

# AMPLIFYING FARMERS' VOICES:

## Farming perspectives on alternative proteins and a just transition



Source: Pexels



# SUMMARY

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A transition to alternative-protein production presents a huge opportunity for farmers at a time when climate change is becoming a major threat to farming livelihoods both directly and indirectly. And, since alternative proteins come in so many different forms, solutions can be tailored to the needs of the farm as well as the end consumer.

We conducted detailed interviews with 20 national and international farming organisations that collectively represent 300,000 farmers, mainly in Europe and the US. Our aim here is to amplify the voices of farmers and empower farmer-led solutions for a better future.

The impact of climate change is already having a negative impact on farming yields, as well as increasing weather volatility and disrupting the global supply chain. Farmers are also being affected by reduced consumer demand for conventional animal-based products in the Global North (where the reduction is increasingly motivated by environmental concerns),<sup>1 2</sup> economic pressures from increasing intensification and consolidation across the industry,<sup>3</sup> along with more environmentally focused government subsidies and the anticipation of future carbon taxes.

A solution would be to transition to alternative proteins, supported by automated processes, artificial intelligence (AI), and regenerative farming techniques. This would provide an opportunity to adopt best practices and reduce food waste, while improving yields (especially for healthy calories), and supporting plant-rich diets. By doing this farmers can:

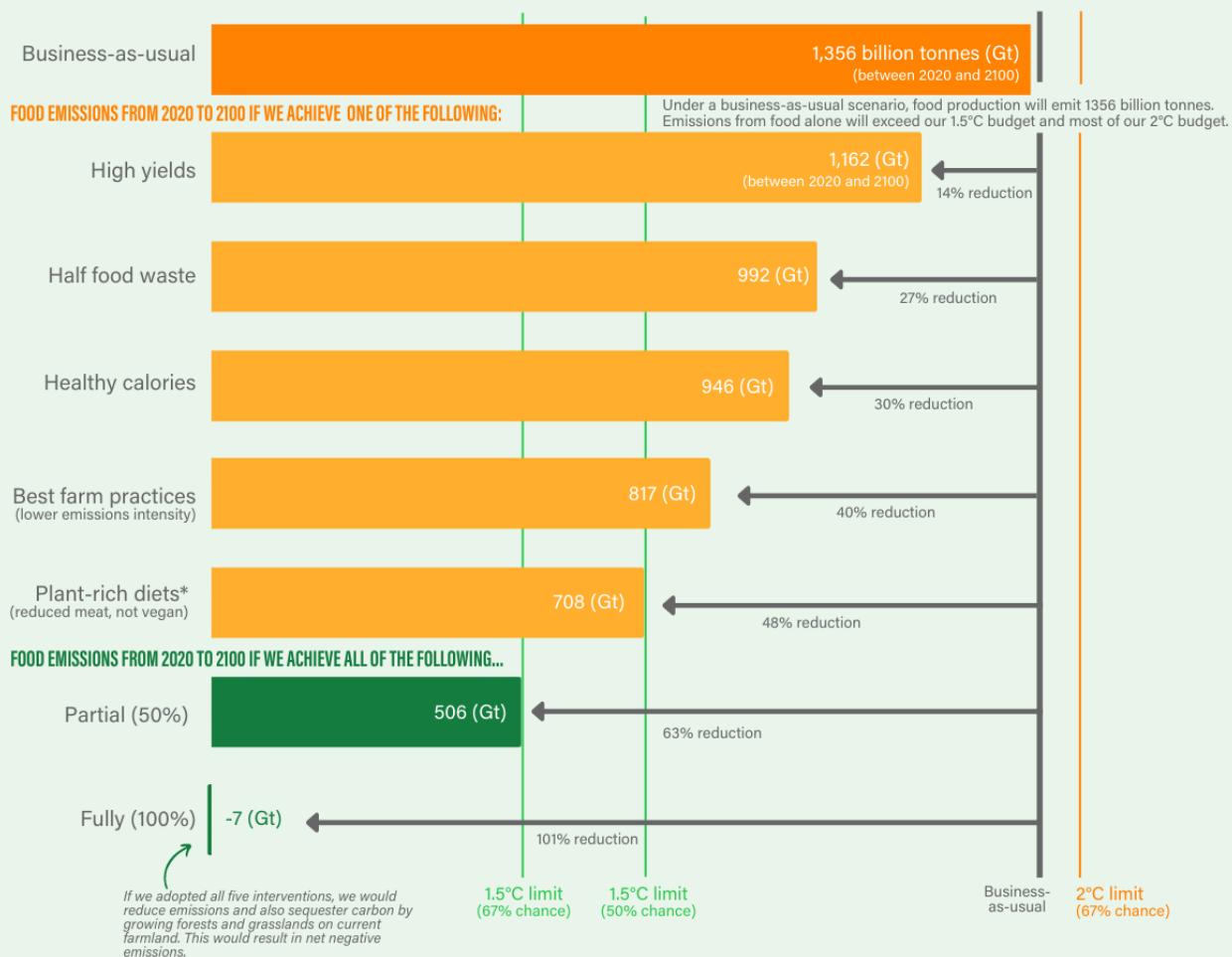
- Help to reduce total global emissions by at least 13% – thus helping to protect their land and their business in the long term through climate-change mitigation.<sup>4</sup>
- Potentially eliminate all emissions from food production and actually sequester carbon (by regrowing forests/grasslands on agricultural areas), resulting in net greenhouse gas (GHG) negative emissions.<sup>5</sup>
- Improve yields, capture carbon, and reduce reliance on chemical pesticides – thereby increasing eligibility for environmentally targeted subsidies.
- Future-proof their output by meeting the increasing consumer demand for plant-based milks and alternative proteins.
- Refine and produce the alternative proteins they grow – thus also becoming food manufacturers and unlocking greater revenues from crops.

Transitioning to alternative proteins might also bring some new risks for farmers. These may include new growing challenges, initial yield uncertainties, and dependency on new machinery. ProVeg is working with businesses across the food sector, including ingredient suppliers, manufacturers, and retailers to help mitigate these risks for farmers – through co-financing arrangements, flexible long-term contracts, political engagement, and the open sharing of knowledge.



## HOW CAN WE REDUCE GLOBAL GREENHOUSE GAS EMISSIONS FROM FOOD?

Below are estimates of cumulative greenhouse gas emissions from food production from 2020 to 2100 under a business-as-usual scenario, and five interventions to reduce emissions. This is measured in CO<sub>2</sub> warming-equivalents (CO<sub>2</sub>-we).



\*Based on the EAT-Lancet Planetary Health diet, which includes reducers but does not eliminate meat or dairy consumption. Source: Michael Clark et al (2020). Global food system emissions could preclude achieving the 1.5°C and 2°C climate change targets. *Science*. OurWorldInData.org - Research and data to make progress against the world's largest problem.

Adapted from Our World In Data: <https://ourworldindata.org/food-emissions-carbon-budget>  
(Accessed 2022-05-19)

A just transition for farmers from farming animals to alternative proteins can deliver better outcomes for farmers, producers, consumers, and our planet. Doing so will future-proof farming businesses, reduce uncertainty and price volatility, and slash food-related emissions. If you're a farmer who is seeking a long-term, independent, empowered future that is financially viable in a net-zero world, a transition to alternative proteins will be an essential part of your strategy.

Help shape the future of farming by joining our working group. For more information, please email [corporate@proveg.com](mailto:corporate@proveg.com).

# INTRODUCTION

In this paper, we focus on the perspectives of farmers from around the world, looking at the opportunities, motivations, and challenges of transitioning to alternative proteins. We conducted detailed interviews with 20 national and international farming organisations that collectively represent 300,000 farmers across Europe and the US. Our aim here is to amplify the voices of farmers and empower farmer-led solutions for a better future.

Farmers are at an historic fork in the road. On the one hand, conventional and industrialised animal farming is facing unprecedented economic pressure as well as the threat of climate change, which the sector is unintentionally accelerating. On the other hand, alternative proteins offer farmers a future that is more sustainable, financially viable, and resilient.

Climate change is already reducing farming yields and driving up production costs.<sup>6, 7</sup> This is creating a negative feedback loop since the production of meat and dairy is responsible for the majority of food-related emissions. If we are to feed 10 billion people by 2050, we urgently need to reform the global food system. Alternative proteins can be grown and produced in a wide range of ways, and we believe that farmers should be empowered to choose the future that best suits their resources, enabling them to deliver a sustainable future for all.

## Note

Of the 20 farming representatives we interviewed, the majority wished to remain anonymous. As such, we have only attributed quotations where permission was given. We are deeply grateful to these representatives who provided the perspectives of their members for this piece.



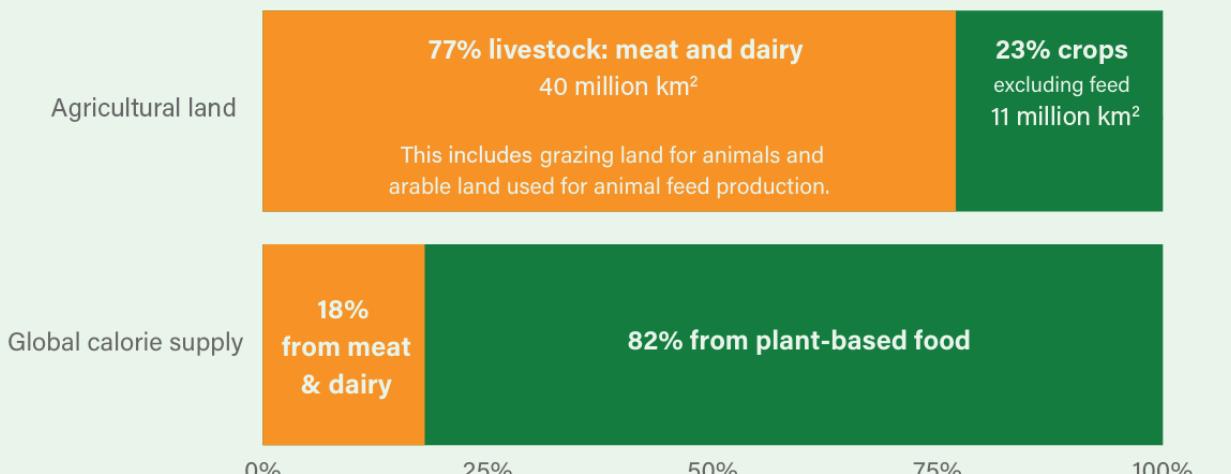
# THE FARMING PROBLEM: FARMED ANIMALS AND CLIMATE CHANGE

Our food system is one of the world's biggest emitters of greenhouse gas – and the majority of those emissions come from intensively produced animal meat and dairy. According to recent estimates, emissions from animal-based foods account for almost 20% of total anthropogenic greenhouse gases.<sup>8 9</sup>



Source: Unsplash

## GLOBAL LAND USE FOR FOOD PRODUCTION



Source: UN Food and Agriculture Organization (FAO) OurWorldinData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Hannah Ritchie. Adjusted by Hannah Ritchie and Max Roser (2019) - "Land Use"



Over three-quarters of the world's agricultural land is used for farming animals (meat and dairy). Due to the inefficiency of animal calorie conversion, this land only produces 18% of the world's calories.<sup>10 11</sup> We urgently need to transition to alternative proteins.

