EATING FOR 2 DEGREES
NEW AND UPDATED LIVEWELL PLATES

SUMMARY REPORT

Revised edition

Cover photo
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August 2017

Note on revised edition
As a result of a query about inconsistencies between the carbon footprint breakdown and the figures in the composition tables presented in *Eating for 2 degrees – new and updated Livewell Plates* (May 2017), a miscalculation error has been identified which led to incorrect values across the Livewell Plates being published. Although the suggested consumption of various products is affected by this, in particular beef and veal, poultry and processed meat, it does not affect the overall conclusions of the report.

Blonk Consultants

About WWF
WWF is the world's leading independent conservation organisation. We're creating solutions to the most important environmental challenges facing the planet. We work with communities, businesses and governments in over 100 countries to help people and nature thrive. Together, we're safeguarding the natural world, tackling dangerous climate change and enabling people to use only their fair share of natural resources.

Food is at the heart of many key environmental issues WWF works on. Growing, producing and importing food contributes substantially to climate change. It's a driving force behind habitat and biodiversity loss. And it's a huge drain on water resources. That's why helping to develop a sustainable food system for healthy people and a healthy planet is one of WWF's priorities.

Find out more about our work at **wwf.org.uk/food**

About Blonk
Blonk Consultants helps companies, governments and civil society organisations put sustainability into practice. Our team of dedicated consultants works closely with our clients to deliver clear and practical advice based on sound, independent research. To ensure optimal outcomes we take an integrated approach that encompasses the whole production chain.

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FOREWORD

At WWF, we know that what we eat and how it's produced have consequences for the whole planet. Research shows that 20-30% of total global direct carbon emissions are from food and agriculture. Around 70% of all fresh water withdrawn is used for agricultural irrigation. And agriculture is the most significant cause of deforestation – and hence loss of biodiversity – around the world. Indeed, our current food system is responsible for 60% of our global biodiversity loss.

A well-functioning food system depends on a rich web of organisms, and animal and plant species. Food is therefore at the heart of our work if we want to achieve our vision of a world which allows people and nature to thrive.

WWF has worked on food consumption since 2010. In our first report *Livewell: a balance of healthy and sustainable food choices* we demonstrated that we can significantly reduce our environmental impact by changing the balance of our diets. We introduced our Livewell Plate – a visual representation of the types and portions of food we need to have for a nutritionally viable, low-carbon diet.

Over the years, we've shown how a healthy, sustainable diet can help us achieve a 25% reduction in greenhouse gas emissions from the European Union food supply chain, and that the Livewell Plate can be adapted to reflect other countries' nutritional guidelines and cultural needs. Our Livewell work has successfully put the topic of sustainable diets on the agenda of governments, food companies and health organisations.

Building on this success, the new Eatwell Guide[1], and the Paris Agreement[2] we decided it was time to update our Livewell work.

In *Eating for 2 degrees – new and updated Livewell Plates* we look at what we need to eat between now and 2030 to stay on track to reduce UK territorial emissions by 60% as advised by the Committee on Climate Change. We've added further environmental criteria to our work – notably water use and land footprint – and incorporated drinks into the analysis. We've also developed Livewell Plates for the elderly, adolescents and vegans.

We remain committed to our work on sustainable diets and believe this report makes important contributions to the food systems debate.

[1] The Eatwell Guide (formerly the Eatwell Plate) is a visual communications tool created by the UK Food Standards Agency to promote nutritionally healthy diets https://www.gov.uk/government/publications/the-eatwell-guide

[2] The Paris Agreement aims to reduce man-made greenhouse gas emissions to a level that limits the global average temperature-rise to well below 2 degrees Celsius compared to pre-industrial levels, with an aspirational goal of 1.5 degree Celsius. In the UK, the Committee on Climate Change has advised the government to reduce territorial emissions by 61% from 1990 levels. For this report we've rounded this down to 60%.

KEY FINDINGS

***Eating for 2 degrees – new and updated Livewell Plates* demonstrates that by following a Livewell diet you'll get your required amount of calories, as well as all nutrient and dietary requirements presented in the Eatwell Guide. This includes a minimum of five portions of fruit and vegetables per day, two servings of fish per week, and a maximum of 70 grams per day of red and processed meat.**

The environmental benefit of eating according to the Livewell Plates is a 30% reduction in carbon footprint by 2030 compared to 1990 levels. In addition, the Livewell Plates have lower impact on land-use change and land occupation.

The estimated cost of most of the Livewell Plates is minimally higher than the current diet. Although this is an approximation, it's important to note that food costs are predicted to go up over time with the cost for high-input food – such as those based on animal feed – rising faster and further than the low-impact food in the Livewell diet.

The carbon footprint of an individual's diet in the UK has been halved over the past five decades, mainly by improvements in food production. However, as 20% of total direct carbon emissions globally are from food and agriculture, it's safe to say that further reductions from the production sector – as well as emissions related to consumption – are needed.

