



PUBLIC EQUITIES

# From Diets to Tech: The Opportunity in Sustainable Agriculture

INSIGHTS



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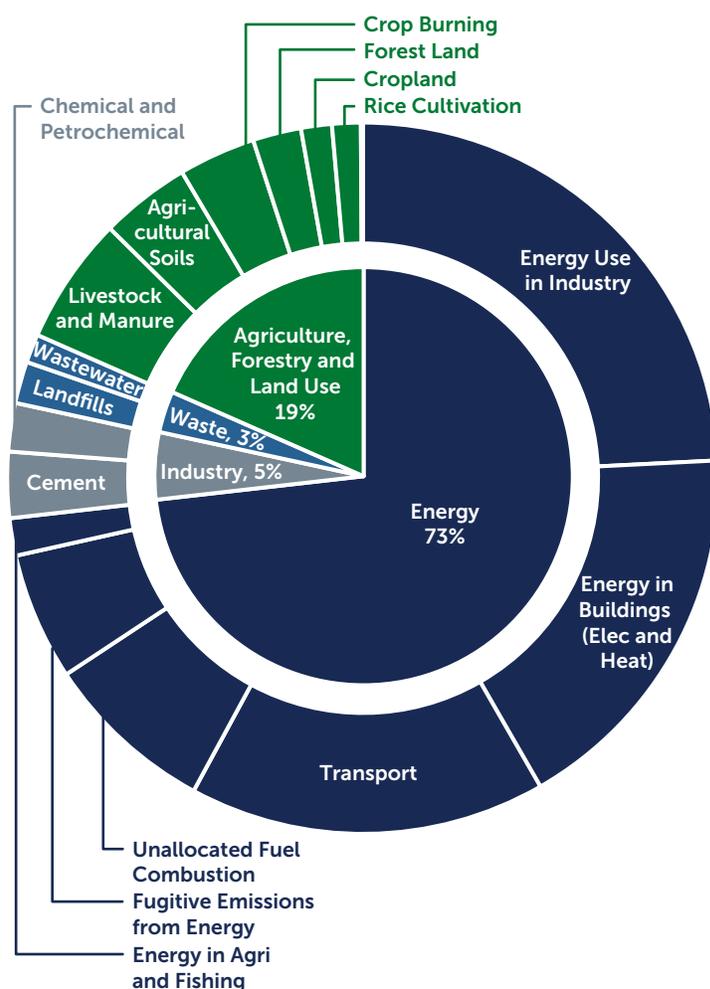
## Key Points

- Carrying on with business as usual is not an option for global agriculture and food systems. In fact, an academic study suggests an 87% increase in GHG emissions and a 67% increase in demand for cropland to meet the anticipated increase in food demand between 2010 and 2050.<sup>1</sup>
- The use of innovative technologies such as Precision and Digital Ag, biological solutions and seed technology are key to boosting agricultural productivity with a reduced environmental impact.
- Protein production needs to be made more sustainable with improving productivity in the form of animal feed and health. A shift in people’s diets—from animal-based to more plant-based—is also necessary.
- A third of all food produced for human consumption is lost or wasted along the supply chain with losses and waste at every stage in the food system.
- At Barings, we believe that by integrating environmental, social and governance (“ESG”) into research due diligence, it is possible to uncover risks that are not apparent from traditional fundamental analysis—and to identify increasingly sustainable business practices and investment opportunities. This philosophy is achieved through a focus on integration, forward-looking dynamics, and active engagement over a reliance on exclusion, in order to unlock long-term returns in equities.
- Focusing on our approach, we refrain from speculating on food prices (which can stoke food inflation). Instead, we concentrate on the components within the infrastructure that support the industry do more with less, increasing productivity to support a growing global population by increasing yields and sustainability in the process, and doing so with a lower carbon footprint than the universe’s average.

