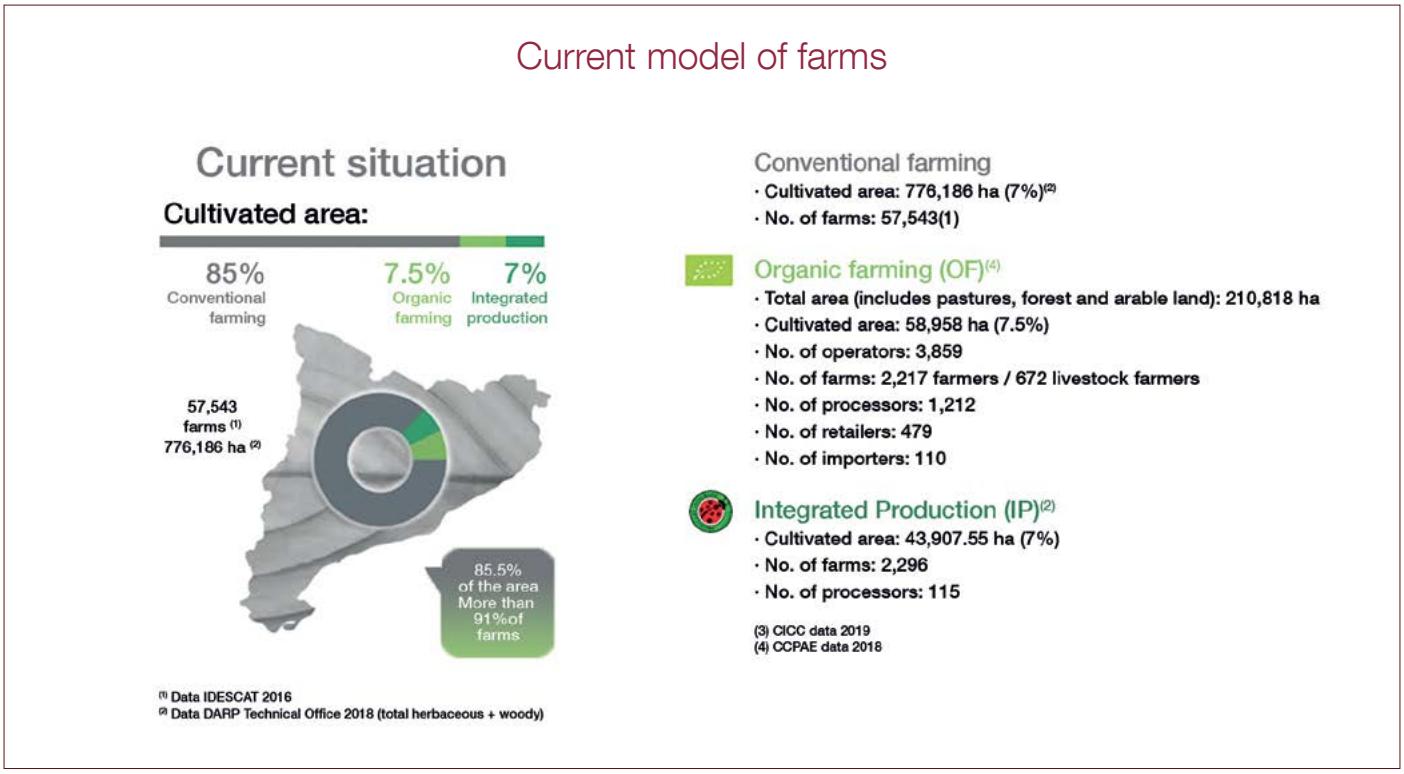
Agricultural production is subject to extensive regulation under the control and inspection of the Ministry Climate Action, Food and Rural Agenda. But these two production systems also have their own regulations: in the case of Organic Farming, the European model, and, in the case of Integrated Production, the state and regional models, under the rules of the International Organization for Biological Control (OILB). Therefore, farms that are part of these production systems follow rules that are even more demanding than the sectoral regulations themselves.

04. Sustainable Agricultural Production in Catalonia

Sustainable Agricultural Production in Catalonia (PAS in its Catalan initials) arose as a result of the reflection on what production model should be promoted among our agricultural companies in order to find a balance between production and competitiveness in food production and the preservation of resources and the environment, aware that the economic activity generated depends entirely on these resources and, consequently, it is the farms themselves that are the main stakeholders in their conservation.

In this context, Organic Agricultural Production and Integrated Production can be taken as examples, a transition from more intensive models towards more sustainable models and approaches more typical of agroecology. The transformation of our food production model is essential to advance our food system towards a model that allows us to achieve a greater degree of self-sufficiency in quality, healthy and local food and, at the same time, to respond to the challenges facing the planet and Catalonia with regard to the climate emergency and the loss of biodiversity.

In this sense, water, land, nutrients and other natural resources must be used efficiently and at a rate of replenishment that allows for their conservation; biodiversity must be managed in order to maintain biological resources, and the impact of agriculture and livestock



Current model of farms. Source: IDESCAT and DACC.

farming on the environment must be mitigated, so that damage is kept to a minimum.

The PAS also incorporates the principles of agroecology, as defined by the FAO, such as diversity, synergies, efficiency, resilience, recycling, co-creation, knowledge sharing, human and social values, culture, food traditions, responsible governance and the circular and solidarity economy.

PAS promotes sustainable agricultural practices, aimed at minimising negative impacts on resources and the environment, in a holistic approach that supports decision-making and incorporates the concept of sustainability.