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CALL TO ACTION

WWF works with key stakeholders from all areas of the food sector to define the boundaries of a sustainable food system which enables people and nature to thrive.

To achieve this goal we call on:

- The UK government to request advice from the Committee on Climate Change on setting a goal to reduce emissions from the food system, including overseas emissions resulting from UK consumption.
- The UK government to develop healthy eating advice (in the form of the Eatwell Guide) that incorporates sustainability.
- The UK government to develop an integrated food policy with a centralised responsibility for implementation.
- The farming and processing sector to develop a demand-led strategy to increase consumption of fruit and vegetables, support improved consumer health, and deliver growth for the UK horticulture and potatoes sector.
- Retailers and the food service sector to reformulate recipes and develop menus that will increase the range of food products that contain fruit and vegetables – particularly ready-to-go products and ready meals.

WHAT WE SET OUT TO DO

The aim *of Eating for 2 degrees – new and updated Livewell Plates* was to look in more detail at the environmental consequences of our dietary choices. We wanted to use additional environmental criteria to update the 2020 Plates and to produce individual Plates for 2030 for four separate groups: adults, adolescents, the elderly and vegans. The Plates presented in this report meet current national nutritional requirements. They also contribute to our national carbon reduction target, which for this report is rounded down to 60% from 1990 levels by 2030, in line with our commitments towards the Paris Agreement.

In the report, we assumed the food sector needs to make the same level of contribution as the rest of the economy to achieve the 60% reduction target. We divided the food sector into production and consumption, and – while we've also explored other proportions – we've based our mitigation efforts on a 50/50 split.

The total direct emission equivalent for the UK was 152 $MtCO_2$ in 1990. Applying our 50/50 split between production and consumption, leads to a 30% reduction by 2030. Assuming a linear reduction path of 114 Mt per 10 years, gives us the below reduction targets.

On a broader environmental level we wanted to see if our new Livewell Plates could help stop the on-going loss of global biodiversity caused by deforestation, and reduce the overexploitation of global fresh water. Agriculture is the main driver of both these problems, and we influence them directly through the choices we make about the food we eat. We set up our research model to try to find solutions that helped on both fronts.

Livewell is not about telling people they can't enjoy their food. Our objective instead is to show how easy it is to adopt a diet that's good for people and the planet – and that in many cases this doesn't require any radical change. Throughout, we've kept our solutions as close as possible to current diets and nationally-accepted nutritional advice. In each case, we've calculated the cost of the new Plates to ensure they remain accessible to everyone, including those on low incomes. Finally, we wanted to gain a better understanding of the impacts on health and the environment of historical changes in the UK diet since 1961; so we addressed this in our analysis of the data as well.

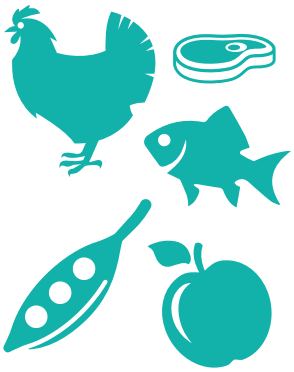
Table 1: Environmental reduction requirements for Livewell Plates for 2020 and 2030

	1990	2020 LIMIT	2030 LIMIT
Total carbon footprint ($MtCO_2$)	**152**	**117.9 (-23%)**	**106.5 (-30%)**

LIVEWELL SHOWS HOW EASY IT IS TO ADOPT A DIET THAT'S GOOD FOR PEOPLE AND THE PLANET.

METHODOLOGY

The analysis behind the Livewell Plates is carried out with a tool called Optimeal, which uses a data programming process known as optimisation. In simple terms, it takes the nutritional requirements of each consumer group and finds a division of food products that meet these needs. Various environmental constraints (such as a maximum carbon footprint) can be included, and the optimisation process will hone its approach so these are part of its solutions. Our goal was to find a diet with the fewest possible changes relative to the current diet, while meeting all restrictions.