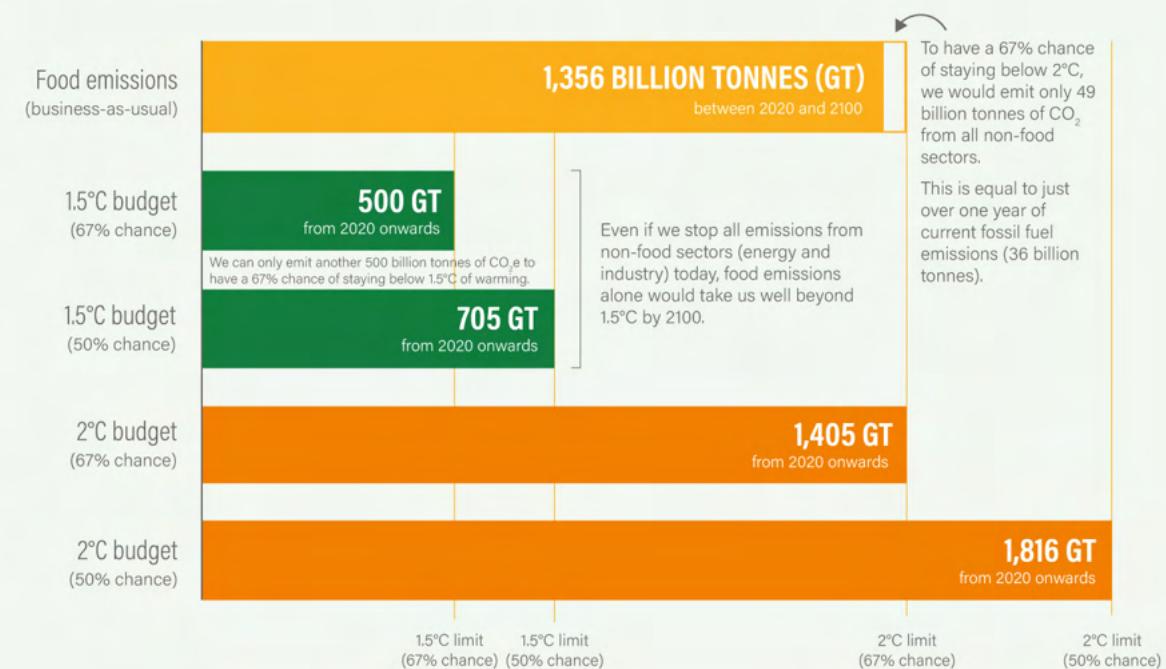
In Europe, 40% of consumers are actively reducing their consumption of animal-based products (either identifying as flexitarian, pescatarian, vegetarian, or vegan)<sup>12</sup>. While health remains the top driving force, environmental impact is now a close second – becoming the number-two reason why consumers chose plant-based foods in 2021.<sup>13</sup>

However, in developing countries the demand for animal meat is rising. Scaling up our current meat-heavy western diets to the rest of the world is not only ecologically and financially unsustainable, it's physically impossible.<sup>14</sup> We simply don't have enough land on Earth to grow the feedstock required for that many animals.

In terms of emissions, if the current food system doesn't change, it will use up our entire global emissions budget, destroying any possibility of meeting the Paris Agreement targets and of mitigating the impact of climate change.<sup>15</sup>

## FOOD EMISSIONS COULD CONSUME MOST OF OUR 1.5°C OR 2°C CARBON BUDGET

Shown here are estimates of cumulative greenhouse gas emissions from food production from 2020 to 2100, based on population, dietary, and agricultural trends in a business-as-usual scenario. This is shown relative to total cumulative emissions to keep global average temperature rise below 1.5°C or 2°C by 2100.



To keep average global warming below 1.5 degrees Celcius, we must radically reduce food-related emissions. This requires a transition from farming animals towards farming and manufacturing alternative proteins.

*"Climate change is the number one thing our farmers worry about – we just surveyed 2,000 farmers across the US. They're actively looking for solutions – they're front-line environmentalists."*

**— Vanessa Garcia Polanco,  
Federal Policy Director at the National Young Farmers  
Coalition (USA)**



Source: Adobe

*"In the 1980s, my community in Tanzania harvested huge yields from the growing season. But now climate change, deforestation, and soil infertility are reducing yields."*

**— Jackson Buzingo,  
Tanzania Director at One More  
Salary, a sustainability NGO.**

Since the majority of food-related emissions come from animal farming, a transition to alternative proteins will provide a means of substantially reducing global food emissions. This is good news since food-system reform is achievable quickly, using existing and emerging technologies, and can thus rapidly deliver climate benefits.

While the focus is usually on carbon when talking about emissions, the predominant greenhouse gas emitted by farmed-animal production is methane. Animal agriculture accounts for around a third of global anthropogenic methane emissions.<sup>16</sup> Why is this significant? Well, the warming effect of methane is 80 times more potent than CO<sub>2</sub> for the first 12 years.<sup>17</sup> After that, its warming effect decreases as the gas breaks down in the atmosphere, and becomes comparatively negligible.<sup>18 19</sup> Carbon dioxide, on the other hand, lingers in the atmosphere for hundreds of years, warming the planet at a much more consistent rate.

At the moment, our food system is continually replenishing and increasing atmospheric methane by rearing new cattle and other farmed animals. But if we transition away from this, and replace farmed animals with low-emission alternative proteins, we will start to experience cooling benefits within decades.<sup>20</sup> This makes food-system reform a uniquely effective climate intervention, and a key tool for businesses to achieve their net-zero targets.

Thus far, we've established that the scientific consensus points to intensive animal agriculture as a leading cause of climate change. In the next few sections, we'll focus on farmers' perspectives – first with regards to the causes and effects of intensive agricultural methods, and then with regards to climate change, including the role they see the farming community playing, and what they believe the community needs in order to adapt.

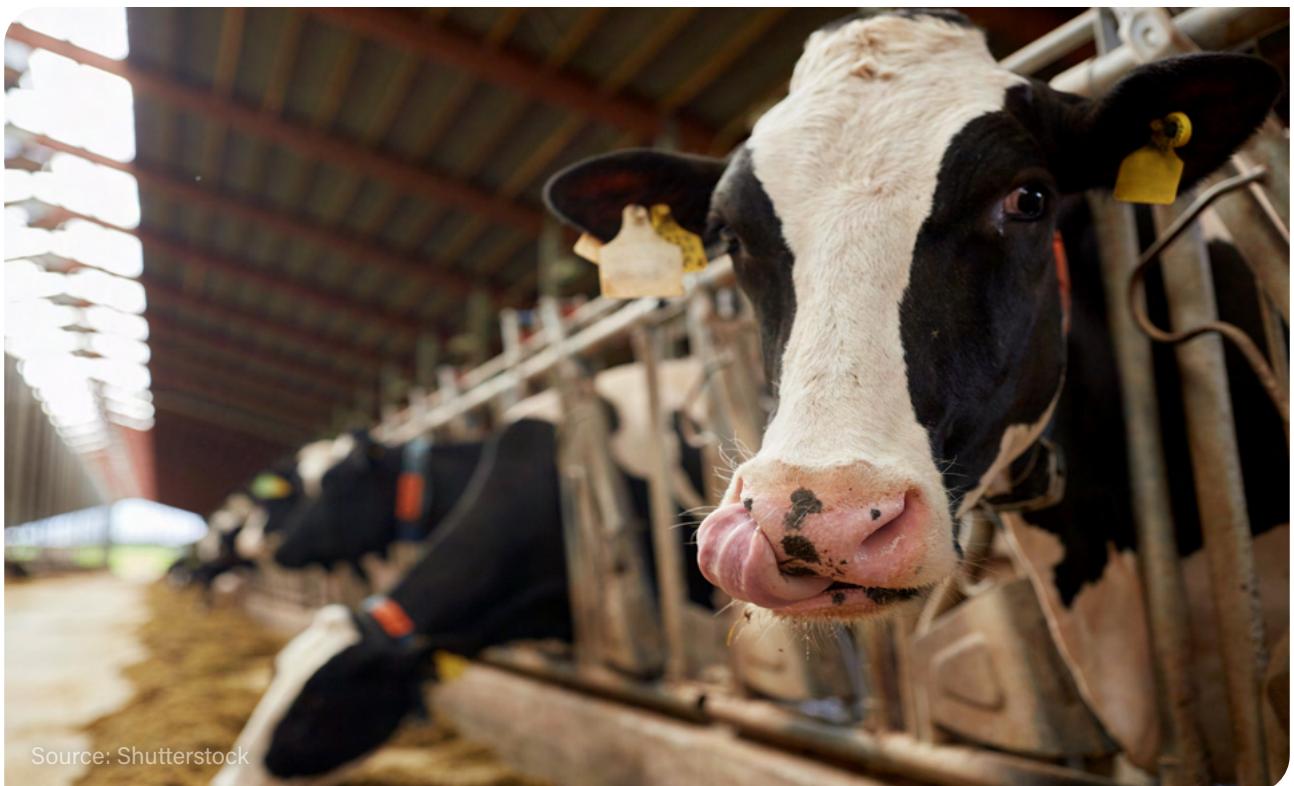


Source: Pexels

## FARMERS' PERSPECTIVES ON INTENSIFICATION

"Consumers often choose the cheapest products, so there is enormous pressure on farmers to produce cheaply," explains Padraig Elsner, Public Relations Manager at Badischer Landwirtschaftlicher Hauptverband (BLHV), a major German agricultural association.

