



The Future of Protein

The Protein Challenge 2040:
Shaping the future of food

How can we meet the protein needs of **9 billion** people in a way that is affordable, healthy and good for the environment?¹

We don't have all the answers, but we have a strong place to begin.

**We invite you to join us.
Get in touch.**

s.billing@forumforthefuture.org

'The outcome of this refreshing collaboration will be practical interventions which work across the whole supply chain and across a range of protein sources to make a real impact for sustainable protein. Through the collaboration, international businesses and NGOs are working together to generate real energy and momentum to ensure the world now focuses on protein.'

Andy Richardson, Head of Corporate Affairs, Volac

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Shaping the future of protein

Why **protein**?

Protein is an **essential** part of any diet. Different sources of protein vary in their ability to provide us with the essential amino acids we need for growth and repair. Animal sources, and some plants like soy and quinoa, provide the full range of essential amino acids needed by humans in sufficient quantities.

Many plant protein sources lack one or more amino acid in sufficient quantity to fulfil human needs, but this can be addressed by regularly consuming a combination of different proteins, including plant-based sources.²

But the way in which we produce and consume protein at the beginning of the 21st century has significant impacts on both the environment and human health, which will only worsen if no action is taken.

Key players in industry, government and civil society are beginning to recognise the need for action. This has given rise to The Protein Challenge 2040, a first-of-its-kind global collaboration.

In the USA and the UK, the recommended daily protein intake is:

55-56g (2 ounces) for men between 19-50 years old³

45-46g (1.6 ounces) for women between 19-50 years old, with more advised for pregnant or breastfeeding women⁴

This roughly equates to:

2

chicken legs



3

cups of cooked lentils or



1.5

cups of whole almonds



What **constitutes** protein?

Many of us instinctively think of protein as meat and fish. But protein exists in significant amounts **in many other foods** as well.

We are focusing on globally significant sources of protein: those whose value chains have the greatest **scale and impact**, now and in the future. These include:

Animal proteins

Red and white meat, dairy, eggs, farmed and wild-caught fish, insects



Plant proteins

Pulses, nuts, seeds, beans, legumes and grains



Alternative proteins

Microalgae, bacteria, mycoprotein, as well as future alternatives such as synthetic or lab grown meat

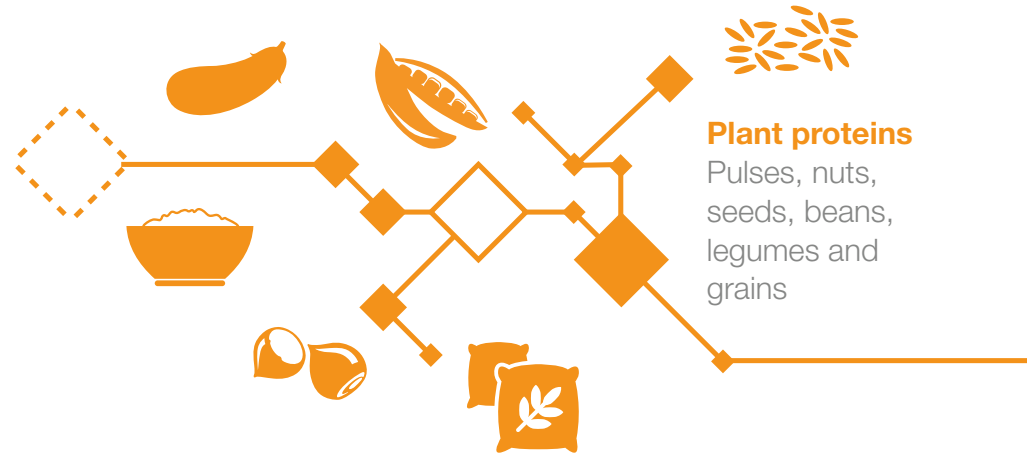
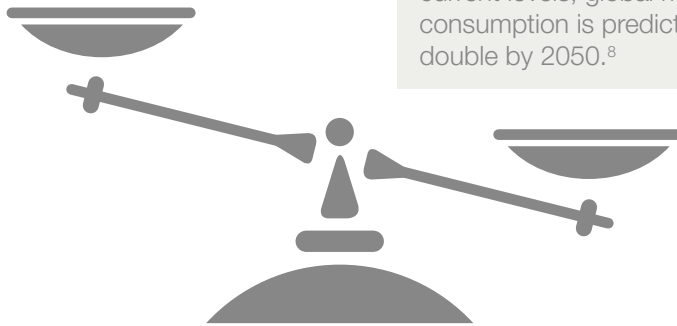


The protein system

Protein is critical to human health. An estimated 2 billion people suffer from undernutrition – a lack of access to key micronutrients – resulting in major health risks.⁵ Those in the world's poorest countries will remain the most vulnerable to malnutrition, who are least able to access good quality protein sources (from both plants and animals), and will worsen if costs of protein increase.⁶

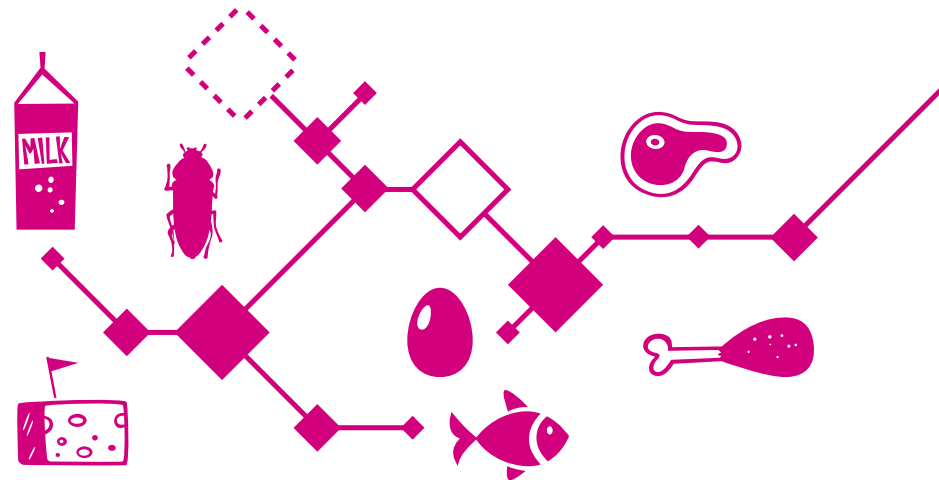
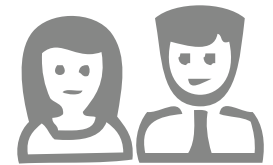
On the other hand, in the developed world the picture is different. Based on individual country recommendations consumption is more than required for optimal health.⁷