To ensure sustainable food production, farmers need to transform their production methods more rapidly and make the best possible use of technological solutions, based on nature and space, to achieve better climate and environmental performance, increase resilience to climate change and reduce and optimise the use of inputs (plant protection products and fertilisers). These solutions require investment in human and financial resources, but can also potentially create added value by better adapting to the needs of society.

The PAS includes all three dimensions of sustainability: economic, social and environmental. Within each dimension, certain practices are defined which enable farms to be classified according to their degree of sustainability. These practices are grouped into different blocks according to the resources to be protected and/or the objectives to be achieved. Thus, in the environmental dimension, these blocks revolve around resources: water, soil, biodiversity, air and energy, and the objectives of reducing waste and promoting the adaptation of farms to climate change.

Within the economic and social dimension, practices are also defined to achieve sustainability in these areas.

The PAS is an opportunity for the agricultural sector to ensure that Catalan farms are increasingly sustainable and to make farmers aware that they are performing a very important task in preserving resources and the natural environment. This, in turn, can be conveyed to society so that society itself is able to better appreciate the role of farmers in caring for the natural environment and the health of people.

This new project is a model of integration, which will include all farms in Catalonia that meet the certification requirements.

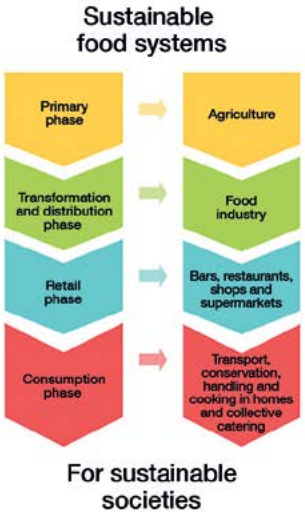
05. The vision, mission and objectives of the PAS

Vision: to make the Catalan agricultural sector a benchmark for sustainability in Europe.

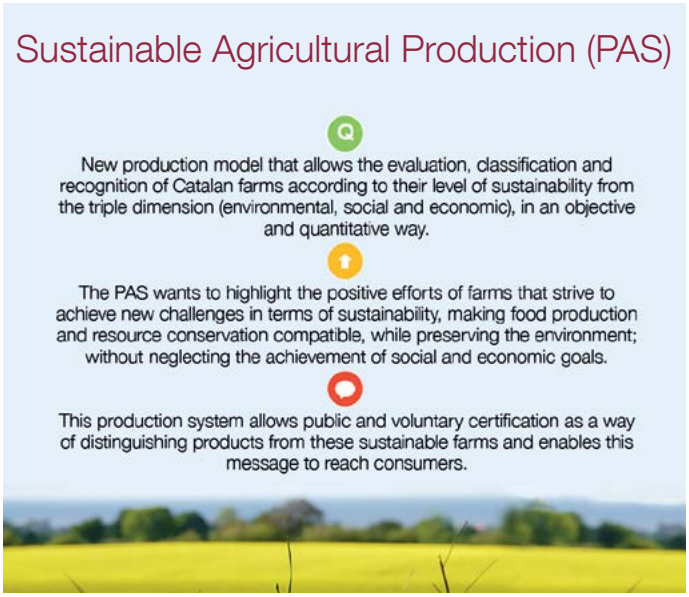
Mission: to promote sustainable agricultural practices on farms in Catalonia.

The PAS will promote the transition towards a sustainable agricultural model, based on the principles of agroecology, for farms in Catalonia, with a very ambitious objective in which, by 2030, the majority of farms in Catalonia will be part of this new sustainable production.

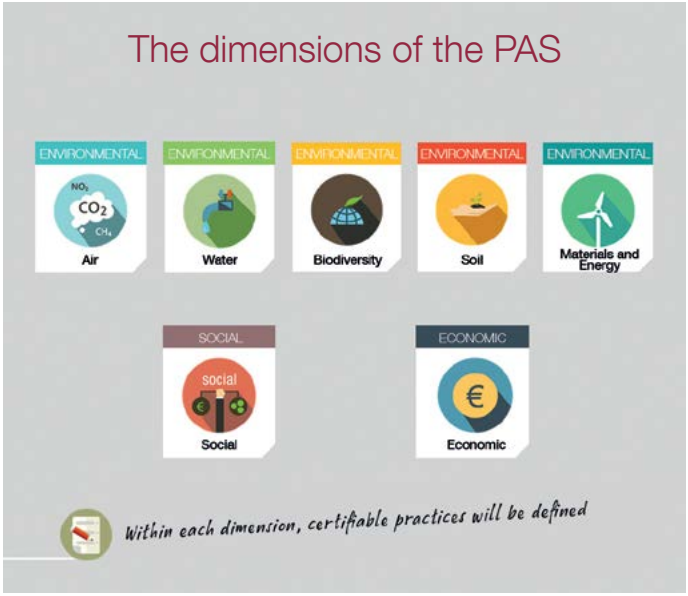
The three dimensions of sustainability



The three dimensions of sustainability. Source: DACC. Adapted from FAO 2014, SAM 2020 and ACSA.



Sustainable Agricultural Production (PAS). Source: DACC.



The dimensions of the PAS. Source: DACC.