"In order for dairy to be cost-effective, there's been a significant increase in the intensification of dairy in recent years," agrees farmer Illtud Dunsford, CEO and founder of Cell Ag Ltd. "There are many notable farms now where the cattle are never — or seldom — let out onto open grass. They're kept in open warehouses."



Source: Shutterstock

"There's [pressure being put on] the beef industry that we focus on reducing the number of cows while maintaining the output of meat. It pushes you towards intensive cattle rearing," confirmed another UK-based farmer.

As developing countries become more affluent, demand for cheaply produced meat is increasing the pressure to intensify production further. "In China, we see an increase in meat demand," says Lore Knaepen, Innovation Manager at Flanders' Food, an agri-food product developer, "but it is not possible for the whole world to eat meat like we currently do in the Western world."



The scale of current animal agriculture is staggering, agrees Professor Andrew Knight, Founding Director of the Centre for Animal Welfare at the University of Winchester. Of all farmed animals worldwide, "around 85% are intensively farmed, and around 80 billion land animals each year are consumed worldwide – that's ten times the human population."<sup>21</sup>

The current system is also incredibly wasteful, notes UK farming consultant Simon Ward. "Roughly 50% of our wheat is fed to animals, which is way higher than the global average. Wheat is 12% or above in protein. By feeding it to animals you're wasting a lot of that protein because the conversion factor is low. Being in Northwest Europe, we're able to grow incredibly high yields of wheat – two-to-three times higher than the US. The problem is that, as a result, we waste it. Plus, the protein content is lower because we have to harvest it at a specific stage to make it suitable for bread."

Farmers have told us that increased demand for cheap animal-based products (and the pressure from supermarkets on supplier prices which drives that demand) is a root cause behind the intensification of farming methods. But in the previous section we established that intensive animal agriculture is seriously accelerating climate change. How do farmers feel about the fact that their activities are driving climate change and thus negatively affecting their own futures?



# FARMERS' PERSPECTIVES ON CLIMATE CHANGE

A key challenge for farmers and the food industries they supply is consumer ignorance around the impact of conventional foods. "If you're a meat or dairy consumer, you're often not aware of the impact of what you're buying from the shed," says Dunsford. The cattle could be grass-fed or intensive – either way, a lot of their feed will be mixed with soya, which is causing deforestation in the Global South, where it's produced."

Another problem is that tinkering with farming methods can only deliver marginal improvements, which aren't adequate in the face of the climate crisis. "It's really hard to reduce the emissions footprint of dairy production. We can only reduce cows' emissions by 20-30% and that's not enough," explained a dairy director who represents thousands of farmers. "In 40 years, the impact from climate change will be so big that we won't have enough rain in the growing season to produce milk."

But, thanks to the fact that methane breaks down relatively quickly, food-system reform presents a huge opportunity to halt and reverse climate change. "Farmers have a big role to play in the global methane pledge signed at COP26," noted one European-based national farming union representative, "and ruminant farming is a big part of that."



Source: Adobe

Many farming professionals are also aware that transitioning to alternative proteins represents a commercial opportunity. "There's a fast-growing market for people seeking a vegan or flexitarian diet, who want more plant-based proteins," says James Woodward, Sustainable Farming Officer at Sustain: the Alliance for Better Food and Farming. "There's definitely an opportunity for UK farmers to get over those cultural and economic barriers, because there could be a lucrative opportunity there."

All of our respondents were keen to emphasise that every farm is unique, and its capabilities are shaped by land, resources, and the local climate. Any transition solutions need to be farm-appropriate and farmer-led.

In the next few sections, we'll explore a range of alternative-protein solutions, along with farming perspectives on each of them. The solutions include:



- transitioning from grazing dairy cattle to growing alternative protein crops;
- producing plant-based milks using crops grown on-site;
- fermentation-derived protein;
- cultured meat;
- vertical farming;
- algae aquaculture;
- regenerative farming;
- carbon credits for alternative land-uses.

One thread that runs through all of these solutions is technology. Given the sophisticated mechanisation and automation already proliferating across intensive animal agriculture, we know that farmers aren't technologically averse. Instead, as we'll discuss later, their main concerns are around risk and capital-investment costs.

*"Technology is going to play a huge part in agriculture's role in addressing climate change. People often think of tree-planting and hedge growing, which is important, but technology and robotics in farming will be massive."*

**- a British farming union**

However, before we dive into the different alternative-protein solutions, we need to consider how farmers feel about changing the way they work.

# FARMERS' PERSPECTIVES ON TRANSITIONING

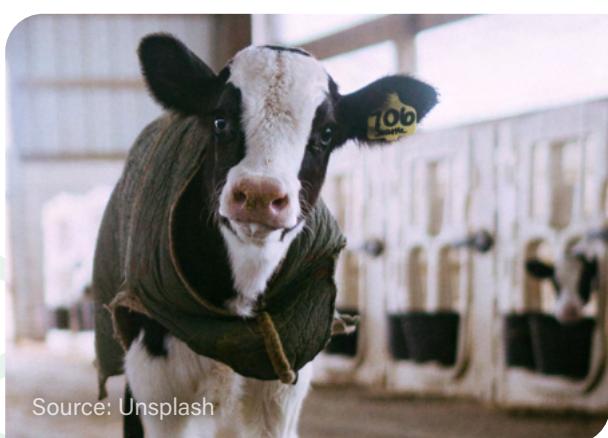
Our interviews consistently confirmed that farmers are worried about climate change, because they're on the front line. So how does this impact their attitudes towards transition opportunities?

"Farmers are acutely aware that net zero and averting climate change is essential," said one British farming representative. "Farmers would love to reduce livestock numbers and their climate footprint, but we have to be financially viable to do our environmental work. If you're talking about replacing lost animal income with something else, then money talks."



Source: Adobe

"Farmers are business people," agrees Elsner, offering a German perspective. "Nothing would prevent a transition to alternative proteins if the demand and revenue become higher than for livestock production." Increased consumer demand can be achieved through a collaboration between all businesses along the value chain. Ultimately, consumers want nutritious products that are tasty and affordable. By working together, retailers, manufacturers, and ingredients suppliers can achieve the economies of scale needed to deliver price parity with conventional animal-based products. We'll touch on this in more detail later.



Source: Unsplash

"What options are there for livestock farmers?" asks Markus Klinger, Head of Strategy and Ventures at Novozymes Advanced Protein Solutions. "You often stop farming because you retire and someone buys you out. We're seeing mass consolidation of family farms to make economies of scale work. These are big decisions for a family to make. If you're a third-generation cattle farmer, do you want to be the one to make that switch?"

It's about empathy, says Caio Malufe, a sustainable farming investor in the UK. "People need to try and understand the farmers' perspective and give them the assurance that you want to improve their livelihood. Farmers love animals – if you can show them that they're going to make a lot more money without having to kill them, you'll get a lot more interest," he argues.

"A lot of people out there [farmers] want to do the right thing and they understand what that is," says one British farming representative. But "don't present it as an opportunity to be a change agent, a first mover, or replace our beloved livestock industry with world-saving proteins," warns an animal-agriculture representative. "Present it as a risk diversification and economic benefit move."

While there's clearly some division over the cultural aspects of transitioning, there's unity around the economic basics: if the money's there, then the motivation will follow.



Over the past century, farmers in the Global North have become accustomed to government subsidies, which have historically made them risk averse. But subsidy structures are starting to change, largely driven by the urgent need to avert a climate disaster. Subsidy reform is bringing farmers new opportunities but also new headaches.

"Farmers are open-minded but there's a tsunami of opportunities and a lack of clarity about how the new subsidies will work," explains one European-based farming expert. "It's a really difficult time. At the end of the day, farmers just want someone to put down the numbers so they can make an informed choice about their ROI [return on investment] in 10-20 years' time and understand what it means for their families and their succession plans."

Any transition "needs to be done in a sensitive way," says one national farming union. "A lot of farmers see new plant-based products as a threat to their livelihood."

In the coming sections, we present a diverse range of solutions that don't threaten farming livelihoods, but rather provide choices for a sustainable future.



# OPPORTUNITIES FOR GRASSLAND FARMERS AND THE ROLE OF ROBOTICS

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In Europe, many dairy farmers have large land assets which they use for grazing. Depending on the soil, climate, and topography, there could be a good opportunity for some of these farmers to transition from cattle farming to alternative-protein crops.

"In Northern Bavaria, it's possible for our farmers to transition to crop production," explained one German dairy representative. "The farmers can use their land and soil for alternative-protein production."

"For farmers that are on high-quality soils, there's fantastic opportunity there," agrees another national farming union in Europe. But what about farmers on less fertile land?



Source: Shutterstock

Malufe (US) challenges the significance of soil quality as a barrier. "Most regenerative and agro-forestry operations start by taking completely depleted land and restoring it. You could recuperate any type of land and make it fertile again. Once you've removed the soil limitations, you're just dealing with climate limitations. But for that, you could just provide farmers with geo-suitable crop lists to help them transition."

Later, we'll discuss ways in which farmers can restore soil fertility – with a focus on sustainable, animal-free regenerative methods that are delivering great results in Europe. But soil and climate aren't the only limitations for grazing farmers looking to transition.