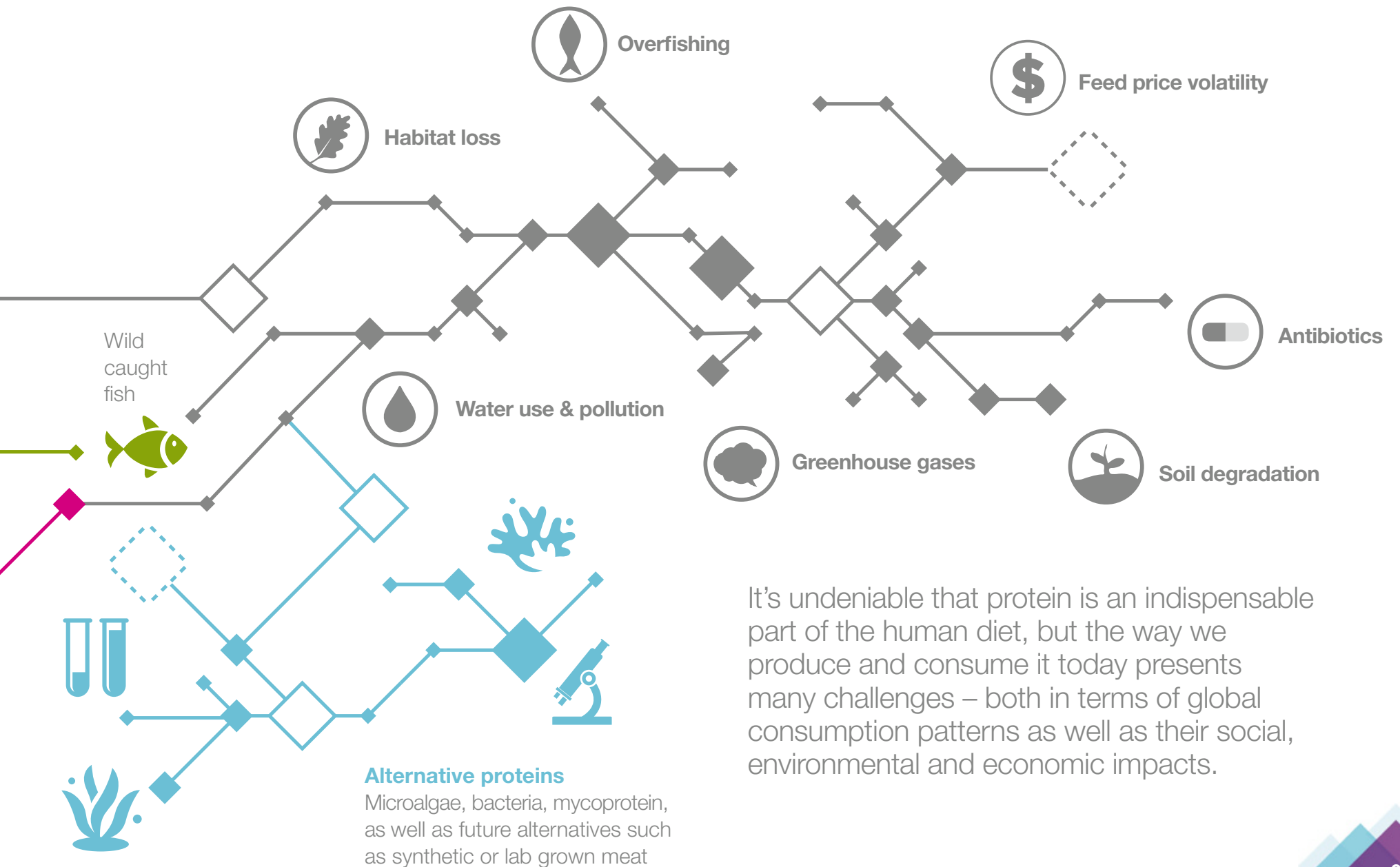
In emerging economies, demand for animal protein is growing rapidly due to urbanisation and rising incomes. Based on current levels, global meat consumption is predicted to double by 2050.⁸



Plant proteins
Pulses, nuts, seeds, beans, legumes and grains

Farmed animal proteins
Red and white meat, dairy, eggs, farmed fish and insects





It's undeniable that protein is an indispensable part of the human diet, but the way we produce and consume it today presents many challenges – both in terms of global consumption patterns as well as their social, environmental and economic impacts.



Impacts of production

In the ocean

Fish and seafood are a critical source of protein for 3 billion people, but the ocean's supply has reached its limit.



Overfishing

90.1% of global fish stocks were fully or over exploited in 2011.⁹ Seas are over-exploited for wild-caught fish, leading to severe consequences for marine ecosystems – and yet as much as 40% of caught fish are discarded every year.¹⁰ Farmed fish is likely to make up the gap and is predicted to represent 2/3 of global supply by 2030¹¹, but it is fast reaching its limit as well. Farmed fish is heavily dependent on wild caught fish for feed (fishmeal).¹²

On land

Agriculture takes up two-fifths of total global land use.¹³ Of the total plant protein produced, less than half is used for human consumption.¹⁴ This includes high-quality soy protein which could otherwise be used to feed humans. The shift towards industrialised animal farming systems creates significant demand for grain and other plant proteins as feed for animals, as well as contributing to production challenges of waste, pollution, deforestation, greenhouse gas emissions and soil degradation.