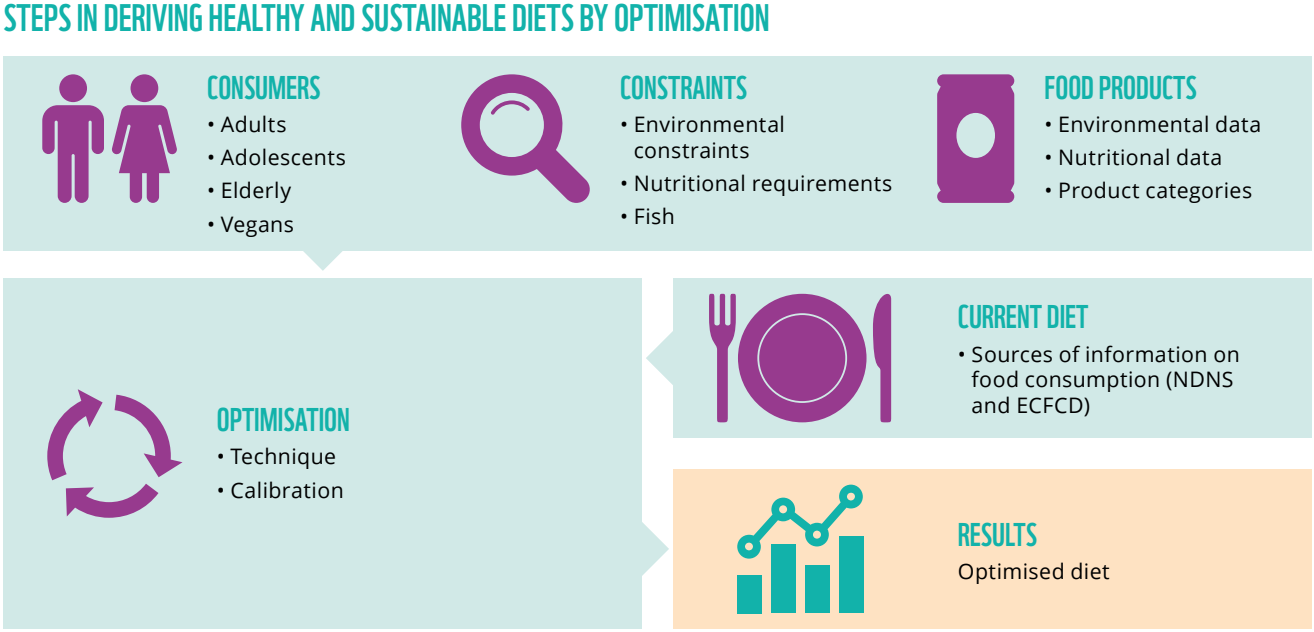


THE GOAL OF THE PROCESS IS TO FIND A DIET WITH THE FEWEST POSSIBLE CHANGES WHILE MEETING THE RESTRICTIONS IMPOSED.

The quality of Optimeal's analysis depends on rigorous and robust data. From creating a comprehensive range of food product groups to calculating their nutritional outputs and the environmental footprints of hundreds of products through their full life cycles, our researchers amassed a highly detailed store of information to feed into the optimisation. This meant working with a wide range of approved sources and metrics to build a database that realistically reflects the complex nature of today's food system.

The results of the optimisation exercise – expressed in terms of grams of each product – make up the new Livewell Plates.

Figure 1: Steps taken in the optimisation process of Livewell Plates.



LIVEWELL PRINCIPLES

EAT MORE PLANTS

Enjoy vegetables and whole grains.

EAT A VARIETY OF FOODS

Have a colourful plate.

WASTE LESS FOOD

One third of food produced for human consumption is lost or wasted.

MODERATE YOUR MEAT CONSUMPTION, BOTH RED AND WHITE

Enjoy other sources of proteins such as peas, beans and nuts.

BUY FOOD THAT MEETS A CREDIBLE CERTIFIED STANDARD

Consider MSC, free-range and fair trade.

EAT FEWER FOODS HIGH IN FAT, SALT AND SUGAR

Keep foods such as cakes, sweets and chocolate as well as cured meat, fries and crisps to an occasional treat. Choose water, avoid sugary drinks and remember that juices only count as one of your 5-a-day however much you drink.