"In the Black Forest there is a lot of land on slopes that is not suitable for crop cultivation and therefore has no other use besides livestock," says Padraig Elsner at BLHV. "In the southern alpine regions it's not possible for farmers to switch to soya," notes another German dairy representative.

Historically, terrain was indeed a prohibitive factor. But just because land can't accommodate combine harvesters doesn't mean it's only suitable for animal agriculture.

"There's a holistic approach needed to understand the best approach for that area," explains Dunsford. Agroforestry, carbon credits for tree farming, and ecological tourism all offer new ways for farmers on difficult terrain to monetise their land assets – without reliance on unsustainable farming practices.

So far, we've established that there's an opportunity for animal farmers to transition to sustainable arable farming if:

- their land is flat enough to accommodate farm machinery;
- they restore soil fertility through plant-based regenerative methods;
- they're able to choose geo-appropriate alternative-protein crops.

The key question is: if such farmers were offered support in navigating these factors, would they be interested?

Simon Ward thinks so. "Pig production has declined in Norfolk and Suffolk [in the UK]. If you offered those farmers a good price for peas or beans, they would get rid of the animals overnight. It would be a business decision. Of course, they would need confidence that the market's going to remain," he adds.



How confident can farmers be that there will be continuing market demand for alternative proteins? The good news is that plant-based products typically require a blend of ingredients to achieve the desired nutritional and taste profiles. This means that farmers have access to a broad global market if growing conditions don't align with the types of plant protein being demanded by local manufacturers.

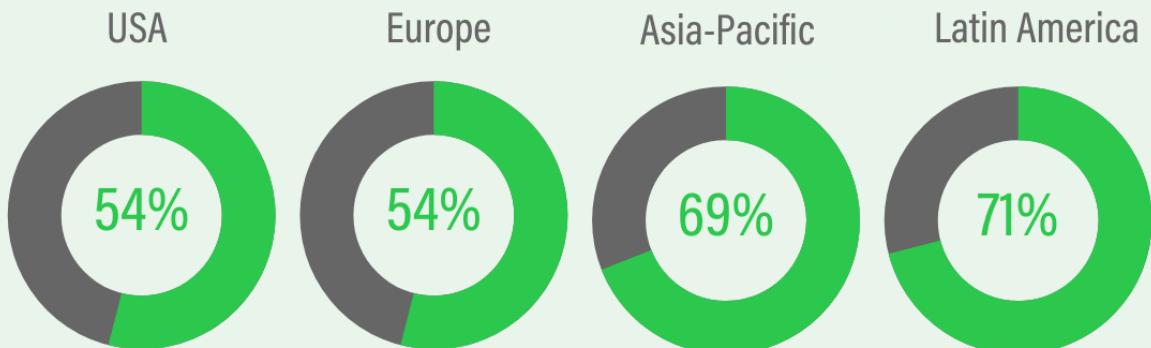
"We have a really wide range of targets for crops," explains one German producer, whose organisation is diversifying away from dairy products and into plant-based alternatives. "We have 15 different crops in development that we're exploring as solutions, including almonds, oats, and beans, and these are promising in terms of protein bases."



Of course, industry demand is informed by consumer demand, but the indications are extremely positive for plant-based options, with, for example, over half of households worldwide already buying plant-based milks every week.<sup>22</sup> “In the end, we have to fulfil the wishes of the consumer, and in my opinion, future consumers will have a mixture,” the German producer concludes.

## CONSUMERS USING PLANT MILK

Either by itself or in addition to cow's milk



Source: Cargill 2018 Adjusted by ProVeg e.V. (2019); Plant Milk Report 2019



The 2019 ProVeg Plant Milk Report found that over half of consumers worldwide regularly consume plant-based milks.

Transitioning from animal agriculture to arable agriculture also brings an opportunity for farmers to leapfrog legacy technologies and deploy the latest precision-farming techniques. Some producers are already supporting farmers on this by providing a whole new value chain.

“We’re working with farmers, seed producers, and machinery producers to achieve precision farming, avoiding herbicides,” explained a German farming representative.

“If smallholders can use technological solutions, that would be a big help,” agrees Jackson Buzingo, a Tanzanian farmer.

By increasing the efficiency, reliability, and size of farming yields through automation, farmers can maximise their returns from alternative proteins.



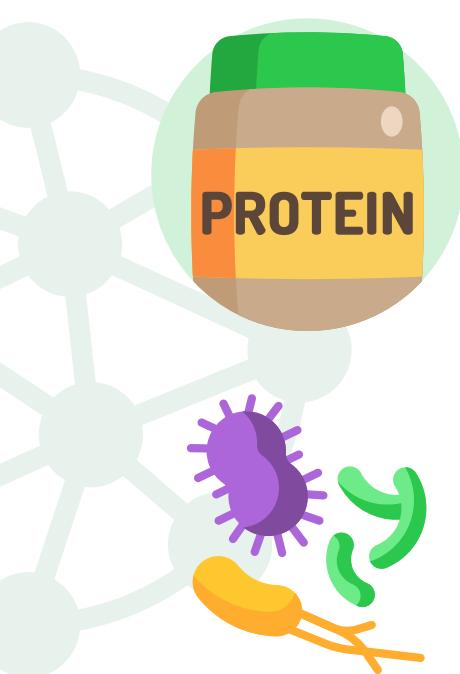
# OPPORTUNITIES IN FERMENTED PROTEINS

Firstly, let's understand what modern fermentation can do. There are two types of fermentation: biomass and precision.

Precision fermentation is used to produce specific ingredients that, for example, can be used in meat or dairy alternatives. "You specifically make it for its functionality – not as an alternative protein source or meat replacement," explains Lore Knaepen, Innovation Manager at Flanders' Food, an agri-food product developer in the Netherlands. "Biomass fermentation is where you can make alternatives to animal meat."

The good news for producers is that fermented proteins can be a cost-effective way to produce edible proteins and functional ingredients. This is partly because some methods can use ingredients sourced from sidestreams. Fermentation-derived proteins "can grow on a lot of things", adds Knaepen, including "waste products like potato peels and beets. Carbon dioxide and hydrogen can also be used, it really depends on which bacteria you use."

One of the most established biomass-fermentation protein products consumed worldwide is Quorn, which is made from mycoprotein (a fungus derivative). Its popularity proves that there's market demand and acceptance of fermentation-derived proteins. So why haven't other brands caught up yet?



A key obstacle has been getting approval in the EU as a 'novel food'. Quorn was already on the market before this law was introduced in 1997, and was thus able to continue trading. As global demand for alternative proteins has accelerated in the past decade, so too have the fields of biomass and precision fermentation grown. Fermentation-enabled products are poised to provide a wide range of texture, taste, and nutrition solutions for plant-based alternatives. But these products are generally not yet ready to take to market.

"For every different bacteria that you make a protein from, you need to prove it's safe and free from toxins," explains Knaepen. "It will take a while before we have different products on the market because it takes many years to get novel foods approved – a minimum of 18 months – and it's an expensive challenge. [However], if you can prove that something is already eaten in other parts of the world, then the novel-food application in Europe is easier."





These wheels are already firmly in motion. For example, Impossible Foods is a hugely popular plant-based burger sold in the US. To get an authentic meaty taste, the brand combines naturally-occurring heme from soya-bean roots with genetically modified yeast cells. Then they use fermentation to multiply the yeast cells and produce heme in large quantities for their alternative burgers.<sup>23</sup> Impossible Food products are currently sold in eight countries, and the brand is seeking regulatory approval in the UK and Europe.

Another fermentation-enabled protein brand likely to expand outside of the US market is Triton Algae, which, in 2021, announced a collaboration with established alternative-protein brand Tofurkey.<sup>24</sup> Meanwhile, several European companies are pursuing precision and biomass fermentation – with German biotech company LegenDairy currently seeking EU regulatory approval for their fermentation-based cheese alternatives. Global beverages giant ABInBev also recently announced several entries into the fermentation space as part of its sustainability strategy. The company will use waste from its beer-brewing operations to provide its food partners with functional ingredients created through precision fermentation.

Now that we've established that biomass and precision fermentation can be used to produce food-grade products and ingredients, and that there's an established and growing global market for these products, the critical question is whether farmers would see this as an opportunity for them. There are two opposing views on this.

"Livestock is a very traditional industry," says one European-based agri-tech expert, who has clear reservations. "Even though there's been a lot of innovation, and a lot of livestock farmers do see the writing on the wall in terms of the environmental impact, I can't see many of them I know wheeling in a fermenter. Retrofitting old land into highly complicated technical apparatus is hugely time-consuming and expensive. Farmers often outsource the management of anaerobic digesters because it's like running a living thing."

On the other hand, a German farming union brought a different perspective, suggesting that existing farm infrastructure from animal agriculture could be retrofitted with fermentation machinery. "Some decommissioned barns could be used, for example for fungi-agriculture. Farmers don't care if they're going to the barn to take care of animals or of fungi," he explained. Simon Ward agrees with this view of farmers as pragmatists, adding that "if you can come up with something that's profitable, farmers will be very enthusiastic."

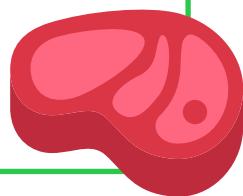


Source: Adobe

# OPPORTUNITIES IN CULTURED MEATS

First up, what is cultured meat? Also known as cultivated meat, cell-based meat, or cellular agriculture, cultured meat is animal meat that is produced from animal cells rather than from whole, live animals. By culturing cells to produce meat, fish, and seafood, the raising and slaughtering of animals can be avoided, along with many of the environmental costs of animal agriculture.

Cellular agriculture has the potential to reduce the climate impact of food by up to 92%.<sup>25</sup>



In order to produce cultured animal meat and seafood, stem cells are sampled from living animals through a painless biopsy. These cells are then fed with nutrients in large vats or cultivators, where they multiply and differentiate. The cells then grow into muscle tissue, which is the main component of meat.