Water use and pollution

The production of protein is a heavy user of fresh water, with agriculture accounting for 70% of freshwater use. Not all proteins are created equally, for example for beef the water footprint of protein is 6 times larger than that of pulses.¹⁵



Habitat loss

Over 40% of global plant protein – including 85% of soy crops – are used to feed animals and fish.¹⁶ Soy cultivation is a big driver of deforestation, particularly in South America.¹⁷ The production of animals and of crops for feed alone accounts for nearly a third of global deforestation and associated carbon dioxide emissions.¹⁸



Greenhouse gases

Food and agriculture are major contributors to climate change. Livestock production in particular are associated with 14.5% of all human-caused greenhouse gas emissions.¹⁹



Feed price volatility

The overdependence on soy for animal feed is a growing risk, leading to future uncertainty of supply and animal feed costs. 90% of global soy crops is produced in just 3 countries: the USA, Brazil and Argentina – the supply of which is at risk due to climate change.²⁰



Antibiotic resistance

45% of antibiotics in the UK and 70% in the US are used for livestock rather than humans.²¹ Antibiotic overuse in human and animal medicine contributes to resistant infections, which cause 25,000 deaths per year in the EU alone.²²



Soil degradation

Fertile soils are critical for plant production and food security, yet this resource is being degraded at an alarming rate primarily due to overgrazing, deforestation and agricultural activities. It is estimated that 25 billion tonnes of fertile soil are lost each year.²³

Presenting: **The Protein Challenge 2040**

The Protein Challenge 2040 is a groundbreaking global coalition that brings together the animal, plant and novel protein industries, as well as global environmental and health organisations for the first time. Through collaboration and partnership, it will lead these industries in taking action on key areas that will shift the production and consumption of protein onto a more sustainable path.

Global sustainability non-profit Forum for the Future is the independent facilitator bringing 20 years of expertise in running multi-stakeholder collaborations to solve complex sustainability problems.

'We know that in order to achieve our overall goal of people and planet living in harmony, we need to work with others, within the environmental sector and without. The scale of the challenge is huge and covers issues such as health, economics and conservation. In order to ensure a joined up approach we need to move out of our silos and collaborate with other organisations and policy makers to ensure a sustainable future.'

Duncan Williamson, Programme Manager, WWF



The Protein Challenge 2040 aims to accelerate progress towards sustainable production and consumption of protein and help scale up impactful solutions.

By 2020, we aim to have:



Raised the profile of protein as an integral and important part of a sustainable food system with key stakeholders, including business and government



Changed the conversation around protein: from 'good' and 'bad' sources towards a better balance of sustainable protein



Catalysed action and increased investment in sustainable solutions, and influenced policy that address key hotspots across the system

'The Protein Challenge 2040 reaches for the ambitious goal of connecting several value chains in one partnership for maximum impact. We know that the greatest achievements in sustainability will only be reached by working together.'

**Birgit Schleifenbaum, Director
Discovery Natural & Sustainable,
Innovation, Flavors, Firmenich SA**

The scenarios

Forum for the Future uses futures tools to track and anticipate change, highlight uncertainty and inform more sustainable decision making.

Future scenarios are an invaluable tool for helping identify future risks and opportunities, inform strategic decision making, and stimulate innovation.

Through our research and interviews, we identified a number of mega-trends where the outcomes are fairly certain, e.g. population growth, resource scarcity, increasing competition for land. However there are other trends where the outcome is more uncertain, e.g. consumer acceptance of new technology.

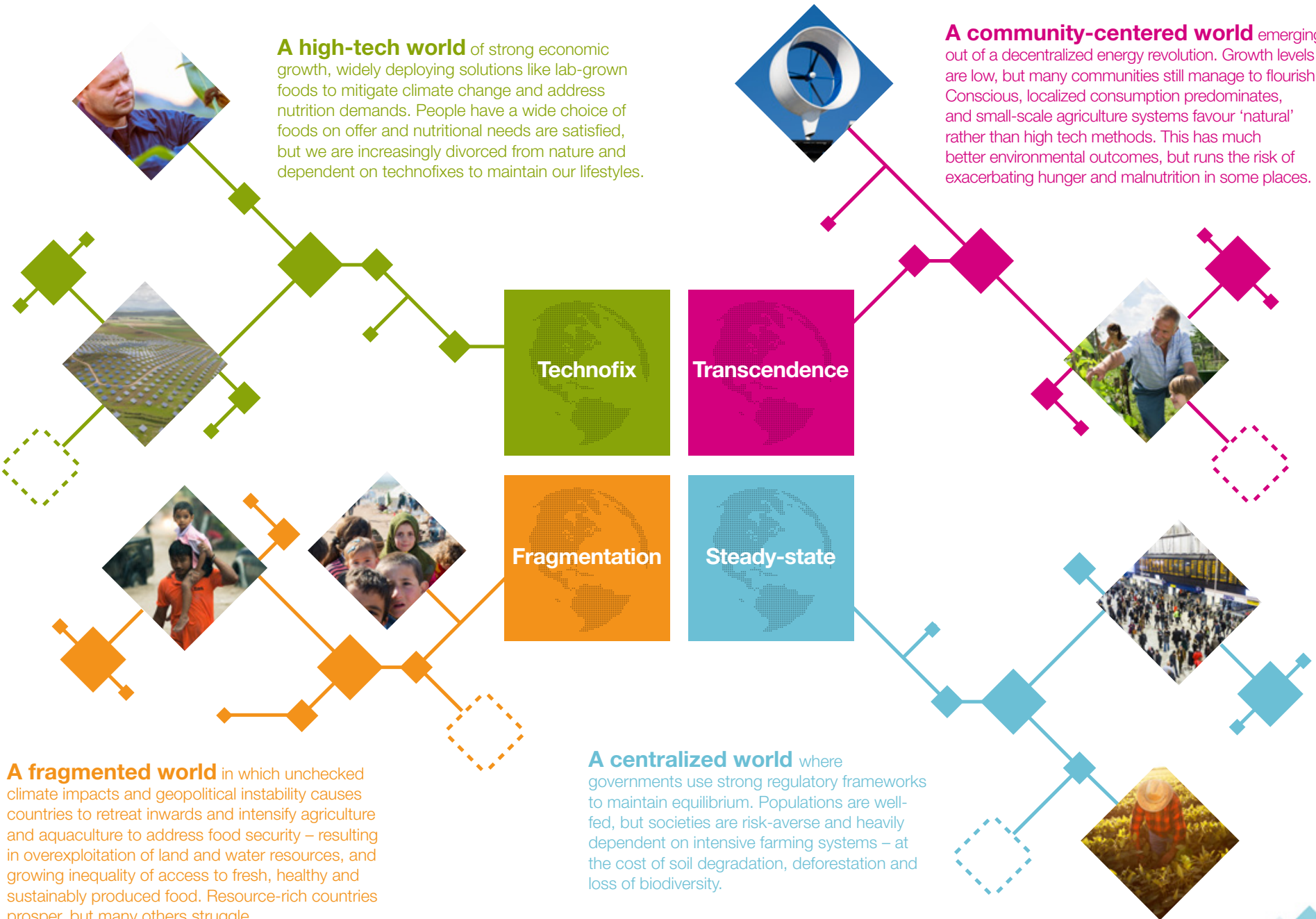
We created four different scenarios that are different plausible futures. These are not predictions or visions of a desirable future. The scenarios helped us identify risks and opportunities, and highlight areas that needed to change in the current system to create a more sustainable protein system for the future.