ADULT 2020 PLATE

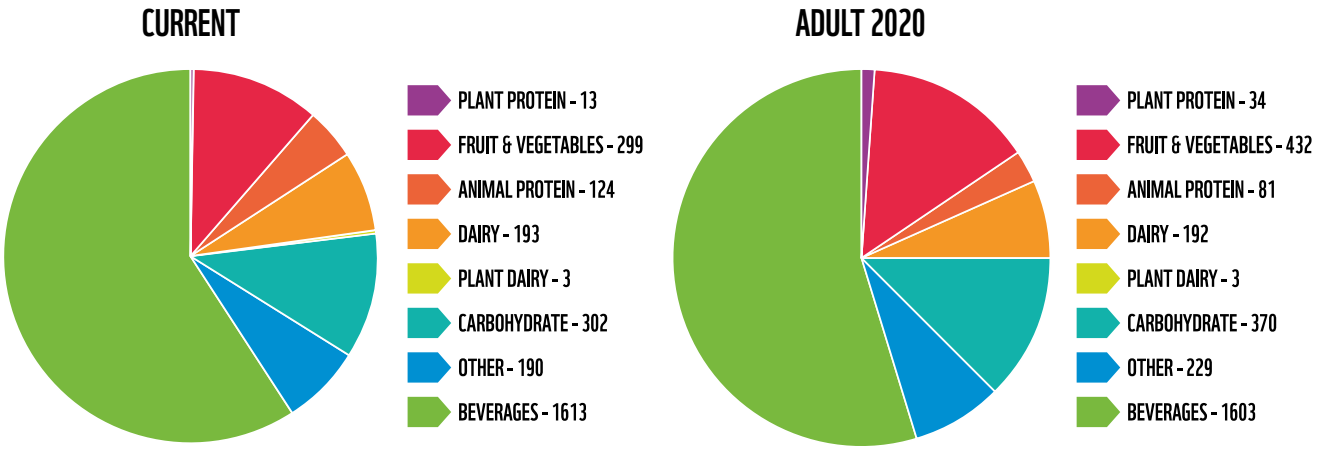
The Livewell Plates for UK adults provide the required amount of calories (2,388kcal/day), as well as meeting all national nutrient requirements and food-based dietary recommendations. By following the reduction path as set out above, the adult 2020 Plate can achieve a carbon footprint reduction of 23% relative to 1990 levels. It has lower land occupation and notably less grassland, while the need for cropland grows slightly. All areas come in well under the environmental limits we imposed during our analysis. The 2020 Livewell Plate appears to bring a minor increase in blue water footprint and overall cost, although these final two indicators can only be measured approximately.

The most obvious change from the current diet is a reduction in all meat products and cheese. These groups are reduced on the Livewell Plate 2020 because other foods can provide the same essential nutrients with much less environmental impact, particularly in terms of carbon footprint. Nutritional deficiencies in the current diet also contribute to the makeup of the Livewell Plate 2020. Legumes, nuts and oilseeds increase considerably for both environmental and nutritional reasons; along with – in relative terms – a notable increase in meat replacers. Vegetables, dairy and aquacultured fish also increase. Significantly, the new Plate appears to show that a diet with reduced environmental impacts can also be better in nutritional terms.

Table 2: Environmental indicators and diet cost for current diet and the adult 2020 Plate.

	1990	CURRENT	LIVEWELL 2020	LIMIT
Carbon footprint (kg CO_2eq)	7.28	5.17	4.25	4.77
GHG including land-use change (kg CO_2eq)		5.79	4.67	
Land occupation (m^2*a)		6.4	5.3	17.7
Grassland (m^2*a)		3.2	1.87	12.1
Cropland (m^2*a)		3.2	3.43	5
Blue water footprint (m^3)		0.16	0.19	
Cost (£)		3.89	3.95	

Figure 2: Pie-charts of the composition of the current adult diet (NDNS) and the adult Livewell Plate for 2020. Amounts are in grams/day. Please see Table 5 for the detailed composition of the Livewell Plates.



Please note: *Animal protein* includes meat, fish and egg; *Plant protein* includes legumes and meat replacers; *Plant dairy* includes soy drink and soy yoghurt; *Carbohydrate* includes grains and grain-based products, starchy roots and tubers, and sugar and confectionery.

ADULT 2030 PLATE

To stay in line with the UK's carbon target, the Livewell Plate for 2030 achieves a reduction in carbon footprint of 30% compared to 1990 levels. Reaching this figure means approximately 20% less land is needed to grow the food for each individual's diet compared to the current diet; with grassland area falling by about half. As with the Livewell 2020 Plate, there's a minor increase in cropland area, blue water footprint and cost of the Livewell Plate 2030.

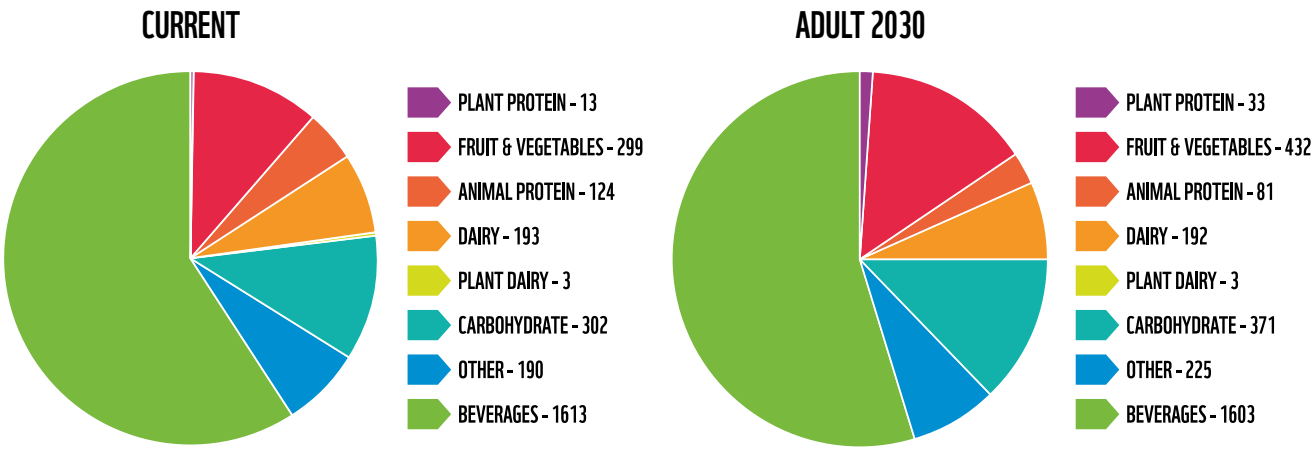
Again, the 2030 Plate meets all national nutritional requirements and dietary recommendations. The composition is largely similar to the 2020 Plate, with a small increase in poultry and cheese, and a minor reduction in pork and egg products.