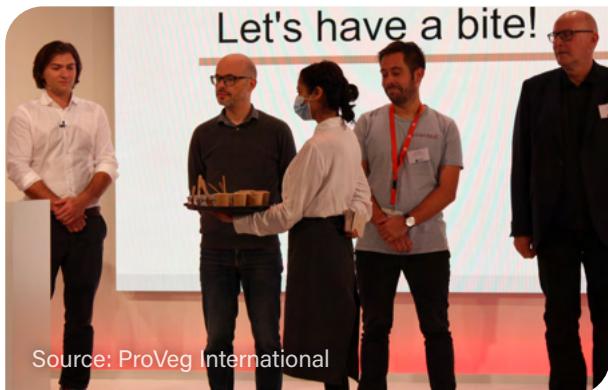
The aim of cellular agriculture is to provide people with the meat products that they know and like, but with numerous human health benefits, a lighter impact on the environment, and a reduction in animal use and slaughter.

As we discussed in the opening section, there is high global demand for animal protein, but no physical way to meet this demand through intensive animal-farming methods. Agrifood companies are therefore exploring cultured meats as a sustainable long-term solution. A growing number of universities, along with about 80 companies and startups around the world, including some of the world's leading meat producers, are currently working on developing cellular-agriculture products.

In 2020, Singapore became the first country to approve the sale of cultured-meat products for human consumption. Other regions are catching up. The EU's European Food Safety Authority published new guidelines in March 2021, specifically for novel-food applications from cultured-meat producers.

The EU is also funding two cellular agriculture projects in the Netherlands. In the US, the FDA is reviewing its regulatory requirements, meaning that cultured meat could hit retail shelves in late 2022.<sup>26</sup>

In other words, cellular agriculture is in its early stages but it's a fast-emerging sector with huge potential. Surveys suggest that regulatory approval will assuage most consumers' safety concerns, and that about half of consumers will be open to trying cultured meat.<sup>27</sup> According to the consulting firm Kearney, cultured meat could represent 35% of global meat consumption by 2040.<sup>28</sup>



Conference delegates at ProVeg's New Food Conference at Anuga 2021 had the opportunity to taste-test cultured meat – a first for most of them!

However, these rural communities are suffering under the current system. Between 2003 and 2019, the number of dairy farms in the US plummeted by 50%<sup>29</sup> – and the decline is continuing. Farms file for bankruptcy on a daily basis, driven to collapse by flawed subsidy systems and competition from intensive, feedlot-driven megadairies.<sup>30</sup> We believe these communities deserve better – and that alternative proteins can provide a sustainable future for people and the planet.

"Within farmers' minds, alternative proteins are a niche thing – they're very new. Farmers won't know how to move their business from livestock to fermented or cultivated meat. To fundamentally change their business would take a huge amount of investment and knowledge," explains James Woodward, Sustainable Farming Officer at Sustain: the alliance for better food and farming (UK). "There's a cultural barrier to that too – farmers wouldn't necessarily see that as farming."

Perhaps a hybrid approach, integrating cellular agriculture within a more conventional approach, could offer farmers the best of both worlds. In the next section, we'll briefly outline the role that carbon credits could play for farmers.



Now that we understand the aims and potential of cellular agriculture, how do our farming representatives feel about it?

"Alternative proteins are commonly painted as a threat to the wonderful fabric of rural communities, which are predominantly livestock farmers," explained one major cattle breeder. Putting aside the fact that, globally, 85% of farmed animals are intensively farmed, we need to be mindful that, for farmers, loss of their communities and identities is a serious concern.

# OPPORTUNITIES IN TREE FARMING AND CARBON CREDITS

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Based on their existing infrastructure and land footprint, feedlot farms are well-placed to transition to fermentation or cellular agriculture solutions. For former dairy farms on grazable land, there's the question of what to do with the unused space.

Some farmers are anticipating governments paying them to sequester carbon – either through tree planting or through regenerative soil management. "There's a big increase in the value of C3 [mixed woodland<sup>31</sup>] poor-quality grass land," explains Simon Ward . "Despite the fact that those lands graze cattle and sheep, which require huge subsidies, the land price is going up. People are anticipating governments paying them to grow trees to store carbon."



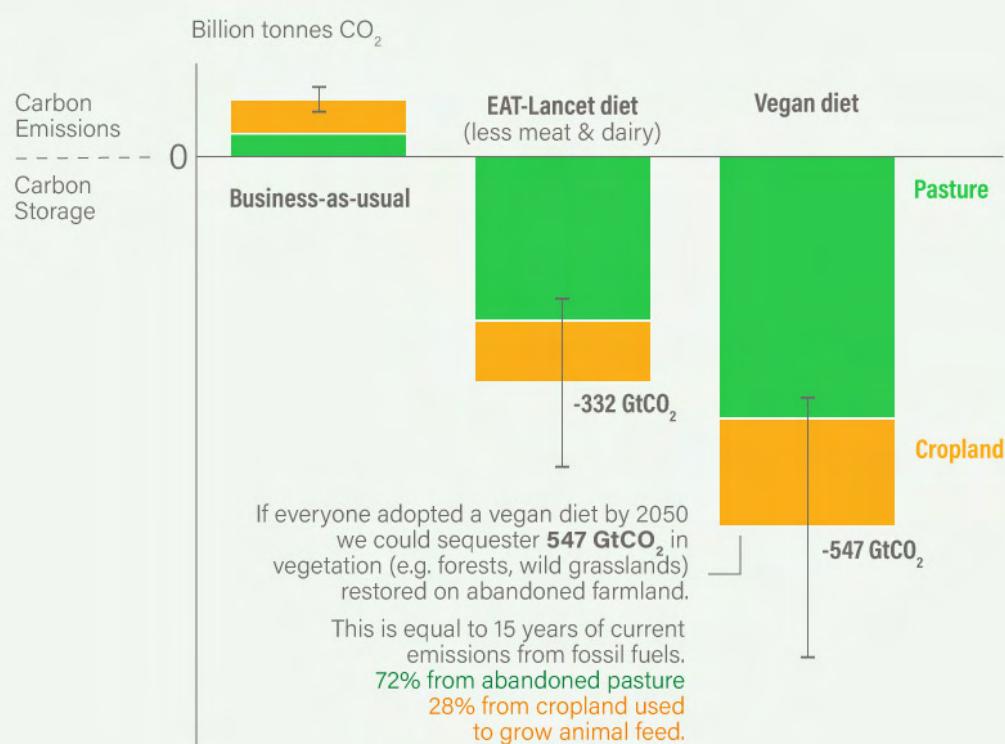
But even if farmers were to embrace tree farming or carbon farming, getting recognised and paid for these services isn't straightforward. "There are about 70 GHG calculation tools available for farmers in the UK, and they all deliver different results," warned one national farming union. "Where does the emissions counting begin? Does it include the fertilisers? Or the transport on and off farm? And what would the process look like for a farmer to get accredited? It would bring a massive list of measuring and documenting burdens. Would the farmer be fairly compensated for delivering this benefit? Would they get better prices?



Source: Pexels

# HOW MUCH CARBON DIOXIDE COULD REGROWTH OF TREES AND WILDERNESS STORE IF WE CHANGED GLOBAL DIETS?

Using land for agriculture – either crops or pasture for livestock – prevents natural vegetation such as forests, or wild grasslands from growing on that land. The CO<sub>2</sub> this land could sequester is the 'carbon opportunity cost'.



Note: Figures only include carbon storage in vegetation – they do not include reductions in greenhouse gas emissions from food production. Soil carbon sequestration is also not shown, but the authors estimate an additional 135 – 225 GtCO<sub>2</sub> of carbon storage in soils.

Source: Matthew Hayek et al (2020). The carbon opportunity cost of animal-sourced food production on land. *Nature*. Licensed under CC-BY by the author.

What are the carbon opportunity costs of our food?. Our World in Data. Retrieved on 13th of April 2022, from <https://ourworldindata.org/carbon-opportunity-costs-food>



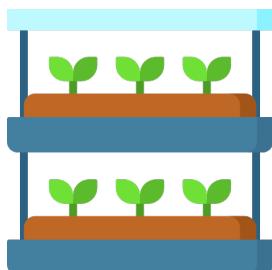
By moving away from animal agriculture towards plant-based diets, we can free up massive amounts of land for reforestation and carbon sequestration.

While governments are lagging behind in providing clear answers to these questions, businesses are already stepping in – commissioning former cattle farmers on semi-arable land to sequester carbon for them. This brings a long-term income for the farmers, and helps the businesses to accelerate their net-zero targets by offsetting unavoidable emissions.

# OPPORTUNITIES IN VERTICAL FARMING AND AQUACULTURE

## VERTICAL FARMING

Another opportunity for cattle farmers is to transition to vertical farming. It circumvents the need for fertile, flat, arable land. While it requires significant capital expenditure, the long-term benefits are substantial.



"Nearly every crop you can think of can only be harvested once a year – which means that your capital is only used once a year. A vertical farm could produce continuously," explains Ward. "You're also closer to automating the process as well – which is great for vegetable farmers where labour shortages in the UK are becoming a major problem. If you have an all-year-round vertical greenhouse, you can have permanent rather than seasonal staff."

Of course, as with any technological solution, the energy required needs to be derived from renewable sources. Fortunately, this dovetails with modern energy strategies under most national and commercial net-zero targets.



So how do cattle farmers feel about vertical farming opportunities? Well, some have already transitioned. Mike Weaver was a struggling poultry farmer in the US. He turned his former chicken barns into vertical farms for hemp, and is now running a legal, sustainable, and highly profitable farming business without the need for animals. "Farmers in America are in bad shape... I'm trying to do my part to get that changed," he explains.<sup>32</sup>

## AQUACULTURE

What about farmers who don't already have such infrastructure to retrofit, but still have large land assets? "European farmers are looking to diversify into glamping [high-end camping]," explains an agritech expert. It's all about finding the right business model for their location, she continues. "If I've got 10,000 hectares, I don't need that land for fermentation. Aquaculture might be an option but you need huge space for big algal ponds."