The objectives of the PAS are:

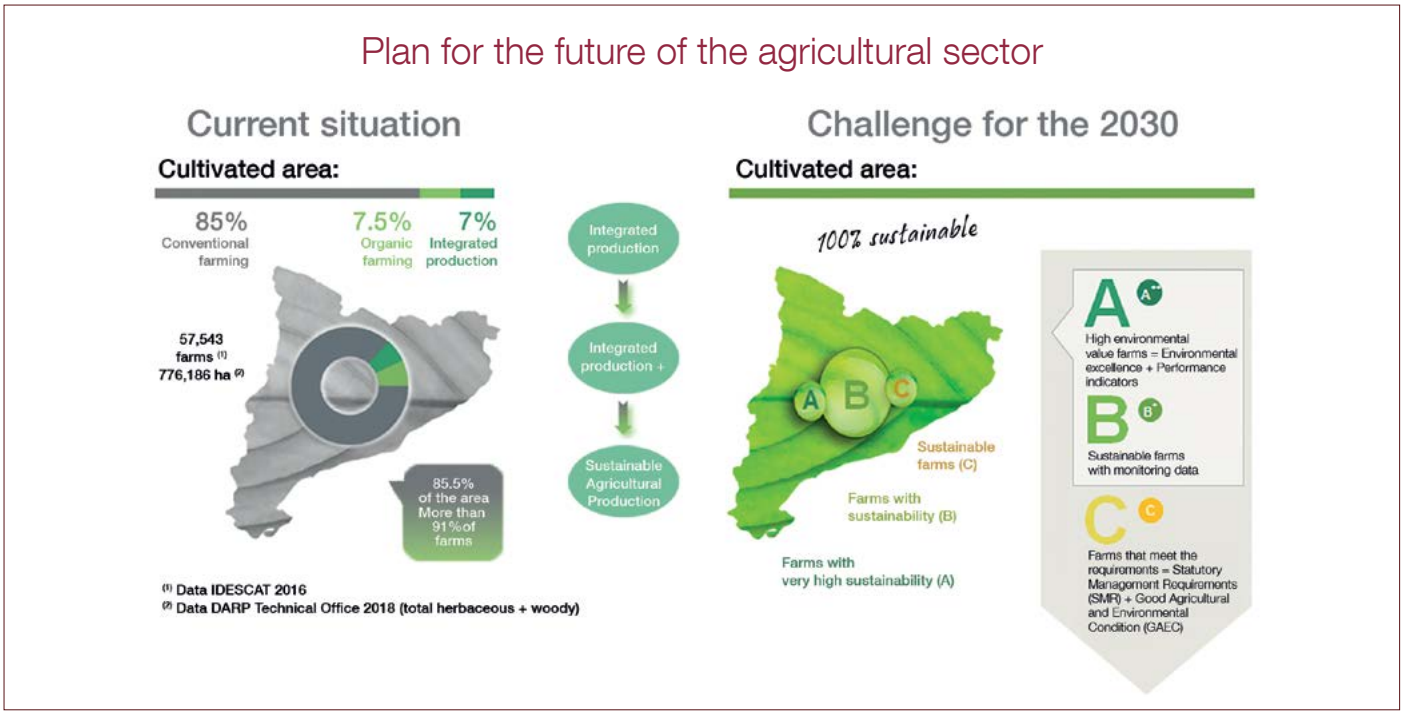
- Ensure that the food chain (production, transport, distribution, sale and consumption of food) has a neutral or positive environmental impact, and preserve and restore the natural resources on which the food system depends. This will contribute to mitigating climate change and adapting to its impacts: this means protecting the land, water, air, plant health, animal health and welfare, and reversing biodiversity loss.
- Guarantee food security, nutrition and public health, so that all people have access to sufficient, sustainable and nutritious food that meets high standards of safety, quality, phytosanitary products, animal health and welfare. People's nutritional needs and food preferences must be respected.
- Maintain the affordability of food while generating a fairer economic return in the food chain so that the most sustainable food is also the most affordable. Foster the competitiveness of the sector, promote fair trade and create new business opportunities.
- Establish a public and transparent protocol to assess the sustainability of Catalan farms, in environmental, social and economic terms, compatible with other initiatives that may be developed in other areas of the European Union.
- Raise awareness on the effort that farmers make to obtain quality and healthy food in a sustainable way.
- Support farms in the transition to the principles of agroecology using training as a vehicle to acquire the knowledge that farmers need to implement the new production system (PAS).
- Contribute to the economic viability of farms in Catalonia.
- Increase the quality of life of people working in the countryside by promoting the development of skills, fair access to means of production, fair trade practices, non-discrimination, gender equality, the heath and safety of individuals, cultural diversity, and ultimately recovering traditional knowledge and food sovereignty.

The transition to sustainable agricultural production in Catalonia involves ensuring the well-being of people and guaranteeing food security without depleting resources and without diminishing the capacity of the land's ecosystems. At the same time, the climate and environmental objectives of the European Green Deal must be achieved, while improving the income of primary producers and strengthening the competitiveness of Catalan farms. This new model can bring opportunities for both citizens and food system operators.

06. How will the expected economic, social and environmental impacts be assessed?

The PAS will collect data on the sustainability of farms and make it available to promote a process of continuous improvement. In this way, farms will be able to know their sustainability levels compared with other farms of similar type. This is in line with the Farm to Fork strategy in that it calls for a network of agricultural sustainability data that allows the performance of farms to be evaluated against regional, national or sectoral averages. The strategy also promotes specific advisory services that provide information and guidance to farmers and link their experience with existing research projects.