The global agricultural industry is a major emitter of greenhouse gases. The World Resources Institute estimates that agriculture, forestry and land use are responsible for 19% of global greenhouse gas emissions.<sup>2</sup>

When focusing on sustainable agriculture, it is about doing ‘more with less’, and in the process, balancing the requirement to feed an increasing global population, with a reduced environmental impact and sustainable land management. If the world is to feed 10 billion people in 2050 in a sustainable manner, we need to change both food production and consumption—particularly if the amount of land available to agriculture is lower. This will require the technological revolution that is currently underway. In this paper, we describe some of the innovations that are increasing the productivity and sustainability of both arable farming and protein production.

Figure 1: Global Greenhouse Gas Emissions by Sector



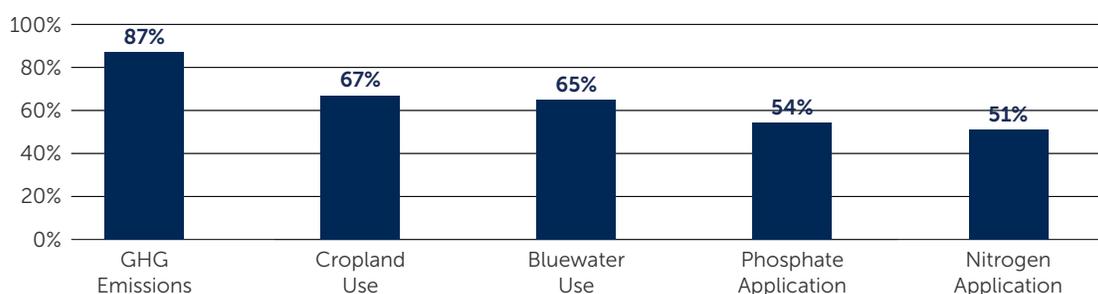
Source: Climate Watch, The World Resources Institute (2020).

1. Source: Springmann, M. et al (2018), Options for keeping the food system within environmental limits, Nature, 562 (7728), pp. 519–525.  
 2. Source: Climate Watch; The World Resources Institute (2020).

## The Challenge

Dr. Marco Springmann from Oxford University’s Oxford Martin Programme on the Future of Food wrote a paper titled, “Options for keeping the food system within environmental limits”, in which he explored the environmental impact of sharply increasing food production and consumption from 2010 to 2050.<sup>3</sup> Dr. Springmann found that in the absence of technological change and other mitigation measures, a rise in the demand for food would add to the environmental pressures on the food system (**Figure 2**). The projected increases are a baseline projection to 2050 and are shown as a percentage increase from 2010 levels. The most striking impact is in the projected increase of 87% in GHG emissions and 67% of cropland over this 40-year forecast period. A key reason for the massive jump in GHG emissions is the increase in animal-based products—demand for animal-based products is expected to rise not only because of the expected higher global population but also due to increasing wealth in emerging markets, creating a shift in diets toward animal-based products.

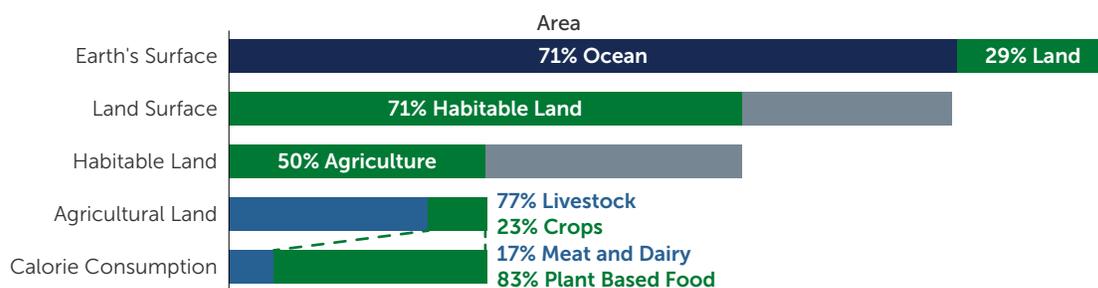
**Figure 2: Environmental Impact of an Increase in Food Demand (2010–2050)**



Source: Springmann, M. et al (2018).