The algal-pond idea is already past the proof-of-concept stage. Farmers in Kenya are growing vast amounts of spirulina — a natural source of protein, essential omega fatty acids, and other nutrients, and an increasingly popular dietary supplement.<sup>33</sup> "But it's not for the faint-hearted," warns our agri-tech expert. Algae need near-constant stirring and fertilising, plus the extraction and drying processes are delicate. "A beef farmer in Texas might not want to spend their time tending temperamental algae," she cautions, although she acknowledges that the terrain and climate do lend themselves to this solution.



Source: Unsplash



Source: Adobe

Farmers may find it easier to overcome these hurdles by co-investing in automated processes, together with their buyers. This will help both sides to achieve efficient, scalable production at a mutually beneficial price point.

# OPPORTUNITIES IN REGENERATIVE AGRICULTURE

Regenerative agriculture is not a single style of farming — it's more of a values-based approach. The general idea is that you use nature-based solutions to deliver sustainable yields. Some approaches use animal agriculture, while others use plant farming. Broadly, we advocate for the latter because it removes the global need to produce huge quantities of supplementary feedstock, which animal-based regeneration would likely still require<sup>34</sup>, but we'll explore both here.



What's the problem with the current non-regenerative model? Well, "a lot of arable farmers use intensive nitrogen fertilisers," explains a UK-based farmer. These are damaging on three key levels:

1. They emit carbon during their production process.
2. They pollute waterways worldwide, killing marine life.
3. They can lock farmers into expensive chemical dependencies.

"We need to work with nature to ensure that the farmers can be independent through nature-based farming, because most small holders don't have money for chemical fertilisers every year. The future of food is regenerative agriculture, the agro economy," argues Jackson Buzingo, a Tanzanian farmer.

Regenerative agriculture is a way out of this problem. "Arable farmers are now moving towards crop rotations and introducing livestock back into these rotations, which helps them reduce the need for chemical spraying," the farmer explains. This is because, in the UK at least, there's a "big focus on the bacteria and fungi in soil, and the ability to produce yields with fewer chemical inputs."



A circular inset image showing a close-up view of various green plants, likely crops or forage, growing in a field. The plants have different leaf shapes and textures, including broad leaves and narrower, blade-like leaves. The background is blurred, focusing on the foliage in the foreground.

A similar practice is becoming popular in the US, according to Vanessa Garcia Polanco, Federal Policy Director at the National Young Farmers Coalition. "Many ranchers now are women focusing on regenerative practices using livestock, which consumers pay a premium for," she explains.

"Livestock also help with weed production," adds a European cattle breeder. "Arable farmers are now relying on livestock to help maintain their soil quality. Ranchers are leasing cattle to those farmers for a year, while other farmers are reintroducing closed herds for their own purposes."

## DOES REGENERATIVE FARMING REQUIRE THE USE OF ANIMALS?

Circling back to our earlier question, does regenerative agriculture actually need cattle? There are obvious (and non-exclusive) benefits around nutrient recycling and habitat diversification, but some cattle farmers are suggesting that grazing cattle are eco-friendly because they sequester carbon by churning topsoil. This myth persists, despite a 2017 Oxford University analysis which found that this benefit would only offset 4–11% of total livestock emissions.<sup>35</sup>

Herbivores have their place in nature, of course, but farmed-animals exist in artificially high quantities and graze in functional environments managed by humans. Animal-free regenerative agriculture brings wide environmental benefits – without the high emissions and slaughter that come with farming animals.

The term ‘biocyclic vegan’ is sometimes used to describe this regenerative method. “The biocyclic vegan way shows that it is possible to restore and increase soil fertility without any [farmed-]animal input,” explain Axel Anders, Freya Shulz, and Anja Bonzheim of German NGO Biocyclic Vegan Agriculture (BVA).<sup>36</sup>

They don’t use chemical fertilisers, animal manure, or slaughterhouse waste. Instead, they aim to create a closed loop of nutrient cycles by using organic plant matter to increase the humus layer. “We use the organic matter of the grassland and legumes that are usually used as fodder,” the BVA team continues. “These plants fix nitrogen in the soil and are the basic element of organic agriculture. Of course, you need to find ways to bring legumes into the system – for instance in a compost, or a cut-and-carry or mulch system.”

## HOW DOES BIOCYCLIC FERTILISATION/GROWING WORK?

The biocyclic method seeks to close the nutrient cycle as near to the farm as possible, by sourcing materials such as woodchip and food waste locally.

Some alternative-protein crops already lend themselves to regenerative practices, adds Markus Klinger, Head of Strategy and Ventures at Novozymes (Advanced Protein Solutions). “With soya beans, for instance, you don’t need a lot of nitrogen fertilisers because the plant roots have a symbiotic relationship with nitrogen-fixing microbes.”



Source: Adobe



This makes them a great candidate for 'mixed cropping' (also called inter-cropping). "For example, if you have a wheat field, you might plant soya in it too. We call this mixed cropping, and it allows for two harvests," explains the BVA team.

"You do have to grow most crops in rotation," adds Ward UK. "Particularly now, because we have resistance to many insecticides, fungicides, and herbicides." Fortunately, crop rotations have been used for centuries to break pest and disease cycles and maintain soil fertility.<sup>37</sup> After a 20th-century hiatus, it's making a comeback as a cost-effective nature-based solution that doesn't require the farming of animals.



Source: Shutterstock

## HOW DOES BIOCYCLIC REGENERATIVE AGRICULTURE AFFECT YIELDS?

"There is a research project in the Netherlands that has been ongoing for nine years and it shows that purely plant-based fertilisation is comparable to other forms of organic farming using animal inputs," explains the BVA team.<sup>38</sup> Furthermore, they continue, "a recent field trial by the Agricultural University in Athens, Greece, has shown that biocyclic humus soil delivers even better yields than conventionally fertilised soil."<sup>39 40</sup>

## ARE THERE OTHER BENEFITS?

"A key benefit we need to talk about is climate resilience," says the BVA team. "With conventional [arable] farming, plants are given easy access to nutrients, meaning their root systems are weaker, and this is making the land vulnerable to soil erosion from flooding. Organic farming is much more resilient."

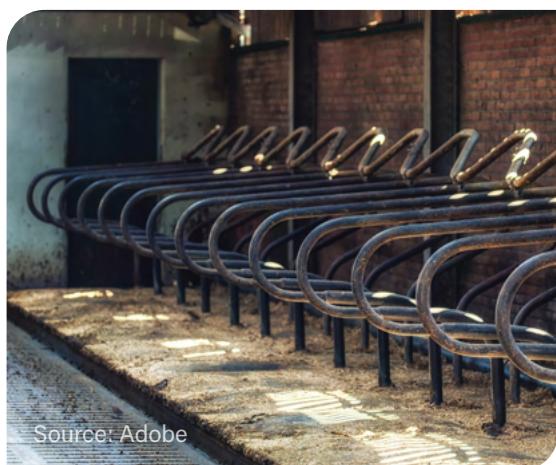
Buzingo agrees, explaining that "most of the heritage crops we have in Tanzania, Kenya, and other nearby countries are naturally drought-resistant. Farmers should be supported to embrace these nature-based solutions to increase yields and restore soil fertility."

## TRANSITION CASE STUDY: FROM DAIRY FARMING TO BIOCYCLIC REGENERATIVE AGRICULTURE

"We work with an ex-dairy farm in Dorset, UK, (Northwood Farm) which used to be conventional," says the BVA team. "The farmer not only decided to become organic, but he got in touch with our partner organisation in the UK, Farmers for Stock-Free Farming, who helped him to switch to stock-free, then transition to new crops, and enter new markets over time. It's a successful example of a conventional animal farm transitioning to biocyclic vegan."

Northwood farm has benefited from transitioning to biocyclic vegan farming in a number of ways:

- tackling the climate emergency by halving their emissions footprint;
- maintaining soil fertility and yields through organic, vegan farming methods;
- increased consumer demand for plant-based products - which is satisfied by farms like Northwood supplying alternative proteins to manufacturers, creating a virtuous feedback loop as economies of scale grow the market.



Source: Adobe

"We've got to get to net zero as soon as possible, and that will mean a reduction in global live-stock numbers. The vegan community needs to go to the Government and say, 'we've got an agricultural system that is sustainable, is sequestering carbon, and it works; let's run with this!'"  
- Laurence Candy, owner of Northwood Farm<sup>41</sup>

Northwood is one of several farms the BVA team have helped to transition, and their work is now being replicated and amplified by national governments.

"In the Netherlands, the government is already providing support for farmers who move away from live-stock towards other methods," says the BVA team. "The Environment Agency and the Federal Ministry for the Environment are funding our project 'Vegan Organic Agriculture – VegÖL' to help establish biocyclic vegan farming all along the supply chain and to make it more visible. This project raises awareness and is helping biocyclic vegan agriculture to gain more interest from producers, processing and trading companies, and consumers - it's a question of communication now."

ProVeg recommends that farmers prioritise biocyclic vegan methods and avoid using animal inputs in their regenerative methods. Plant-based fertilisation can enhance crop yields while delivering the greatest environmental benefits overall.

# OPPORTUNITY: SHOULD FARMERS BECOME PRODUCERS?

Consumer demand is shifting towards plant-based products, and anticipated emissions legislation and tariffs are expected to put further pressure on the finances of animal farming and animal-based products. Unless farmers change their model, they risk losing relevance – and thus revenue.

"Plant milk is made in a factory, not on a farm. Most of the value chain moves from the farmers to the industry," explains a German farming representative. "Farmers fear becoming irrelevant, losing their livelihoods."



Consumer preferences are also causing "a move away from fresh veg to processed food, and that usually takes margin away from the farmers," adds a British cattle breeder.

But these changes also represent a huge opportunity for farmers. As demand for plant-based alternatives grows, they can embrace more of the value chain themselves. "I wish more farmers were involved in the operation," says Dunsford (UK). "The asset values that farmers hold is huge. They could own a huge chunk of these operations if they chose to, but they're standing back and letting middle men take those benefits. I know a lot of horticultural businesses but they don't process their vegetables so they're missing a trick. Processing would be a way to diversify their farm further," he adds.