The PAS aims to reach the maximum number of Catalan farms and classify them according to their degree of sustainability in the following way: level C (all farms that comply with legal management requirements and good agricultural and environmental conditions (GAEC)), level B (sustainable farms that



Plan for the future of the agricultural sector. Source: DACC.

carry out data monitoring and implement a series of sustainability measures) and level A (farms that achieve environmental excellence, which can demonstrate the environmental benefits of their practices). This classification will help to highlight the value of sustainably produced food products and could have a positive influence on the demand for these products, which come from more sustainable farms and should therefore be recognised by the retail trade.

The PAS aims to be an integrating model, which also includes organic farming, given that there are aspects of the PAS, such as energy, waste, adaptation to climate change and the social and fair price block that are not developed in organic farming but which can be complemented by the PAS.

The PAS will incorporate all Integrated Production practices and these can be complemented with new sustainable practices to achieve the triple dimension of sustainability.

Presenting this production system as a certified system can offer guarantees that the certified practices are being carried out, something which is highly valued by the agri-food and distribution sectors, as well as by consumers who are increasingly concerned about sustainability and respect for the environment. This should result in a positive economic impact on the farms that follow this production system.

From an environmental point of view, in order to assess the neutral or positive environmental impact, measures will be implemented to monitor farm data to obtain results on environmental footprints, such as the carbon footprint and water footprint.

From an economic and social point of view, if farms can be made economically profitable, this make agricultural work more appealing and thus encourage the creation of new jobs.

Moreover, as part of the monitoring of the PAS, the impacts of system will be assessed using indicators. The system provides for a digital operations logbook of all the items that will enable the impacts to be assessed in all their aspects and the calculation of indicators to quantify these impacts.

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PREVENTION OF FOOD LOSS AND WASTE, keys to moving towards a sustainable agri-food system

Photo: Espigoladors Foundation

01. Introduction

Preventing food losses and waste along the agri-food chain, from primary production to the final consumer, is key to moving towards a sustainable agri-food system. This is the view of the United Nations, which has designated 29 September as International Food Loss and Waste Awareness Day.

In the framework of the Circular Economy Action Plan adopted in 2015, the European Commission (EC) will, in the coming years, adopt legally binding targets to reduce food waste in line with the revision of the Waste Directive published in 2018, which obliges member states to include food waste prevention in their national strategies, and the new Delegated Decision on quantification methodology published in 2019, which will allow the EC to obtain data on food waste levels from different member states.

Both the European Commission, through the European Platform on Food Losses and Food Waste, and the FAO, through the Technical Plat-

form on the Measurement and Reduction of Food Loss and Waste, are working to mobilise the different actors in the agri-food chain to take action to prevent food losses and food waste. Both institutions are working towards the ultimate goal of achieving target 12.3 of the UN Sustainable Development Goals (halving food waste by 2030 and reducing food losses).

Preventing food losses and waste along the agri-food chain is key to moving towards a sustainable agri-food system.

The recent From Farm to Fork strategy published by the European Commission to achieve more sustainable food production and consumption further underlines the need and urgency to prevent food losses and waste along the agri-food chain.

In Catalonia, the General Programme for the Prevention and Management of Waste and Resources (PRECAT20) established the objective of reducing food waste by 50% from its 2010 levels by 2020.

More recently, Law 3/2020 of 11 March on the prevention of food losses and food waste aims to establish preventive actions to reduce food losses and waste and promote actions to increase the use and recovery of food throughout the food chain.

The prevention of food losses and food waste is also present in the Strategic Plan for Food in Catalonia (2021-2026), which aims to promote a socially responsible, ethically acceptable, environmentally sustainable and economically viable production model.

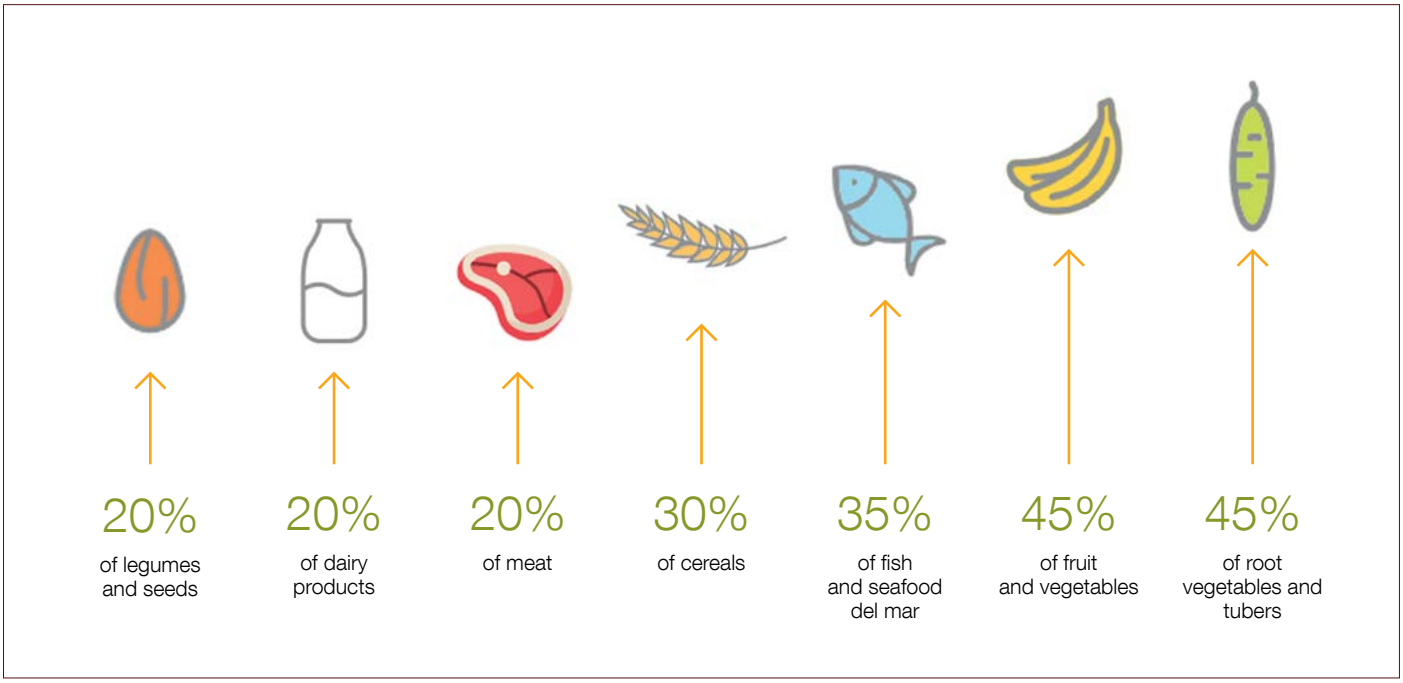
02. The issue of food losses and food waste in today's agri-food system