As well as being resource intensive, agriculture does require a large amount of land. What is particularly striking is that 50% of global habitable land is used for agriculture. The World Wildlife Fund also estimate that 77% of this agricultural land is used for livestock, but is only responsible for 17% of consumed calories (**Figure 3**), highlighting how unsustainable the current trajectory is for food production.

**Figure 3: Land Area for Food Production**



Source: Our World in Data. As of September 2019.

3. Source: Springmann, M. et al (2018), Options for keeping the food system within environmental limits, Nature, 562 (7728), pp. 519–525.



*“There is an increasing need for transformational changes in the global food system to deliver healthy outcomes for a growing population, while simultaneously ensuring environmental sustainability.”*

When assessing the impacts of increasing food demand, one key area of concern is the implications for the biodiversity of the planet. Biodiversity is the variety and abundance of species and the quality and the extent of ecosystems—and a loss in biodiversity threatens food systems and agricultural productivity. For instance, more than 75% of global food crop types rely on animal pollination.<sup>4</sup> Therefore, as we seek to increase food production, we need to reduce the amount of land to produce food in order to maintain biodiversity. This reduction in agricultural area clearly conflicts with the significant increase in food demand until 2050, and thus places more pressure to find technological solutions to boost yields.

A further element of addressing the challenge is clearly to reduce the amount of food waste. The current system is inefficient and unsustainable, with a third of all food produced for human consumption lost or wasted along the supply chain: with losses and waste at every stage in the food system.<sup>5</sup> To give scale to the problem, without accounting for GHG emissions from land use change, the carbon footprint of food produced and not consumed would be the third biggest global emitter of GHG behind China and the U.S.

### **What Can Food Systems Do to Become More Sustainable?**

There is an increasing need for transformational changes in the global food system to deliver healthy outcomes for a growing population, while simultaneously ensuring environmental sustainability. These changes will come for a variety of different solutions, with the aggregate of these marginal gains transforming the way we operate and consume.

4. Source: IPBES (2019); Summary for policymakers, p3 A1.

5. Source: “Food wastage footprint: Impacts on natural resources”, FAO, 2013.

## ARABLE FARMING SOLUTIONS

At the heart of arable farming, sustainable farming solutions will involve technologies in:

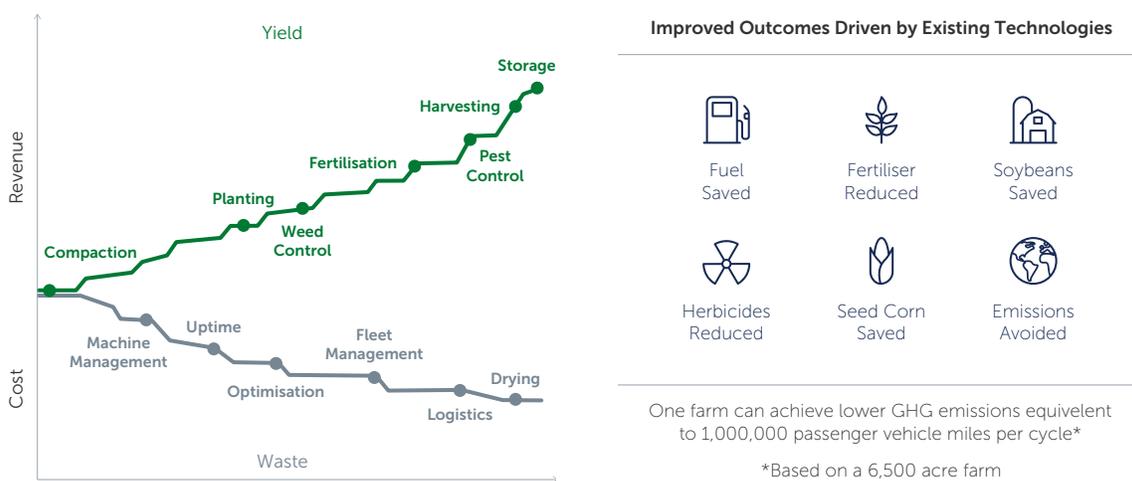
- **Precision and Digital Ag**, which is transforming agriculture and boosting yields by optimizing crop inputs
- **Bio-solutions**, which are providing a more environmentally friendly solution for protecting and growing crops, thus protecting bio-diversity
- **Seed Technology**, which is structurally increasing yields