## TRANSITION CASE STUDY: ARABLE FARMERS BECOME PRODUCERS TOO

"There's a UK arable farm called Glebe Farm that decided to set up processing facilities on their farm to produce gluten-free oat milk, PureOaty, using their own oats. They've created that space for themselves - investing in wholesale change to their business. You'll see their produce in village shops and wholesalers. Because they can show their story as a local family farm producing it, a lot of marketplaces like that." - James Woodward

Glebe Farm differentiates itself by focusing on gluten-free products made from its own oats. They know this is a value-add for health-conscious consumers, saying "since we're involved in every step of growing, milling, and manufacturing our oats, we know exactly what goes into everything we produce."<sup>42</sup>



Glebe Farm grows, refines, and processes its own crops to produce PureOaty, its own brand of gluten-free oat milk. By becoming a producer, the farm has been able to earn more profit from the crops it grows.

Glebe Farm also supplies its gluten-free rolled oats to food manufacturers worldwide. This diversified portfolio helps them to spread their risks, while maximising the potential value they can extract from their crops.

This case study is a good example of how, by investing in knowledge and on-site facilities, farmers can become grower-producers and derive greater margins from their inputs.

In these next sections, we'll discuss the challenges raised by the farmers we spoke to, as well as potential solutions for a just transition to alternative proteins.

## CHALLENGES: SHARING KNOWLEDGE

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We've already heard that farmers are pragmatic and more open to change than some might think. As Vanessa Polanco puts it, "Our farmers are really innovative. If you were to present this as a research opportunity or a pilot project, they'll jump into it. Our farmers are always thinking about innovation, change, learning. They'll try it out to see if it's a good fit for them – especially if it's good for lifecycle assessment, waste management, and CO2 emissions."

However, that doesn't mean change is easy for them. "There's often a disconnect between the innovation at universities and the ability of farmers to access it," explains a British farming union. "Advice on growing alternative proteins is at least as important as financial incentives and security, and should be available free of charge," agrees BLHV's Elsner.



Source: Adobe

Once farmers gain knowledge of new methods and opportunities, this information proliferates horizontally within farming communities. "A key aspect here is peer-to-peer learning," explains Woodward. Dunsford echoes these sentiments, adding that, "Farmers are really receptive to their own community. Farming is insanely personal – the majority of farmers have been born into and brought up in a farming family and business. The challenge is that any outsider telling you to do something differently feels like a personal attack. You work ridiculously long hours with low wages, so the suggestion of change is so utterly personal that you can't delineate between what's your industry and what's the very fibre of your being."

Ultimately, good farming solutions "are never top-down," says Polanco. "It's always farmer-led." ProVeg hopes that this report will be a springboard for further discussions around alternative proteins within the farming community.

# CHALLENGES: FINANCING THE TRANSITION (CAPITAL EXPENDITURE)

"The real problem is capital investment," says Ward. "One of the main barriers will be whether farmers can get investment for the different machinery they would need," agrees Woodward. "Farmers will need access to affordable finance to be able to invest in the changes they need to make. That finance could come from public spending, but there's a lot of opportunity for private investment to step in, too."

On the other hand, there's an argument that farmers are in a strong position to borrow against their own future investments. "You can borrow money in agriculture very easily. In fact, capital has never been easier to get," explains a European agritech expert. "The tricky bit for farmers is the market side – they need confidence that they would be producing a product that consumers want."

"This is part of a broader transition of farmers away from subsidies," he continues. "A lot of farmers are worried about how to make beef or dairy production profitable as subsidies are changed. The question is how you transfer the entire land-management business."



"Big companies are better suited for this transition," adds Kingler (DE). "Smallholder farms will struggle and might disappear – but they already are because of efficiency costs." Businesses might be able to help smaller farms to bounce back through efficient, technological solutions like fermented proteins, vertical farming, or cultured meat and dairy.

But the capital-expenditure costs will also apply to arable solutions. "For the vegetable market, where you're growing soft green peas for the end product, you need a £300,000 viner machine for harvesting, then a freezing factory nearby so it's frozen within minutes," says Ward. "You couldn't grow enough product on a single farm to offset the capital-expenditure costs. Most pea farms are owned by cooperatives which share machinery. Those groups would love to expand, though."

This latter point provides an opportunity for food manufacturers and retailers to help – by building and supporting farming-cooperatives that pool finances. Happily, some producers are leading the way on this.

"We have invested heavily in our French plant," explains a German dairy producer. "We've invested €100 million. The plant can now produce dairy products from animal bases *and* from plant-based products. This makes it possible for farmers to produce either."

In other words, farmers should encourage their buyers to build flexible processing facilities. It's the smart thing for businesses to do, agrees Kingler. "Cargill's portfolio includes both concentrated animal-feeding operations and plant proteins. If Cargill loses out on beef, they'll probably win on plant-protein."



## CHALLENGES: LONG-TERM BUYING AGREEMENTS

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"Getting contractual arrangements between the grower and the supplier is really hard. Neither party understands the other's problems," says Ward. This needs to change if farmers are to successfully transition, agrees Malufe. "Farmers need to see that it's a long-term relationship [with new alternative-protein buyers]. Then they'll transition in phases – 5% of the land one year, then 10%, then 15%, etc."

"If you're a large dairy producer and expanding, then you're probably borrowing to gain efficiencies – like robotic milking systems, slurry tractors, etc," adds Dunsford. "If you want to make the switch, something you've been making efficient for the last 40 years suddenly becomes a black hole for cash."

To avoid the sunk-costs mindset, farmers need buyers to offer them long-term, profitable partnerships as alternative-protein providers.

"Negotiating long-term contracts with farmers could be part of the solution, and we're in the first stages of this," agrees a major German dairy producer. "Farmers have to invest a lot of money to make the transition and they need a secure future, which is why it's really necessary to negotiate long-term contracts."



Source: Adobe

"The most important thing is [for farmers] to have reliable market partners as buyers," echoes Elsner. "Farmers need three-to-five years of security typically, but it depends on the crop and what kind of investment is required. Really, it should be an undertaking forever."

Of course, farmers aren't operating in a vacuum. "You need the value chain around processing," says Markus Klinger, Head of Strategy and Ventures at Novozymes Advanced Protein Solutions. For instance, "you need a supply chain of grain elevators that can turn around pulses. It's going to need a lot of investment."



"Risk is a big issue," emphasises a European agritech expert. "There are regular attempts to grow new crops, which depend on there being an end market. Your crop goes into a huge global grain market, and while your new grain may be amazing, you still need to persuade all the mills to recalibrate to process it, then the bakeries to use the new supply in their recipes. Understanding end-market creation is going to be key."



"UK agriculture desperately wants to be supplying domestic producers," adds a UK farming and estates manager. "They're interested in British food producers who are willing to move away from European supply chains over to British-grown operations. What would be very exciting would be an opportunity for UK farms to supply the new plant-based production facilities that are being built – like those producing oat milk. You'd think it makes sense for them to use British oats but much of it is being imported."

Assuming that quality is consistent, the only reason to import a given ingredient is a lower price. By partnering instead with local food manufacturers and retailers on long-term contracts, farmers can transition to alternative proteins and:

- protect themselves against global shipping crises and logistical problems;
- protect themselves against price volatility;
- negotiate economies of scale to benefit both parties;
- reduce their ingredient-transportation costs and emissions.



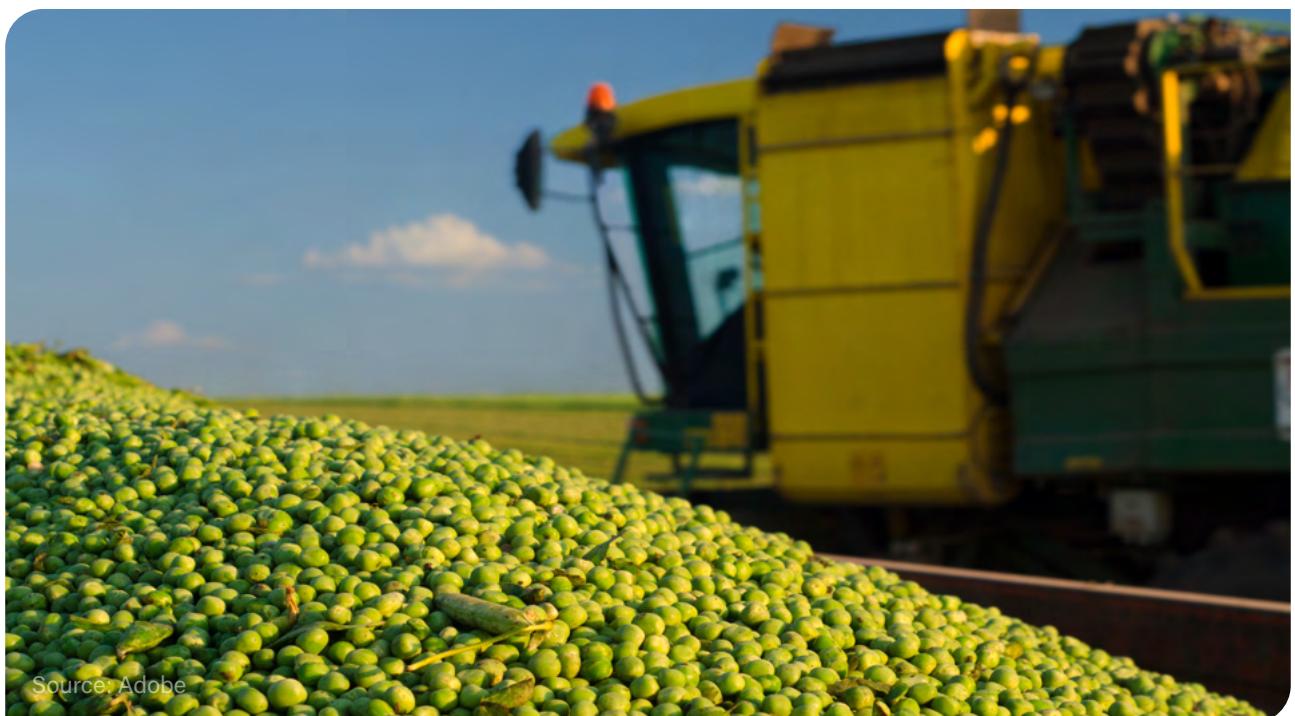
## CHALLENGES: DIFFERENT KINDS OF RISK

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Farmers transitioning from grazing cattle to alternative-protein crops will be trading old risks for new ones. However, with good planning and strong commercial partnerships in place, these risks can be mitigated.