The Futures Centre

We established a Future of Protein topic hub on the Forum for the Future's Futures Centre to track trends, innovation and signals of change in protein production and consumption, and to build a community of stakeholders ranging from food and agriculture experts to innovators interested in the solutions.'

Visit the Futures Centre's Future of Protein topic hub to join the conversation and help us spot emerging trends and innovation that will accelerate change.

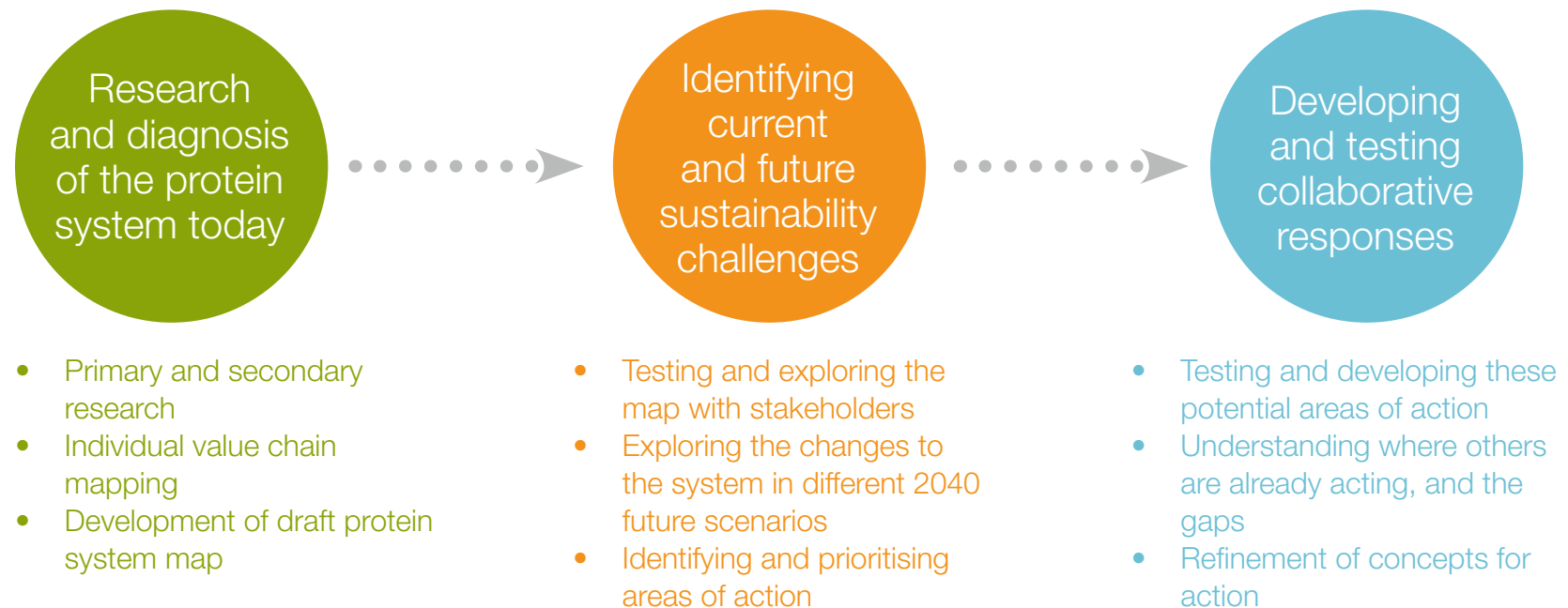




Diagnosing **the protein system**

Phase 1 of The Protein Challenge 2040, which took place between February and October 2015, involved an exhaustive diagnosis process.

Our research, interviews and workshops (in London, New York, San Francisco and Rotterdam) engaged more than 250 expert stakeholders and drew on countless research reports to create a comprehensive protein system map that ties together different value chains and sustainability issues across plants, farmed animals and wild-caught fish, and new and novel forms of protein for the first time.



Areas of **innovation**

We identified six areas of high potential for driving significant change from across the protein system. Taking action against all six areas would allow us to make real progress towards a more sustainable protein system.