Fish makes an important nutritional contribution in both 2020 and 2030: wild-caught fish stays at the same level for ecological reasons, but aquacultured fish increases by nearly 200% on current levels.

Table 3: Environmental indicators and diet cost for current diet and the adult 2030 Plate.

	1990	CURRENT	LIVEWELL 2030	LIMIT
Carbon footprint (kg CO_2eq)	7.28	5.17	4.09	4.09
GHG including land-use change (kg CO_2eq)		5.79	4.5	
Land occupation (m^2*a)		6.4	5.06	16.1
Grassland (m^2*a)		3.2	1.67	11.1
Cropland (m^2*a)		3.2	3.39	4.6
Blue water footprint (m^3)		0.16	0.19	
Cost (£)		3.89	3.95	

Figure 3: Pie-charts of the composition of the current adult diet (NDNS) and the adult Livewell Plate for 2030. Amounts are in grams/day. Please see Table 5 for the detailed composition of the Livewell Plates.



Please note: *Animal protein* includes meat, fish and egg; *Plant protein* includes legumes and meat replacers; *Plant dairy* includes soy drink and soy yoghurt; *Carbohydrate* includes grains and grain-based products, starchy roots and tubers, and sugar and confectionery.

EATWELL GUIDE COMPARISON

The government showcases a healthy diet through its Eatwell Guide recommendations. These include both nutritional requirements and more general aims – such as 5-a-day. When the UK Carbon Trust analysed the Eatwell Guide diet, it found that it had a carbon footprint 30% lower than the current national average diet.

We haven't been able to reproduce these results in our own analysis, either in terms of the balance of food groups or the carbon footprint reduction (in fact we find a small increase). The most obvious nutritional differences are in oils and spreads, and dairy and alternatives: Eatwell Guide recommendations for both are around half what our own modelling suggests. This doesn't imply any errors as such, but it reflects the complexity of diet modelling.

ADOLESCENT, ELDERLY AND VEGAN PLATES

We've expanded our new Livewell Plates to cover different nutritional needs. In addition to our Plate for adults (18-64) we've also created Plates for adolescents (10-17), the elderly (65-84) and vegans (18-64). All these Plates meet nutritional and environmental requirements.

ADOLESCENTS 2030

UK adolescents consume less meat, fish, fruit and vegetables than UK adults, along with more fruit juice and sugary products. Most of the changes in their Livewell 2030 Plate need to be made for nutritional rather than environmental reasons as their current carbon footprint is notably lower than for adults. The 2030 Livewell Plate for adolescents contains more legumes, nuts, fruit, fish, snacks, and meat and dairy replacers and dairy replacers, and vegetables. The extra products added to the diet inevitably increase its carbon footprint, so meat and meat products are reduced to compensate.

ELDERLY 2030

The UK elderly have a similar dietary carbon footprint to UK adults, largely due to their consumption of meat. The Livewell Plate brings a reduction in overall land occupation, grassland and cropland. Nutritionally, the UK elderly are closer to Eatwell Guide recommendations than younger adults. Their 2030 Livewell Plate contains more legumes, nuts, fruit, vegetable oil, meat replacers, grain-based products and vegetables; while all types of meat (including composite food), cheese and dairy are significantly reduced. Other food groups remain mostly unchanged from the current diet.

VEGANS 2030

If a large proportion of the population adopted a vegan diet, it would have far-reaching implications for the food system. Although we have less data for current UK vegan diets, it's clear that they have a lower carbon footprint than other groups, and it's straightforward for vegans to come in well under 2030 carbon targets and other land occupation metrics. The main challenge is to meet nutritional requirements usually associated with animal-based products. This largely explains increases in legumes, nuts and oilseeds, meat replacers, dairy replacers and vegetable oils on the vegan Livewell Plate for 2030. Nutrient-rich vegetables are also increased, balancing a reduction in fruit.

Table 4: Environmental indicators and diet cost for current diet and adolescent, elderly and vegan Plates.