### Precision and Digital Ag

Precision and Digital Ag technologies have seen structural growth from when they first started appearing in the market. These technologies have boosted yields, reduced waste and increased farmer profitability—fundamentally enabling farming to do more in terms of output with fewer inputs from crop protection, fertiliser and seeds. These breakthroughs involve the use of “Big Data”, drawing historical information to create predictive analytics of soil quality and composition, and the most ideal weather conditions, often using satellite or aerial imagery. By having this at hand, farmers are able to make better decisions on what to use to grow (seeds, fertiliser and crop protection products) and when to plant and ultimately harvest. This data can then be programmed into the equipment so that the machine autonomously plants the seeds in the correct density, alongside the crop protection products and fertiliser within the most productive parts of the field.

AGCO, a leading manufacturer in “Precision Ag”, estimates that through using their complete Precision Ag tech portfolio, a farmer can see a 20% improvement in profitability over five years by both improving yield and reducing cost. In addition, AGCO’s “Precision Planting” division has the objective of achieving a one- to two-year payback for farmers on their equipment—which, in our view, is a compelling proposition to encourage change. This is especially prevalent when considering that AGCO’s technologies can be retrofitted to old equipment, transforming old planting equipment to become “smart”, and at a budget that is accessible.

**Figure 4: Economic and Sustainability Benefits of Precision Ag Technologies**



Source: AGCO; Deere 2020 Sustainability Report. Cost and revenue data as of March 2021.

Similarly, John Deere estimates that a Midwest farmer growing corn and soybeans on a 6,500 acre farm using their latest technology today through planting to harvest can save on key crop inputs of fertiliser, seeds and herbicides, as well as over 1,600 gallons of diesel fuel. This has a material economic benefit of \$40 per acre, or over \$260,000 for the whole farm.<sup>6</sup>

When focusing on herbicides, Deere currently offers technologies, which can reduce herbicide application by up to 77%.<sup>7</sup> Typically, when a farmer applies herbicides they tend to spray the whole field, whereas Deere's See & Spray technology uses cameras to only spray identified weeds—thus potentially cutting herbicide usage by a staggering amount. While this technology was initially nascent in small areas of farming, it is now being expanded to apply to the more industrialised row crops, increasing the speed at which farmers can spray herbicide through the field, increasing its practicality as a long-term solution, and benefitting both from an economic and environmental perspective.

Further, Precision and Digital Ag is also providing sustainable solutions to managing carbon levels in the soil. This could pave the way for a system in which farmers generate carbon credits, and are rewarded for reducing emissions and sequestering carbon. North American fertiliser and agriculture retail company Nutrien and global fertiliser company Yara International, have already begun to roll out a farmer carbon credit trading system. We believe this carbon market, while still in its infancy, has huge potential. Nutrien suggest that agriculture could be a major source of carbon credits and potentially represent 30% of the total carbon market by 2050, while Yara estimate that the agriculture carbon credit programme has the potential to be worth \$10 billion.<sup>8</sup>

### **Bio-solutions**

Bio-solutions are another method for farmers to reduce chemical pesticide usage and replace it with alternative methods such as enzymes and microbes instead. Bio-solutions can protect plants against pests and diseases (as a substitute for herbicides, pesticides and insecticides). Moreover, new biological inoculants can be applied to either the soil or the plant in order to improve productivity and crop health, for example by making plants more efficient in their uptake of fertiliser. In both of these categories, microbials still only account for a low to mid-single digit percentage of the total market size, but have great potential for future growth.