02.01 The size of the problem

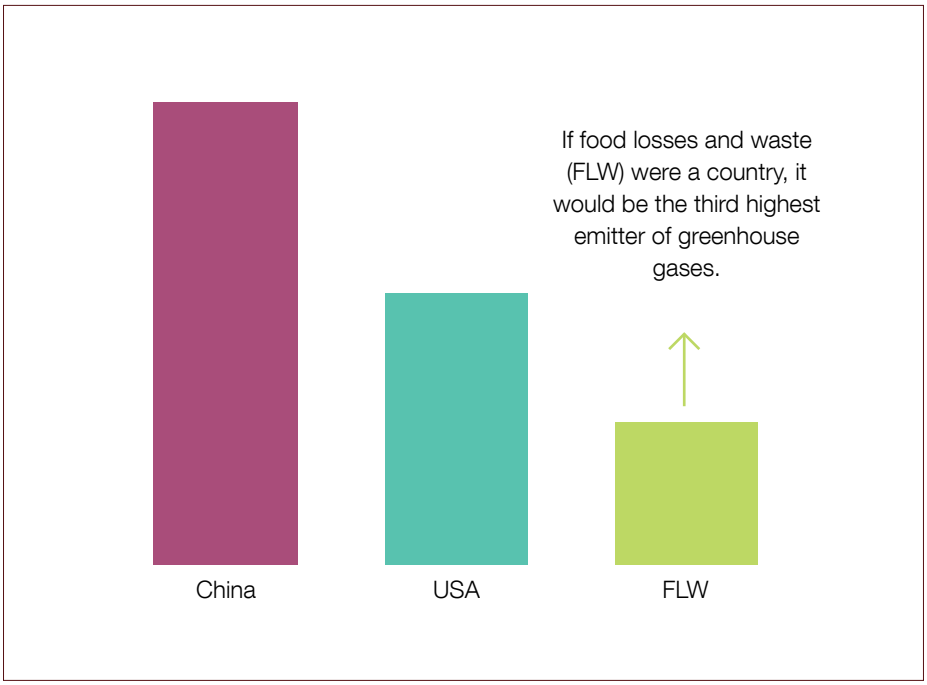
According to the FAO, world food production will have to increase by 70% by 2050 in order to supply food for the projected population increase from 7 to 9 billion people (FAO, 2009). Meanwhile, one third of the food produced for human consumption is lost or wasted along the agri-food chain, equivalent to 1.3 billion tonnes per year (FAO, 2011).

In the European Union, approximately 88 million tonnes of food are lost or wasted each year, equivalent to 20% of the total food produced or 173 kg per person (FUSIONS, 2016). In Catalonia, more than 262,000 tonnes of food are wasted annually in households, retail outlets and restaurants, equivalent to 7% of food purchased or 34.9 kg per person (ARC and UAB, 2012). From a more sectoral point of view, food losses and waste of more than 32,000 tonnes of peaches and nectarines in primary production, agro-industry and wholesale distribution, 16,000 tonnes of apples and 10,800 tonnes of pears were generated in 2018 in Catalonia (DACC, 2019).

Food is lost or wasted throughout the agri-food chain, from primary



Percentage of food lost or wasted on a global scale. Source: by the authors based on FAO 2011.



Greenhouse gas (GHG) emissions from food loss and waste. Source: by the authors based on FAO 2013.

Globally, one third of the food produced for human consumption is lost or wasted every year for multiple reasons, which is clear evidence of the inefficiency of the current agri-food system.

Food losses generate environmental, economic and social impacts that call into question the sustainability of the current agri-food system.

production to the consumer. While losses at the start of the chain are more frequent in developing countries, waste attributable to the consumer predominates in developed countries (FAO, 2011).

The causes of these losses and waste are manifold. In primary production, losses occur mainly as a result of low prices and non-compliance with aesthetic standards in the agri-food industry, food is wasted due to lack of planning, defects or inefficient machinery; in distribution, food is wasted in transport or storage, and consumers waste food for different reasons such as non-compliance with preservation techniques or confusion between best-before and use-by dates.

However, in many cases, food losses and waste occurring in one link of the chain may be caused by an upstream or downstream link, or by causes beyond the company's responsibility (customer requirements, changes in demand, last minute cancellations, etc.).