	1990	ADOLESCENT CURRENT	ADOLESCENT 2030	ELDERLY CURRENT	ELDERLY 2030	ADULT CURRENT	VEGAN 2030	LIMIT
Individual carbon footprint (kg CO_2eq)	7.28	4.16	3.4	5.18	3.37	5.17	2.33	4.09
GHG including land use change (kg CO_2eq)		4.68	3.67	5.79	3.73	5.79	2.51	
Land occupation (m^2*a)		5.15	3.63	6.52	4.02	6.4	3.17	16.1
Grassland (m^2*a)		2.55	0.71	3.44	0.97	3.2	0	11.1
Cropland (m^2*a)		2.6	2.91	3.08	3.05	3.2	3.15	4.6
Blue water footprint (m^3)		0.14	0.21	0.14	0.11	0.16	0.15	
Cost (£)		2.94	3.26	3.69	3.63	3.89	3.48	

Figure 4: Pie-charts of the composition of the current adolescent diet (NDNS) and the adolescent Livewell Plate for 2030. Amounts are in grams/day. Please see Table 5 for the detailed composition of the Livewell Plates.

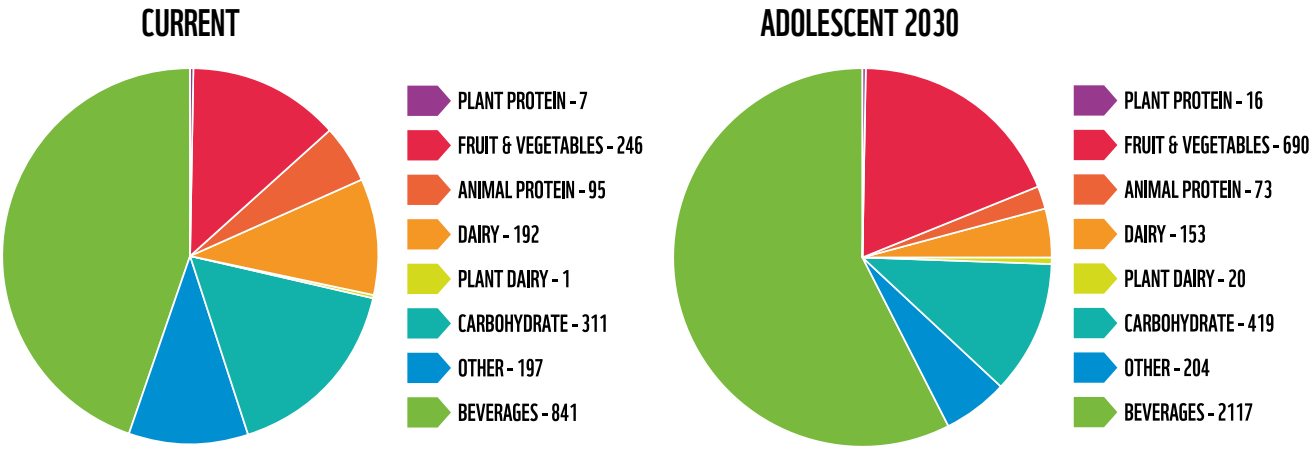


Figure 5: Pie-charts of the composition of the current elderly diet (NDNS) and the elderly Livewell Plate for 2030. Amounts are in grams/day.