Novozymes, a world leader in biological solutions, estimates that if all U.S. cornfields and chicken production applied bio-solutions, it would result in an additional production of 130 million gallons of biodiesel, 10 billion gallons of bioethanol, 2.3 billion extra pounds of protein rich animal feed and 21 TWh of bioelectricity. This productivity enhancement would be delivered while saving 90 million metric tons of GHG emissions, which is equivalent to taking 18 million U.S. passenger cars off the road.

6. Source: Deere 2020 Sustainability Report.

7. Source: Deere Sustainability Report 2021.

8. Source: Yara ESG Seminar. As of December 2020.

### Seed Technology

Another tenet is seed technology, which will need to improve to deliver higher yields, and resistances, particularly if the land available to agriculture is reduced over the long term. Over the last 30 years, the majority of the yield growth in row crops has been generated from breakthroughs in higher yielding seeds. This has been driven through enhancements in germplasm, which is the basic genetic material of a seed. Taking this understanding, technology can improve seed breeding, increasing the quality of the germplasm and the yield potential. Genetically Modified (GM) crops supplement the traditional breeding of crops by inserting certain traits in the seeds, from pest management, herbicide tolerance and drought resistance. Although we accept there is some concern with GM seeds around its impacts to biodiversity, we believe this is outweighed by the advantages of higher yields, less chemical pesticide usage, and the evolutions required to protect crops from the effects of climate change.

Leading seed companies such as Corteva and Bayer are in the vanguard of developing the germplasm and GM seed traits. Both companies are set to continue to benefit from this structural demand, while the European Green Deal's Farm-to-Fork strategy outlines the increasing governmental support for access to seed varieties adapted to the pressures of climate change.

### Sustainable Protein Production Solutions

Animal protein production is responsible for a significant proportion of global agricultural GHG emissions. We look at how animal-based production can be made more sustainable through more efficient animal feed, improving animal health and sustainable agriculture. Finally, we look at plant-based protein alternatives such as plant-based meat and dairy products, which have a much lower environmental impact.

#### INCREASING THE SUSTAINABILITY OF MEAT PRODUCTION

The use of feed additives can improve feed efficiency and the health of animals, while simultaneously reducing environmental footprints. One such additive called eubiotics improves the gut health of animals and can displace the use of antibiotics, for instance. However, we are seeing this concept grow into new and exciting areas. Dutch chemical company DSM has invented an animal feed additive called Bovaer—which is part of the company's Project Clean Cow—that inhibits cows' methane emissions by up to 30%, according to DSM. Bovaer was approved for use in the European Union in February 2022, making it the E.U.'s first feed additive that can market for its environmental benefits. New Zealand giant dairy co-operative Fonterra and DSM have signed a collaboration agreement to accelerate the transition to lower methane agriculture—and the Clean Cow technology could potentially help New Zealand take a leadership role in low carbon dairy production.