02.02 Economic, social and environmental impacts

These food losses generate environmental, economic and social impacts that call into question the sustainability of the current agri-food system. Not only because of the impact generated in the production, processing, distribution and sale of food, but also because of its management as waste.

When food is lost or wasted, the natural, technological and human resources needed to make it available to the consumer are wasted. Moreover, the impacts associated with food waste increase as it occurs further down the agri-food chain.

Economically, food loss or waste makes businesses less competitive, increases household spending and forces public authorities to allocate resources to manage surpluses that could have been put to better use. Globally, food losses and food waste cost the world economy USD 936 billion (FAO, 2014). In Catalonia, food waste in households, retail outlets and restaurants costs €841 million per year, equivalent to €112 per person per year (ARC and UAB, 2012).

Socially, food losses and food waste highlight the inequalities of our current food system. It is estimated that a 25% reduction in global loss and waste would be enough to end malnutrition worldwide.

Environmentally, food losses and waste are responsible for 8% of global greenhouse gas emissions (IPCC, 2014). If food losses and waste were a country, it would be the third largest emitter of greenhouse gases.

At the same time, food losses and food waste are responsible for a large loss of the natural resources used to produce this food, such as water, land and energy. An estimated 28% of the world's agricultural land is used to produce food that will never be consumed (FAO, 2013). Food losses and food waste also have an impact on biodiversity loss due to the impact generated in the production of this uneaten food, which is mainly due to unsustainable agricultural practices or the expansion of agriculture into wilder areas (deforestation).

03. Strategies and policies adopted to prevent food losses and waste and to move towards a sustainable agri-food system

03.01 International policies and strategies

In recent years, the issue of food losses and food waste has risen to the top of the international public agenda.

The United Nations Sustainable Development Goals (SDGs) adopted in 2015 within the 2030 Agenda include the specific target 12.3 related to the prevention of food losses and food waste within SDG 12 on Responsible Consumption and Production:

"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".

Achieving target 12.3 is key not only to achieving SDG 12 on Responsible Consumption and Production, but also to achieving SDG 2 on Zero Hunger, and others such as SDG 13 on Climate Action, SDG 10 on Reducing Inequalities, SDG 14 on Life Below Water and SDG 15 on Life on Land.

More recently, the United Nations has designated 29 September as International Food Loss and Waste Awareness Day to call for and reinforce action to reduce food loss and waste in both the public sector (local and national authorities) and the private sector (businesses and individuals).

Another example of UN efforts to achieve target 12.3 is the creation in 2020 of the Technical Platform on the Measurement and Reduction of Food Loss and Waste, which aims to quantify food loss and waste in order to achieve the 2030 reduction targets.

03.02 European policies and strategies

Given the cross-cutting nature of the issue, the prevention of food losses and food waste has been addressed in different European policies: waste policies, but also agricultural and fisheries policies, food quality and safety policies and food chain policies.

The Circular Economy Action Plan, adopted by the European Commission (EC) in 2015, identifies food waste prevention as one of the 5 pri-

The United Nations Sustainable Development Goals. Source: by the authors based on UN 2015.

ority areas for moving towards a sustainable and competitive economy. This area recognises the environmental, social and economic impacts of food waste and establishes different actions to prevent it.

In line with target 12.3, the EC set the following non-binding targets for food waste reduction in the Member States: 30% reduction by 2025 and 50% by 2030. The revision of the Waste Framework Directive published in 2018 obliges Member States to incorporate food waste prevention into their strategies. In addition, this Directive obliges Member States to quantify the levels of food waste according to the new Delegated Decision published in May 2019 and to report this data annually to the European Commission.

Thus, the quantification methodology for food waste published by the EC will allow for a common and consistent quantification for the different links and member states. To formalise this methodology, the EC published in November 2019 an Implementing Decision with the reporting format to be used by the different member states to report food waste data. The data obtained on food waste will allow the EC to set legally binding prevention targets for individual member states.

In order to support the commitment to achieve target 12.3 of the Sustainable Development Goals, the European Platform on Food Losses and Food Waste is working in different areas to provide the necessary tools and support Member States and actors in the food chain in the prevention of food waste. To achieve this objective, the Platform works with the following sub-groups: food donation, food waste quantification, action and implementation, date labelling and food waste prevention.

The Farm to Fork Strategy recently adopted by the European Commission incorporates the reduction of food loss and waste as a key objective to move towards sustainable food production and consumption. This priority is also in line with the reform of the new CAP which calls for more sustainable and efficient food production by Member States.

The European Commission is working to provide the necessary tools to help Member States and actors in the food chain to achieve Sustainable Development Goal 12.3.

Catalonia has responded to international and European guidelines and has implemented different actions to prevent food losses and food waste.

The Bioeconomy Strategy, approved by the European Commission in 2012, identifies discarded food along the agri-food chain as an opportunity to recover this surplus and generate new value chains.

03.03 Catalan policies and strategies

In Catalonia, the prevention of food losses and food waste is a national objective on which different departments of the Catalan Government are working, addressing the issue from the point of view of food health and safety, the efficiency and sustainability of the agri-food chain and food consumption and trade, all the way through free distribution to waste management. It is also worth mentioning PRECAT's reduction targets for Catalonia.

These different actions and policies adopted at the Catalan level are coordinated through the Interdepartmental Commission on the Prevention of Food Losses and Waste, led by the Ministry for Climate Action, Food and Rural Agenda (DACC), in which the different ministries involved in the fight against food losses and waste are represented.