The next phase of The Protein Challenge 2040 aims to accelerate progress in these areas and establish powerful and practical solutions that ensure the protein system is fit for the future.

Areas for immediate action



1

Increasing the proportion of plant-based protein consumption with consumers



2

Scaling up sustainable animal feed innovation to meet demand for animal protein



3

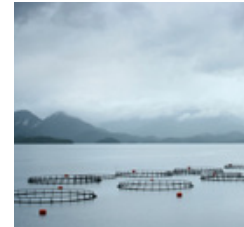
Closing the protein nutrient loop

Areas being scoped for action



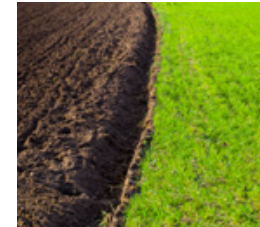
4

Developing indigenous plants as protein sources for local communities



5

Scaling up sustainable aquaculture for food and animal feed



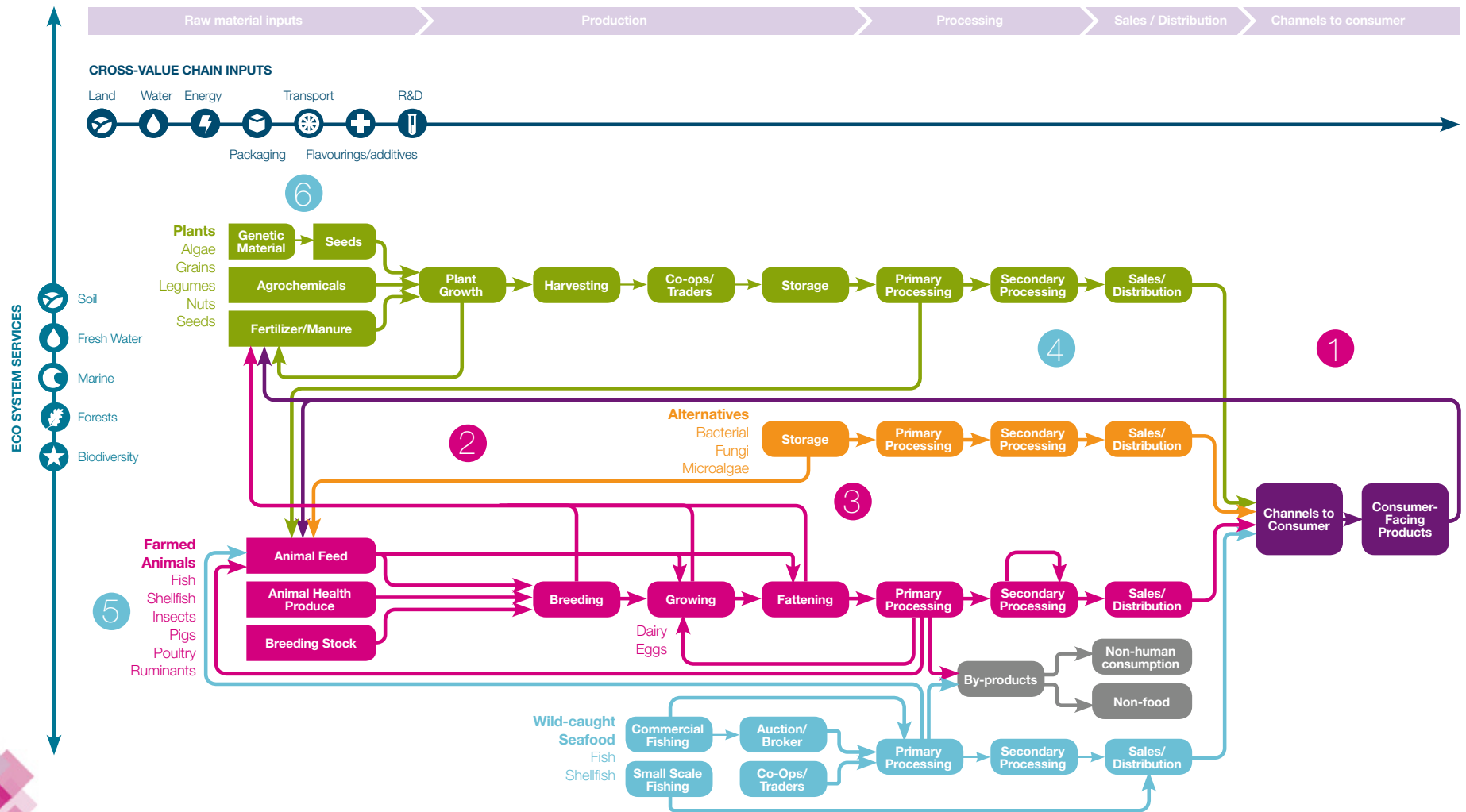
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Restoring soil health



These 6 areas of innovation address key hotspots within the protein system, in order to accelerate change at a system level.

- 1 Increasing the proportion of plant-based protein consumption with consumers
- 2 Scaling up sustainable feed innovation to meet demand for animal protein
- 3 Closing the protein nutrient loop
- 4 Developing indigenous plants as protein sources for local communities
- 5 Scaling up sustainable aquaculture for food and animal feed
- 6 Restoring soil health



Area for immediate action

Innovation area 1
Increasing the proportion
of plant-based protein
consumption with
consumers



In the developed world, many of us consume more animal protein than we need. This has a higher environmental impact than plant sources.

Rebalancing consumption of animal, plant and alternative proteins amongst consumers would help to address many key impacts across the protein system such as human

health, greenhouse gas emissions, water use and pollution, land use change and habitat loss.