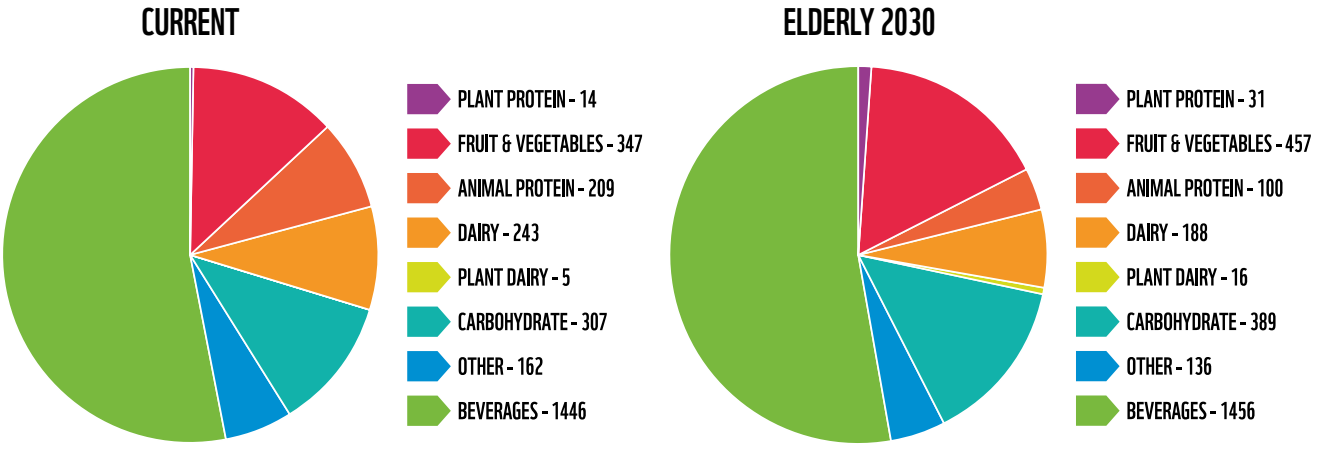
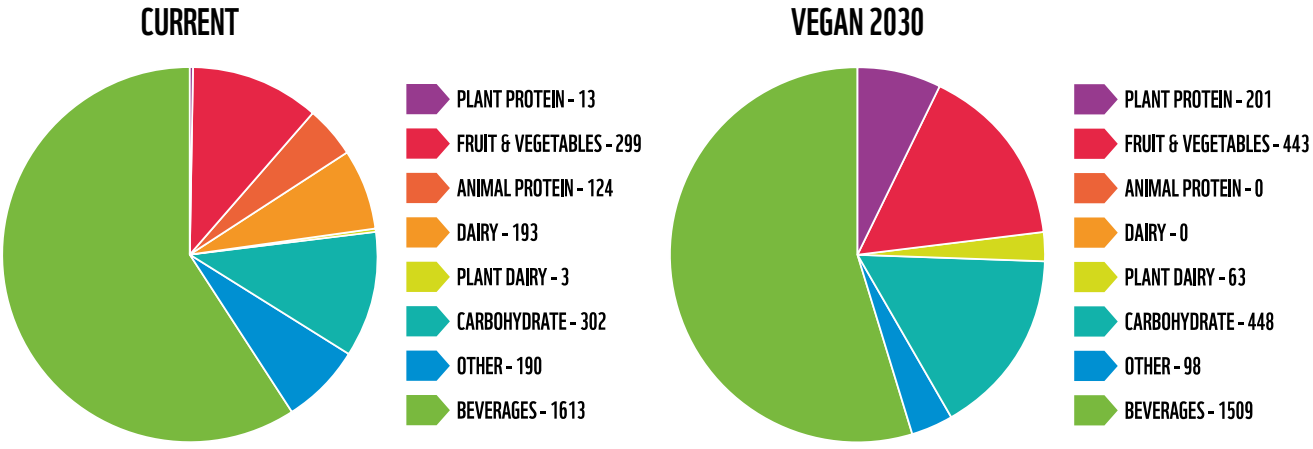


Figure 6: Pie-charts of the composition of the current diet (NDNS) and the vegan Livewell Plate for 2030 Amounts are in grams/day.



Please note: *Animal protein* includes meat, fish and egg; *Plant protein* includes legumes and meat replacers; *Plant dairy* includes soy drink and soy yoghurt; *Carbohydrate* includes grains and grain-based products, starchy roots and tubers, and sugar and confectionery.

Table 5: Composition of the Livewell Plates compared to current consumption.

	ADULT CURRENT	ADULT 2020	ADULT 2030	ADOLESCENT CURRENT	ADOLESCENT 2030	ELDERLY CURRENT	ELDERLY 2030	VEGAN CURRENT	VEGAN 2030
	g/day	g/day	g/day	g/day	g/day	g/day	g/day	g/day	g/day
Legumes, nuts and oilseeds	11	28	28	6	14	14	27	11	123
Fruit and fruit products	92	131	131	62	200	129	162	92	55
Beef & veal	18	4	4	12	3	32	5	18	0
Pork	7	6	5	5	4	19	8	7	0
Lamb	6	4	4	4	3	14	5	6	0
Poultry	30	8	9	26	9	45	11	30	0
Processed meat	29	12	12	29	10	51	23	29	0
Meat replacers	2	6	5	1	2	0	4	2	78
Fish wild-caught	19	19	19	12	5	24	19	19	0
Fish aquaculture	7	21	21	2	35	14	21	7	0
Dairy	179	187	186	180	150	228	183	179	0
Cheese	14	5	6	12	3	15	5	14	0
Dairy replacers	3	3	3	1	20	5	16	3	63
Eggs and egg products	8	8	7	5	4	11	8	8	0
Sugar and confectionary	19	3	3	24	9	14	12	19	4
Fats and oils	13	49	49	11	34	17	46	13	43
Fruit and vegetable juices	61	68	68	98	150	46	52	61	60
Non-alcoholic beverages	608	598	598	350	368	649	656	608	565
Alcoholic beverages	280	280	280	16	0	187	186	280	216
Drinking water	725	726	726	475	1748	611	614	725	728
Herbs, spices and condiments	30	30	30	27	52	24	20	30	0
Composite food	129	126	122	126	42	106	55	129	24
Snacks, desserts, and other foods	17	24	25	33	75	16	15	17	32
Grains and grain-based products	193	261	262	198	230	193	252	193	372
Vegetables and vegetable products	146	232	232	86	340	172	243	146	328
Starchy roots and tubers	90	106	106	90	180	100	126	90	72