On the one hand, there's a logistical vulnerability. "If you have livestock, you can move them in a severe weather event. If you have crops, you have no flexibility or protection – you just watch a flood destroy your yield," explains a British national farming union.

Crop yields are also a risk with alternative protein crops. "I would expect your yields of peas and beans would vary +/-30% between years, which makes your contract very difficult," explains Ward. "You would always have to grow too much, expecting to put surplus into free markets for livestock etc. where the off-take price is much lower. It's also extremely difficult to introduce perennial crops because they require investment, and if it fails in year two, the cost of converting it into something else is extremely high. For instance, if you plant short-growing trees to harvest for [biomass power stations] and it doesn't work, then you've then got to dig all these failed trees out two years later before you plant something else."



Source: Adobe

He also points out that farmers transitioning to growing peas become vulnerable to a mechanical monopoly. "The manufacturers of all the pea viners in the world are owned by a single Dutch company and they're built to order. Getting the equipment is a huge obstacle. Getting rid of all the livestock could drive a huge spike in the prices of pea viners, as these limited-supply critical machines would suddenly become even more valuable."

As discussed previously, cooperatives and co-financing with industry partners, alongside long-term contracts, could provide ways for farmers to mitigate these risks.

## CHALLENGES: POLICY REFORM

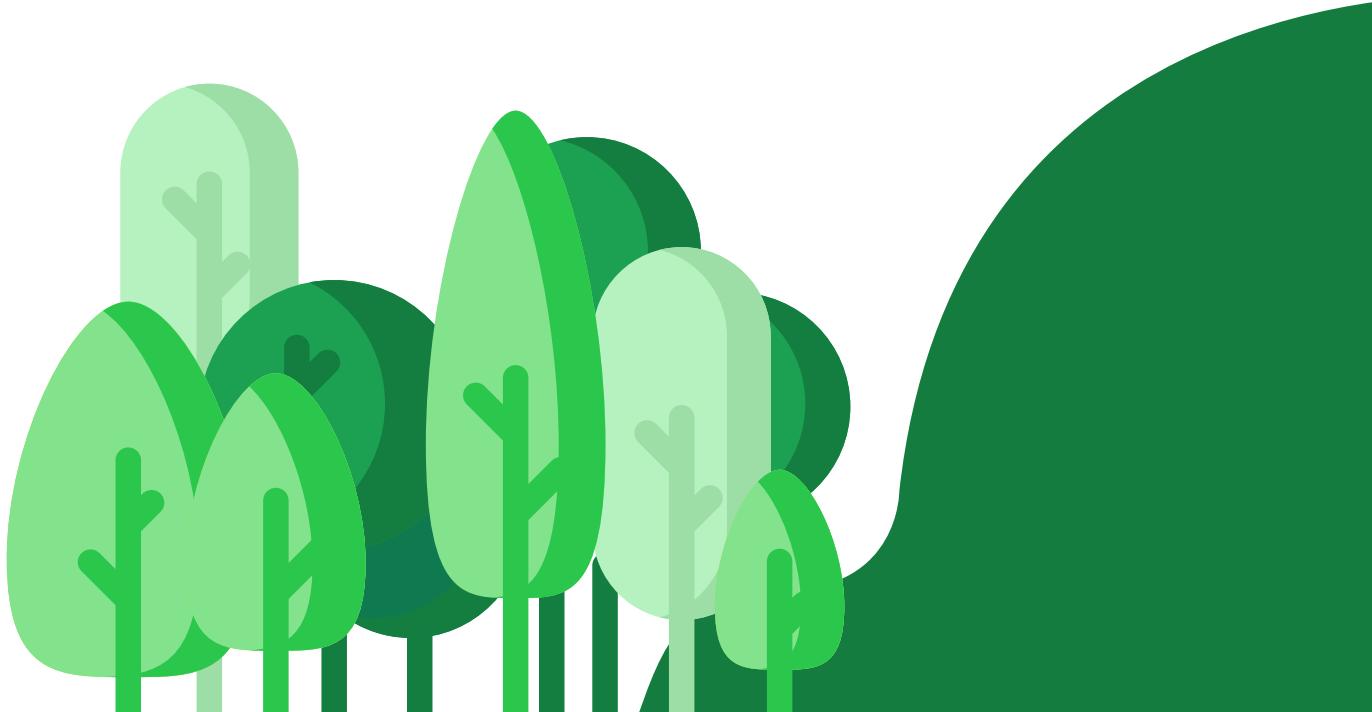
Of course, both farmers and businesses can be supported in the transition if public money is used wisely. "Governments currently give subsidies to people who deplete the land," observes Malufe. "But governments are the ones with the financial power to reward people for recuperating the land. Farmers don't have that kind of financial cushion."

"To bring down the cost of capital in new areas, you need to reduce uncertainty, which is where the government can help," agrees Klinger. "The reality is that every industry that has to decarbonise in some way requires compensation," adds a British cattle breeder.

"It's hard for farmers to have long-term confidence in policy not changing. At the end of the day, it's their land. Top-down solutions will polarise them," says a British national farming union.

"We need a level playing field on eco production quality so EU meat can be eco and compete with imported meat," suggests Elsner. ProVeg would go one step further and suggest that, at a minimum, we need a financially level playing field between animal-based and plant-based products worldwide.

We hope that as farmers become more aware of their opportunities within the alternative-protein space, they will join others in supporting a level-playing field on subsidies and taxes for sustainable versus conventional produce.



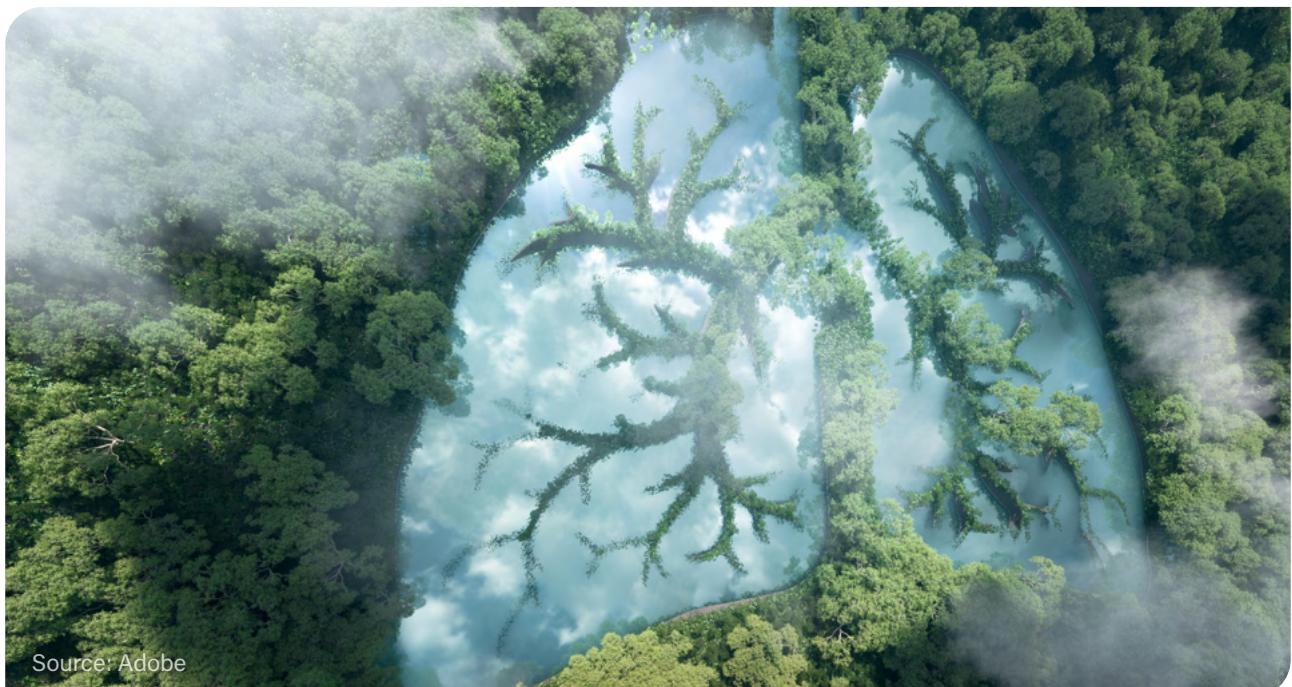
# CONCLUSIONS AND NEXT STEPS

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In this report, we've established that there are huge opportunities for farmers to transition towards sustainable alternative proteins, which can deliver higher margins and greater security through long-term industry partnerships. The farming representatives we spoke to argued that farmers are open to innovation but they need new knowledge and methods to be made freely available by businesses/governments – and validated by their peers.

We also heard repeatedly that farmers can't shoulder the financial risks of transitioning by themselves, and that businesses could provide long-term contracts and offer a range of partnership options for farmers to help them de-risk the switch to alternative proteins. Farmers could partner with buyers or cooperatives to co-invest in capital expenditure around precision-fermentation production or other alternative protein technologies, thus partly de-risking the transition.

Alternative proteins offer both farmers and businesses the opportunity to meet emerging consumer demand, massively reduce their emissions, and restore biodiversity to their land. We urge farming unions to continue supporting their members in accessing information about these emerging opportunities, and we call on businesses and governments to play their part in supporting this transition.



# ACKNOWLEDGEMENTS

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