We will work with stakeholders to highlight the importance of plant proteins for health, nutrition and environmental sustainability. We will create positive messages, share stories and use the power of food brands to empower consumers to make positive choices. Our work programme will be defined by the coalition members, but is likely to include:



Joint marketing campaigns



Product delivery innovation (e.g. ready meals)



Influencing the policy environment



Partnerships with international institutions already working on this agenda, or in the development of public health messages

‘We can no longer meaningfully separate our dietary choices from their impact on the health of our bodies and of the planet. We need new ideas and new and healthy proteins with a low environmental impact to help us achieve this.’

Tim Finnigan, Director R&D and Technology, Quorn

We want to catalyse a shift toward greater inclusion of plant protein in diets

By 2040, we want to:



Reduce the impacts of protein production and consumption, and improve human health by addressing our over-reliance on animal protein

By 2018, we will have:



A powerful coalition of partners which will drive innovation and change within their own organisations and within the food industry more widely

Completed 2-3 pilots which deliver real solutions to barriers and challenges for scaling plant proteins

Have a clear implementation plan to scale these pilots



Signal of change

Researchers patent seaweed that tastes like bacon

Researchers at Oregon State University have been pleasantly surprised to find that dulse, a seaweed they were initially breeding to feed abalone, tastes like bacon when fried.

The scientists have developed and patented a new strain of dulse, a succulent red seaweed that grows quickly and is an excellent source of minerals, vitamins and antioxidants. It also has a high protein content, with twice the levels found within kale.

Could the smoky taste convince consumers to turn from traditional strips to seaweed?

Area for immediate action

Innovation area 2
Scaling up sustainable
feed innovation to
meet demand for
animal protein



Over the last 60 years, farmed cattle, chickens, pigs and fish have increasingly been fed on grains, soy and fishmeal.

Many of these feedstocks are high-quality sources of protein that could be used to feed humans, particularly in places where protein deficiency is common. Additionally, the use of fish as animal feed puts pressure on our ocean ecosystems.

Developing new sources of animal feed to meet the growing demand for animal protein is critical for taking the pressure off land use, and to reduce the overall land footprint of agriculture and impact on ocean ecosystems.

There is already a huge amount of innovation in alternative feeds, from insects to methane-based products. We want to help scale these innovations, turning them into an unstoppable systemic change in favour of sustainable feedstocks that reduce the pressure on land use for agriculture.

We will develop a place for sustainable feed innovators to come together, overcome key barriers and take their innovations to scale.



‘Animal proteins require more natural resources to be produced because of the animals’ need for calories and nutrients to maintain their lives. But at the same time they can (and like to) eat and digest sources of nutrients that we humans can’t or wouldn’t like to eat. And we are wasting too much of those today. We have to be more efficient in using them, reducing the use of natural resources including our available land to feed animals if we want to feed 9 billion people without destroying the planet.’

Carlos Saviani, VP of Sustainable Food, WWF US

We will support and scale up a range of realistic alternative feeds to market

By 2040, we want to:



Find better ways of feeding animals that reduce the environmental impact of feed cultivation and releases both high-quality plant protein for human consumption, as well as land that can be used to cultivate other foods

By 2018, we will have:



A consortium of partners working together on animal feed innovation

Published a high profile report comparing different sustainable animal feeds (e.g. LCAs and other sustainability criteria) to build awareness around the barriers and challenges for scaling, while also spotlighting areas of innovation

Completed 2-3 projects which address barriers and challenges for scaling sustainable feed innovation

Developed a plan to help communicate impacts and successes for helping scale these pilots



Signal of change

Methane: the future of fish feed?

FeedKind is a new fish and animal feedstock product which uses methane gas.

It offers an alternative to conventional fish feed products like fishmeal and soy protein, which can put pressure on land and wild marine fish populations.

However, while the product itself uses little land and water, the same cannot be said for the production of its primary input: methane gas.

Is it better to produce fish feed which supports natural gas fracking, or produce a lower-impact conventional feedstock?

Area for immediate action

Innovation area 3

Closing the protein nutrient loop



Globally, at least 30% of food is wasted. Since protein is vital for human health and is associated with considerable environmental impacts, it's a precious resource – and one we don't want to waste.

There are many types of useful protein sources that are currently wasted.

For example, waste **protein sludge** from starch companies could be used as animal feed. Or proteins could be recovered from **sugar beet leaves**, which are typically left in the field.

Closing the loop on protein waste would mean we could reduce the environmental footprint of protein production. Some innovation is already happening in this space, but mainly in the form

of commercial agreements between two or more businesses.

We need greater collaboration in order to scale up the most effective solutions – and eventually make this type of nutrient cycling mainstream across the food industry.

The innovation area will bring together groundbreaking research to explore how and where protein loss occurs, as well as drive advocacy work and practical initiatives that focus on piloting and scaling solutions.

'Reducing food waste – across all channels – is a critically important and hugely promising lever we can pull to reduce stress on agricultural systems and ensure vital nutrients are available long-term to feed a growing population.'

Lisa Boyd, Senior Group Manager of Food Social Responsibility, Target

We will identify and reduce protein waste streams across the system

By 2040, we want to:



Use protein waste to deliver new, high-value, sustainable sources of protein for human and/or animal consumption

By 2018, we will have:



Mapped where and how nutrients are lost across the protein system and identified possible innovations that will help to close the nutrient loop

Tested the feasibility of these options and catalysed more investment in selected closed loop protein solutions

Launched a number of workstreams that support piloting solutions or scale up existing solutions



Signal of change

Could a biofuel by-product become a source of vegetable protein?

A Sydney-based company has inadvertently discovered a means of producing a low-cost but high-quality source of vegetable protein.

Alternative Fuel Corporation (AFC) is primarily a biofuel company, but it produces a nutritious protein-rich form of yeast as a by-product.

The company is looking to use this high-quality yeast protein in animal feed. This protein source is also reportedly suitable for human consumption, as a milk or egg substitute.

Area being scoped for action

Innovation area 4 Developing indigenous plants as protein sources for local communities



Just three crops – maize, wheat and rice – account for about 50% of the world’s consumption of calories and plant protein.