COST AND HISTORICAL TRENDS

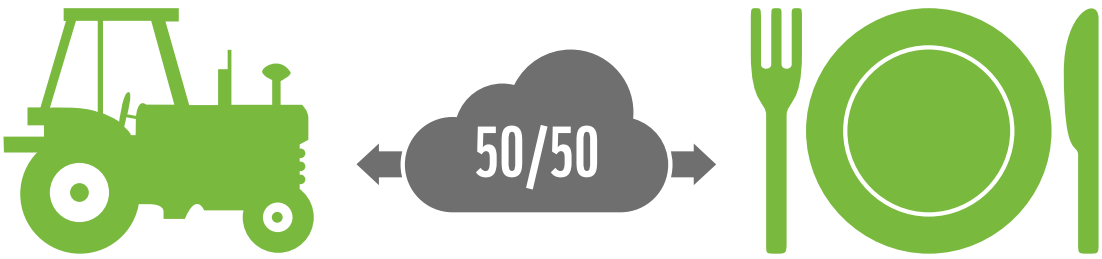
COST

There would be no point in creating a future diet that people can't afford, so our researchers investigated the financial implications of Livewell Plates in some detail. Although figures of this kind can never be exact, the cost of the adult Livewell 2030 Plate is only 1.5% higher than the apparent current diet. In fact, this difference may be due to a tendency in all groups to under-report energy intake, meaning current diets are actually more costly than the data suggests. Whether or not this is the case, Livewell Plates for adults have higher costs on fish, grain-based products, dairy and vegetables; while the contribution of meat – the most expensive food group in the current diet – is reduced.

HISTORICAL TRENDS

We also wanted to investigate what effect historical eating trends have had on health and the environment, and we analysed data going back to 1961. Our results produced a mixed picture, although the general direction of travel is encouraging. Some trends are positive for health: the amount of vegetables consumed increased by more than 50% over 50 years, and fruit consumption also increased considerably. There was a move from animal fats to healthier vegetable oils. On the negative side the supply of calories has increased over the past four decades despite a reduction in sugar, and at 3,400kcal/day is well above the 2,100-2,500kcal/day range supplied by the Livewell Plates.

The climate change potential for the UK diet is dominated by beef and lamb. We ate two and a half times more lamb in 1961 than we do today, while beef consumption has fluctuated due to BSE and – probably – the financial crisis. On the other hand, we eat five times as much poultry meat as we did. Overall though, while the health effects of our changing diet are generally positive, it's difficult to point to a reduction in climate footprint as a result of changes in UK food consumption. The production system, by contrast, has become markedly more efficient, and has probably halved the carbon footprint of an individual diet over the past five decades.



FOOD CONSUMPTION AND FOOD PRODUCTION SHOULD CONTRIBUTE EQUALLY (50/50) TO THE REDUCTION OF GHG EMISSIONS IN THE FOOD SYSTEM.

CONCLUSION

Eating for 2 degrees – new and updated Livewell Plates **set out to produce updated versions of the Livewell Plate by using additional environmental criteria – such as water use and land footprint – as well as individual Plates for adolescents, the elderly and vegans.**

The Livewell Plates presented in the report include the latest nutritional data, environmental metrics and an estimate of costs. The Plates provide the necessary amount of calories, as well as all nutrient and dietary requirements needed to lead a healthy life, while reducing the carbon footprint of the UK's food system by 30% by 2030 compared to 1990 levels. As well as a lower carbon footprint, the Livewell Plates have lower impact on land use change and land occupation.

We believe the findings in this report support our six Livewell principles as the basis of a sustainable diet and a well-functioning food system, which enables people and nature to thrive. Together with key stakeholders we'll use this report to shape policymakers' thinking around our food system. We'll continue to work with corporate partners to support sustainable consumption through innovative and far-reaching partnerships. And we'll work to strengthen the case linking food, feed, nutrition and biodiversity.

Through our own work, partnerships and involvement with various coalitions, we welcome the chance to work with the horticulture, farming and fishing industries; the UK government; and corporate partners to deliver this path to 2 degrees and to explore other scenarios and mitigation potential. Adjustment and innovation within these sectors will enable farmers and food businesses to set the UK on the path to become a leader in delivering sustainable diets.

IN GENERAL LIVEWELL PLATES CONTAIN MORE PLANT-BASED FOODS, IN PARTICULAR THOSE WITH A HIGH NUTRITIONAL QUALITY SUCH AS VEGETABLES, WHOLEGRAIN CEREAL PRODUCTS, NUTS, LEGUMES AND VEGETABLE OILS.

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