The Action Plan for the Prevention of Food Waste in Catalonia (2019-2020), approved in 2019, includes projects from 47 Catalan organisations involved as promoters, and plans to implement 133 projects that affect all sectors of the food chain, distributed throughout the territory.

In compliance with the commitment adopted in the Action Plan mentioned above, the DACC has launched a series of actions under the strategy “Make the most of” food that are organised in 5 areas of work: 1. Knowledge, 2. Awareness raising, 3. Prevention and reduction actions, 4. Regulation and 5. Shared governance.

More recently, Law 3/2020 of 11 March on the prevention of food losses and food waste was approved, which aims to establish preventive actions to reduce food losses and waste and promote actions to increase the use and recovery of food throughout the food chain. Within the framework of this Law, the Government will draw up, together with the Catalan Food Council, a Strategic Plan for the Prevention of Food Losses and Food Waste.

Meanwhile, the DACC has approved the Strategic Food Plan for Catalonia and is currently drafting the Bioeconomy Strategy for Catalonia. With regard to the first of these, preventing food losses and waste will be key to moving towards an economically, socially and environmentally sustainable food system. With regard to the second, the recovery of discarded food along the agri-food chain creates an opportunity to develop new value chains based on the circular bioeconomy.

04. Final reflections

One of the biggest problems of our current agri-food system is its inefficiency, which results in the generation of food losses and waste throughout the agri-food chain, from primary production to the final consumer. This is a complex, cross-cutting and multi-causal problem, for which all actors in the agri-food chain, including the public and private sectors, are partly responsible. Experts believe that preventing food losses and waste can contribute significantly to mitigating the effects of climate change, securing the food supply, increasing efficiency in the use of natural resources and, ultimately, moving towards a more sustainable (economically, socially and environmentally) agri-food system. However, in order to achieve the prevention of food losses and food waste efficiently and effectively, it is important that this objective be integrated into other public policies and complementary strategies.

Europe is leading policies on the prevention of food losses and food waste in line with the guidelines set by the United Nations in relation to Sustainable Development Goal 12.3 of the 2030 Agenda. The establishment of legally binding targets under the revised Waste Directive and the publication of the common quantification methodology and reporting format will allow Member States to make progress in measuring food losses and food waste, an essential first step in managing prevention effectively.

However, the quantification methodology published by the European Commission has some important limitations, such as the fact that it does not include food losses at the level of primary production. The European Commission must continue to work in conjunction with the vision of the FAO and the UN to provide the knowledge and tools necessary for all actors to feel engaged and be involved as part of the solution. Regulatory changes and the establishment of strategies are necessary, but they must be accompanied by action from actors in the agri-food chain.

Catalonia has responded to the guidelines established at international and European level and has implemented different actions to advance in the prevention of food losses and food waste and to contribute to a sustainable agri-food system. The clearest example is the adoption of Law 3/2020 of 11 March 2020 on the prevention of food losses and food waste.

The need and urgency to prevent food losses and waste and to have a resilient and sustainable agri-food system has become even more evident with the food emergency situation caused by the COVID-19 pandemic.

Only through a comprehensive and collaborative approach can we meet the complex challenge of preventing food losses and waste and move towards a sustainable agri-food system.

Further reading

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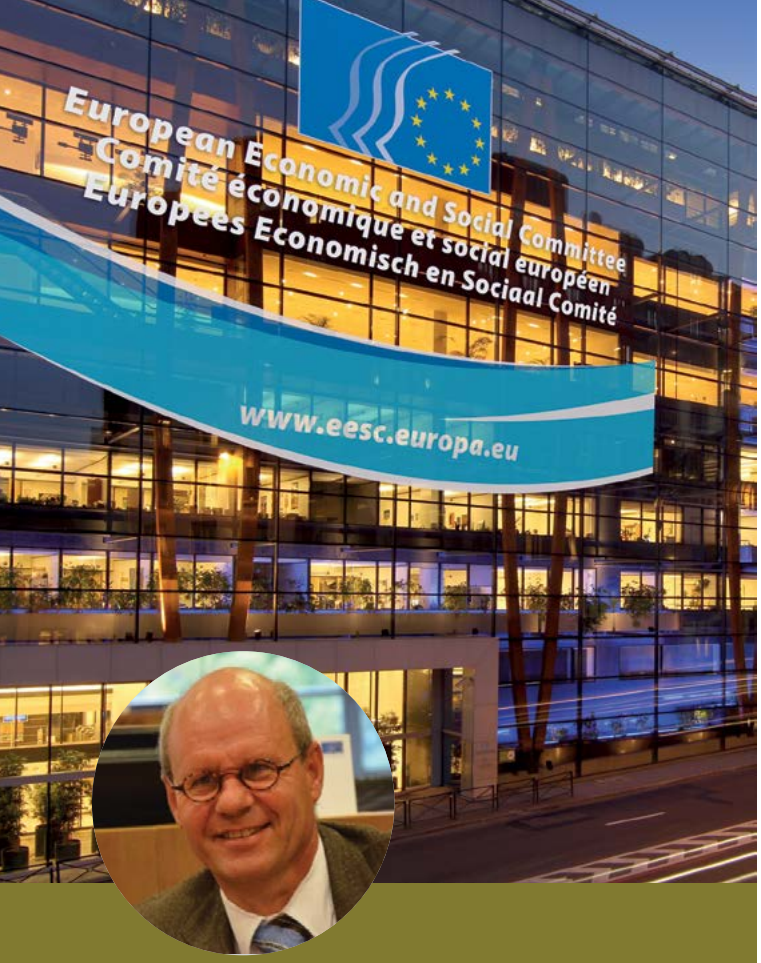