There are vast inequalities in protein intake across the world – and there are serious health problems associated with both over-consumption, and under-consumption of protein.

Indigenous (or ‘orphan’) crops such as finger millet, yam, roots and tubers can play an important role in regional food security. They are often better suited to local climatic conditions, and may even be more resilient in the face of global climate change.

We want to establish a coalition of producer, academic, investor and government organisations

focused on the development of indigenous proteins in developing world – focusing on sub-Saharan Africa and India.

By 2040, we want to:



Increase the resilience of the protein system – and protect people’s supply of protein – by increasing the productivity and marketing of indigenous crops



Signal of change

Heat-tolerant beans developed for resilience amid rising temperatures

Scientists from the Consultative Group for International Agricultural Research (CGIAR) have announced the development of 30 new varieties of ‘heat-tolerant’ beans.

Through traditional crossbreeding methods, scientists have developed strains of bean that are resistant to drought and higher temperatures. These varieties have also been adapted to increase their nutritional value with higher levels of iron.

Are these beans the future of plant-based protein?

Area being scoped for action

Innovation area 5

Scaling up sustainable aquaculture



Today, aquaculture supplies over 50% of all fish that is consumed by humans globally. It is projected to be the prime source of seafood by 2030, due to demand from the growing global middle class and the depletion of wild capture fisheries.

When practiced responsibly, fish farming can help provide livelihoods and feed a global population. However, currently aquaculture is overly dependent on fish oil, fishmeal and soy for feed, which puts pressure on marine and forest ecosystems. There are also challenges around the pollution of local waterways, the excessive use of chemicals and labour rights violations in aquaculture supply chains, to name just a few.

We want to diagnose the key current and future sustainability challenges and opportunities within aquaculture, together with key stakeholders and experts. We will then seek to build

coalitions to act on addressing the key challenges identified.

By 2040, we want to:



Radically improve the sustainability of the aquaculture industry, in a way which minimizes environmental impact, ensures good livelihoods and provides a healthy source of protein – particularly for populations suffering from a protein deficit



Signal of change

Multinational food manufacturer sources shrimp reared in closed-loop system

Multinational food manufacturer Findus has committed to meet all of its shrimp supply needs in Sweden from a sustainable start-up company named Vegafish.

Vegafish uses a 'biofloc' method, where microorganisms introduced to a shrimp pond digest shrimp excrement, and are in turn ingested as a protein feed source for the shrimps.

Biofloc ponds can rear 10 to 40 times more than conventional shrimp farming.

Area being scoped for action

Innovation area 6 Restoring soil health



Without soil, no food could be produced on a large scale, nor would livestock be fed.

Despite this, many of today's soil and crop management systems are unsustainable. The over-use of fertiliser has led to nitrogen depletion in the soil – while in other areas, the under-use of fertiliser is causing leading to soil structure decline, soil degradation and declining yields.

Protecting and rebuilding soils will play a key role in guaranteeing the security of our food supply.

There are already known solutions for building healthy soils – but most of them are on a very small scale.

We want to develop a platform to define a standard for soil health across the world, and develop an advocacy plan for restoring soil health.

By 2040, we want to:



Come up with a global plan to manage soil effectively, alongside wider recognition that the food system depends on the quality and health of our soil



Signal of change

Invasive seaweed refined as soil stimulant in New Zealand

Waikaitu, a New Zealand company, has developed a refined and concentrated seaweed biostimulant from the brown algae 'wakame' (Undaria Pinnatifida).

Wakame is a non-native species of seaweed found in the Marlborough Sounds in the Tasman.

When applied to the soil, plant health is improved through increased soil microbial activity. It stimulates plant growth and assists plants during stressful times such as drought, frost or pest pressure.

How to **get involved**

‘Protein is a vital component of any diet and it is important that we consider how to ensure that people can consume it in an affordable and environmentally sustainable way. Being part of this project gave us a perfect opportunity to take a collaborative and long term view on the nation’s future protein needs.’

Moira Howie, Nutrition and Health Manager, Waitrose

We are looking for collaborators – ambitious and pioneering organisations within and related to the agriculture and food industries – who want to take practical action to drive the change to a sustainable protein system.

The six innovation areas outlined in The Protein Challenge 2040 will be collaborations in the pre-competitive space, allowing us to achieve together much more than we could alone.

If you are a pioneering company that is able to bring technical expertise, industry knowledge and financial support to the six innovation areas of The Protein Challenge 2040, we’d like to take the conversation forward. To get involved, contact Simon Billing at Forum for the Future.

s.billing@forumforthefuture.org

Why get involved?

Future-proof your business:

Reduce protein supply chain risks – now and in the future

Strengthen relationships:

Create new opportunities for collaboration with customers and suppliers

Innovate for the future:

Strengthen your business strategy and boost product innovation

Build reputation:

Gain recognition as a global thought leader on a critical food security issue

Capitalise on group expertise:

Gain key insights through working with peers and experts

Key members of the partnership



Behind the Protein Challenge 2040 is a dynamic consortium of forward-thinking organisations including NGOs such as World Wildlife Fund (WWF) and the Global Alliance for Improved Nutrition (GAIN); fragrance and flavour experts Firmenich; dairy nutrition firm Volac; and brands and retailers such as The Hershey Company, Quorn, Target and Waitrose.

Global sustainability non-profit Forum for the Future serves as the coalition's independent convenor. The search is on for more organisations across the entire protein system that can contribute their expertise, resource and supply chain influence to design a new approach to protein that will benefit everyone.

About Forum for the Future



Forum for the Future is an independent non-profit that works globally with business, government and others to solve complex sustainability challenges.

Like the members of The Protein Challenge 2040 consortium, Forum believes it is critical to transform the key systems we rely on to shape a brighter future and innovate for long-term success. We have a 20-year track record of working with pioneering partners in one-to-one partnerships, and also as part of multi-stakeholder collaborations to address system-wide challenges.

Forum's Protein Challenge 2040 team is led by Principal Sustainability Advisor Simon Billing, and includes:

- Alisha Bhagat
- Ivana Gazibara
- Jessica Rosen
- Joanie Koh
- Jennifer Hudson
- Mark Driscoll
- Stephanie Draper

Find out more at forumforthefuture.org.

With thanks

We would like to thank everyone who has generously taken the time to join us on this journey and contribute to our diagnosis of the protein system by sharing expertise and knowledge.

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Assessment Agency

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AquaFish Innovation Lab

Hugo Jansen Cargill

Irvin Widders

Michigan State University

Isha Datar New Harvest

James Lomax

United Nations Environment

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James Simpson

Marine Stewardship Council

Jan Steijns Freiland Campina

Jane Quartel

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Jessica Fanzo

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Jill Kauffman Johnson

Solazyme

Jim Flatt Synthetic Genomics

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References

1. 'World Population Prospects – Population Division, United Nations'. UN, 2015. Accessed January 19, 2016. <http://esa.un.org/unpd/wpp/Download/Standard/Population/>.
2. Mcdougall, J. 'Plant Foods Have a Complete Amino Acid Composition * Response.' American Heart Association, 2002. Accessed January 19, 2016. <http://circ.ahajournals.org/content/105/25/e197.full>.
3. 'Nutrition Intakes.' Gov.uk. December 1, 2014. Accessed January 20, 2016. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384775/familyfood-method-rni-11dec14.pdf.
4. 'Protein and Amino Acid Requirements in Human Nutrition.' WHO. 2007. Accessed January 19, 2016. http://www.who.int/nutrition/publications/nutrientrequirements/WHO_TRS_935/en/.
5. IFAD/FAO/WFP (2011) 'The State of Food Insecurity in the World.' FAO, Rome, 2011.
6. '2015 World Hunger and Poverty Facts and Statistics by WHES.' WorldHunger.org. 2015. Accessed January 20, 2016. http://www.worldhunger.org/articles/Learn/world_hunger_facts_2002.htm.
7. 'National Diet and Nutrition Survey.' Medical Research Council, 2014. Accessed January 20, 2016. <https://www.gov.uk/government/statistics/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012>.
8. 'FAO's Animal Production and Health Division: Meat & Meat Products.' FAO's Animal Production and Health Division: Meat & Meat Products. November 25, 2014. Accessed January 19, 2016. <http://www.fao.org/ag/againfo/themes/en/meat/home.html>.
9. 'The State of World Fisheries and Aquaculture' FAO, 2014. Accessed February 24, 2016, from <http://www.fao.org/fishery/sofia.en>.
10. Keledjian, A., et al. 'Wasted Catch: Unsolved Problems in U.S. Fisheries.' Oceana. March 2014. Accessed January 25, 2016. <http://oceana.org/reports/wasted-catch-unsolved-problems-us-fisheries>.
11. 'FISH TO 2030: Prospects for Fisheries and Aquaculture.' FAO, 2013. Accessed January 19, 2016. <http://www.fao.org/docrep/019/i3640e/i3640e.pdf>.
12. 'The State of World Fisheries and Aquaculture: Opportunities and Challenges.' FAO, Rome, 2014. Accessed January 19, 2016. <http://www.fao.org/3/a-i3720e.pdf>.
13. World Agriculture: Towards 2015/2030. An FAO perspective. <http://www.fao.org/docrep/005/y4252e/y4252e06.htm>.
14. Smil, V. 'Feeding the world: a challenge for the 21st century'. Cambridge, USA, 2000. MIT Press.
15. Mekonnen, M.M., Hoekstra, A.Y. 'The green, blue and grey water footprint of farm animals and animal products Volume 1: Main Report', December 2010 http://waterfootprint.org/media/downloads/Report-48-WaterFootprint-AnimalProducts-Vol1_1.pdf.
16. Cleary, David. 'An Overview of the Brazil-China Soybean Trade and Its Strategic Implications for Conservation.' Nature.org. Accessed January 19, 2016. <http://www.nature.org/ourinitiatives/regions/southamerica/brazil/explore/brazil-china-soybean-trade.pdf>.
17. 'What's Driving Tropical Deforestation Today? (2011).' Union of Concerned Scientists. June 1, 2011. Accessed January 20, 2016. http://www.ucsusa.org/global_warming/solutions/stop-deforestation/drivers-of-deforestation.html#.Vp9q051FDIV.
18. 'Livestock a Major Threat to Environment'. FAO Newsroom. November 29, 2006. Accessed January 20, 2016. <http://www.fao.org/newsroom/en/News/2006/1000448/index.html>.
19. Gerber, P.J., et al. 'Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities'. Food and Agriculture Organization of the United Nations (FAO), Rome.
20. 'Production Quantities by Country.' FAO Stat. Accessed January 26, 2016. <http://faostat3.fao.org/browse/Q/QC/E>.
21. ECDC/EFSA/EMA first joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals. ECDC, EFSA and EMA, 2015 <http://www.efsa.europa.eu/en/efsajournal/pub/4006.htm>
22. 'New FDA Numbers Reveal Food Animals Consumer Lion's Share of Antibiotics' Centre for Livable Future, 2011.
23. 'The bacterial challenge: time to react' ECDC/ EMEA Joint Technical Report, 2009 http://ecdc.europa.eu/en/publications/Publications/0909_TER_The_Bacterial_Challenge_Time_to_React.pdf
24. 'Land and soil in the context of a green economy for sustainable development, food security and poverty eradication' The Submission of the UNCCD Secretariat to the Preparatory Process for the Rio+ 20 Conference, Revised Version 18 November 2011. UNCCD <http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/Rio%206%20pages%20english.pdf>.

A large crowd of people, overlaid with a teal color filter. The text is centered over the crowd.

'The future is not
what will happen,
it is what we will
do about it.'

Henri Bergson, Philosopher (1859-1941)



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