We talk to: PETER SCHMIDT

President of the Sustainable Development Observatory, European Economic and Social Committee (EESC)

Born in 1962, his first job was as a cheesemaker. He was regional manager of the NGG (Food, Beverages and Catering Union), affiliated to the German Federation of Trade Unions) for 27 years, as head of the dairy and bakery industries. Since 2014, he has been a member of Group II (Workers) of the European Economic and Social Committee (EESC).
From 2015 to March 2018, he was president of the EESC's Permanent Study Group on Sustainable Food Systems, and from April 2018 to September 2020 he was president of the EESC's Sustainable Development Observatory. Since October 2020, he has been President of the EESC's Section for Agriculture, Rural Development and the Environment (NAT).

https://www.eesc.europa.eu

What are the main challenges facing our current food system?

I think the main challenge is that the current policy framework is too fragmented and that we do not have a common European or Member State integrated food policy. Also, we experience a huge imbalance of power in the food supply chain where the big players, notably the retailers and the multinationals of the food processors, are misusing their power. Farmers do not get the fair price, which would be necessary to survive, and workers are paid less than in other industrial sectors. We see in parts of the harvesting area and in the meat sector even a kind of modern slavery system. Not to mention the major environmental and climate impact of food production and consumption on biodiversity, water and soil.

> "Farmers do not get the fair price, which would be necessary to survive, and workers are paid less than in other industrial sectors."

What changes are necessary to tackle these challenges?

First of all, we must internalise all economic, environmental and social costs of the food production. Big retail and multinational processors are making the highest profits while farmgate prices are too low to guarantee farmers' livelihoods and decent working conditions, and often do not even cover production costs. Therefore, we must address the big profit-making of the multinationals, they are at almost 20%! We have to redistribute the money to the farmers and workers with their families.

> "When a litre of milk is cheaper than soft drinks, the consumer loses the awareness of the big efforts, which have been made to produce it."

How should the European food policy be organised to achieve a more sustainable food system?

We need a food policy council at all levels. Starting from the European level down to the local level. Food councils can monitor and organise food systems, which should be built on fairness, short supply chains, no negative environmen-

tal impact and tackling the social aspects. We also need sustainable dietary guidelines for the producers, processors and the consumers. This could be organised at the European level and would also highly contribute to the achievement of the UN Sustainable Development Goals (SDGs).

What about the food value chain do you think should be reworked so that it can make the system more sustainable?

Yes, of course. We have lost the value of food because of a misled competition, which is built on the "race to bottom" concerning the price and to a certain extent the quality. When a litre of milk is cheaper than soft drinks, the consumer loses the awareness of the big efforts, which have been made to produce it.

Could you please give us some examples of initiatives that stakeholders in the food system, from farmers to consumers, could implement to reduce the environmental impact of the current food system and to build a more inclusive society?

There is an increasing number of initiatives being implemented at regional and local level to support alternative food systems. These initiatives establish closer links between producers and consumers, create opportunities for local businesses and new jobs, and reconnect communities with their food, for example farmers' markets, community supported agriculture etc. Cities are also playing a key role in developing more integrated food policies. Processes to reconnect cities to their nearby food production areas are under way in many places (e.g. Milan in Italy, Montpellier in France, Ghent, Brussels and Liege in Belgium and Toronto in Canada) and are likely to accelerate in the wake of COVID-19.

In the own-initiative opinion Civil society's contribution to the development of a comprehensive food policy in the EU, the EESC states that "A comprehensive food policy should build upon, stimulate and develop common governance at all levels". What type of governance is needed to ensure a sustainable food system?

A wide range of stakeholders across food systems have a role to play in overseeing the development and implementation of a comprehensive EU food policy. Improved cooperation between existing bodies is necessary of course, but as I mentioned before, food policy councils would be necessary at all levels. In particular, the option of a dedicated multi-stakeholder and multi-level governance structure should be explored. This structure, for example a European Food Policy Council, should have a democratic and inclusive approach, and should ensure strong and diverse representation of farming groups, civil society (including EU, national and grassroots organisations) and supply chain actors.

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How do you think the recent Farm to Fork Strategy published by the European Commission will contribute to transforming the current food system?

The F2F strategy is good starting point. When we adopted the EESC opinion on a comprehensive food policy in Europe almost four years ago, nobody believed that the Commission would start an initiative like that. However, as always, this strategy is not ambitious enough. We must push the Commission and the Member States to be more coherent together with the Common Agriculture Policy and ensure a real Green and Social Deal. We have now the opportunity for instance to use the Covid 19 recovery fund.

One last question. In recent months we have gone through a health crisis with strong economic and social consequences that have exposed our system's fragility. Do you think this crisis will speed up the transition towards a more sustainable society or will it deliver more "business as usual"?

In my experience, nothing happens without a strong and meaningful civil society engagement. That means that we must not only raise our voices. I think we must urge for a well-being economy – an economy that should protect ecosystems, conserve biodiversity and deliver a just transition to a climate neutral way of life across the EU and foster sustainable entrepreneurship. We have to fight against the big business interests. These interests are blocking real change towards sustainability. But as an optimist, I think it could be possible if we mobilise alliances and power from the street, such as the youth movement Fridays for future.

"We must push the Commission and the Member States to be more coherent together with the Common Agriculture Policy and ensure a real Green and Social Deal."

Generalitat de Catalunya
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