### SUSTAINABLE AQUACULTURE

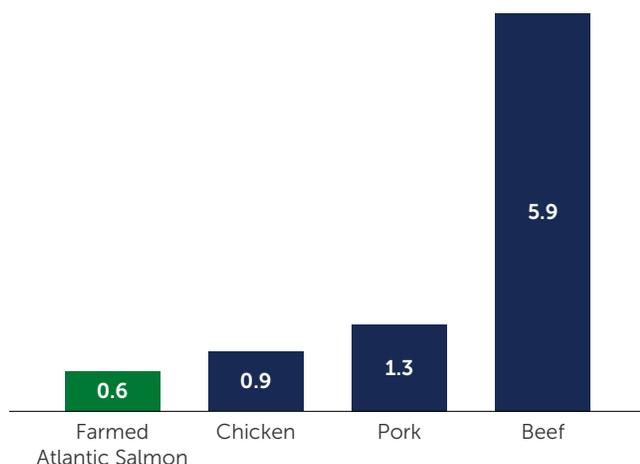
Sustainable aquaculture could also be a part of the solution for protein consumption. Farmed salmon production is relatively efficient in terms of the carbon footprint and there is no risk of by-catch of other species when compared to wild catch in the sea (Figure 5). In our opinion, it is not surprising to see salmon farmer Mowi at the top of the Collier FAIRR Protein Producer Index in 2021. This index was developed by the FAIRR Initiative in order to assess 60 of the largest listed global meat, dairy and aquaculture companies against 10 environmental, social and governance factors—all of which are aligned with the Sustainable Development Goals. The FAIRR initiative engages with the protein industry to improve sustainability, and Barings are the lead investor in a FAIRR engagement with salmon farmer Bakkafrost in order to improve the sustainability of feed for their salmon farming operation.

The sustainability of salmon production can be further enhanced through using more sustainable fish meal and oil, which is used to feed the fish that we consume. Dutch chemical companies Corbion and DSM have used fermentation technology to produce an algae from sugar or corn that is high in Omega 3 and can be used in fish feed as a substitute for the fish meal and oil, supplementing the use of Pelagic fish.

### PLANT-BASED MEAT AND DAIRY

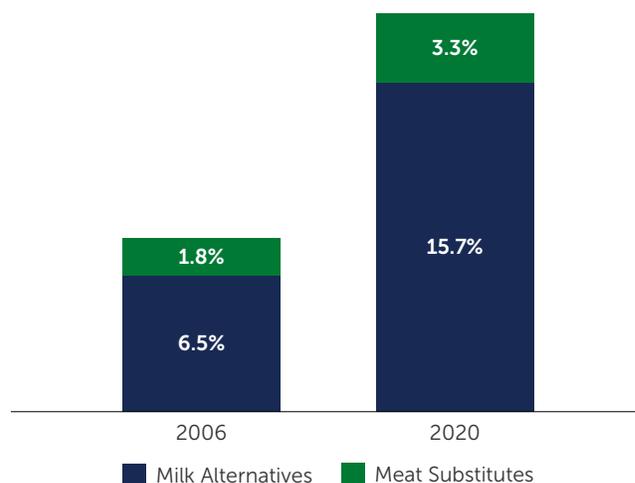
Plant-based protein production has much lower GHG emissions and water usage than animal-based equivalents. Therefore, from an environmental perspective, it would be beneficial if consumers incorporated a more plant-based diet. In fact, we are seeing some evidence of this in the U.S., as well as across the world, as consumers look to adopt a more flexitarian approach. Flexitarianism or ‘casual vegetarianism’ is an increasingly popular eating regime, as people take a more environmentally sustainable approach to what they eat by reducing their meat consumption in exchange for alternative protein sources.

**Figure 5: Farmed Salmon Has a Relatively Low Carbon Footprint**



Source: Bakkafrost, Sustainability Report 2019. Carbon footprint is measured in grams of carbon dioxide equivalent per typical serving (40g) of edible protein of the product.

**Figure 6: Market Share of Alternative Dairy/Meat in U.S. Retail Channel**



Source: Euromonitor; Bernstein Analysis. As of October 2020.

The University of Michigan did a life cycle analysis of a Beyond Meat plant-based burger compared to an equivalent beef burger and found that the Beyond Meat burger produced up to 90% lower GHG emissions than traditional equivalents, while using 99% less water.<sup>9</sup> Supporting this growing “flexitarian” audience, the target market of these products is not just vegans and vegetarians but also meat eaters. According to Beyond Meat, 93% of consumers who bought the Beyond Burger at Kroger grocery stores in the U.S. also purchased meat products during the first half of 2018.<sup>10</sup> Beyond Meat believe that there are three key pillars that are crucial for plant-based meats to become more mainstream:



**Taste and sensory**

High quality products that are indistinguishable from animal meat



**Nutritional content**

Manufacturing a product that is superior in nutritional content



**Pricing**

Bring down prices at parity or below animal protein

Part of the success of Beyond Meat is the advances the company has made in trying to replicate the look, taste and textures of meat to ultimately make plant-based meats indistinguishable. The company has taken a scientific approach to this, analysing meat by its composition, including amino acids, lipids and vitamins, and searching for these nutritional values in plants—which are often in abundance. However, the biggest challenge for plant-based burgers is the premium pricing, as the quality has, and will continue to, improve, and they are generally healthier than animal alternatives. As investment increases, we believe pricing will eventually become less of a hurdle. And with the launch of plant-based burgers by global food chains such as McDonalds, and with Beyond Meat now supplying the likes of KFC, Starbucks, Pizza Hut, Dennys, Subway and Taco Bell, it should only be a matter of time.

**PLANT-BASED DAIRY PRODUCTION**

Plant-based milk is a possible alternative for consumers who have lactose intolerance. In part due to this reason, Asia Pacific is the largest market for plant-based milks and, according to Morgan Stanley, represented around 50% of the market in 2017. Plant-based milks are a more mature market than the meat market, suggesting that growth rates are likely to be lower than the plant-based meats market where the recent improvement in quality has been significant and is helping to drive strong growth from a low level.

**Key Takeaway**

Food production and diets need to change in order to sustainably meet the anticipated increase in demand by 2050, while achieving other objectives such as increasing biodiversity—which is crucial in managing climate change.

Technology is creating a revolution in agriculture, particularly with Precision and Digital Ag, which is boosting productivity with a reduced environmental footprint. These technologies importantly also increase the economic sustainability of the farmer—in particular, AGCO estimate that full adoption of Precision Ag technologies could result in a \$80 billion improvement in farmer profitability globally. Further, Digital Ag and Precision Ag technologies provide the prospect of a carbon trading place for agricultural emissions, which gives farmers an economic incentive to adopt more environmentally friendly farming techniques. In our opinion, this is a very exciting prospect to advance sustainability across the industry. The agricultural machinery companies with Precision Ag technologies could disproportionately benefit from this structural growth opportunity.

The growing emphasis on more environmentally friendly solutions will likely provide structural growth in biological solutions and increasingly displace synthetic chemical pesticides. Furthering seed technology to continue boosting yields will likely remain important to increase production without further inputs. We would also argue that there is a place for GM seeds as part of the solution to sustainably increase production and reduce chemical pesticide use.

9. Source: Beyond Meat press release. As of September 2018.

10. Source: Business Insider. As of April 2019.



Animal-based meat production will need to become more environmentally sustainable with improving animal feed and health. However, it is also clear that the amount of animal-based meat in diets will also likely need to reduce as it is so resource intensive to produce. In our view, it seems inevitable that plant-based alternatives such as plant-based meat and dairy products will continue to gain traction, particularly with the decline in prices of plant-based products.

## Uncovering Opportunities

While sustainable arable farming solutions and protein solutions are two key sectors in helping to improve sustainability in agriculture and associated food chains, there are many more sustainability-related themes in the industry—from health and wellness, to circular economy/bio-products, to distribution and forestry.

*“Technology is creating a revolution in agriculture, particularly with Precision and Digital Ag, which is boosting productivity with a reduced environmental footprint.”*

The trends in health and wellness are about improving or increasing access to more nutritious food. For example, ingredient companies such as Tate & Lyle can improve the nutrition of food by increasing the protein and fibre content and reducing salt, sugar and saturated fats. Meanwhile, distribution focuses on companies that responsibly source food or provide a more sustainable and efficient transportation alternative—such as Bunge and ADM. This is becoming increasingly important as the world directs agricultural trade to meet increasing global populations, particularly in Asia, while protecting more land for biodiversity.

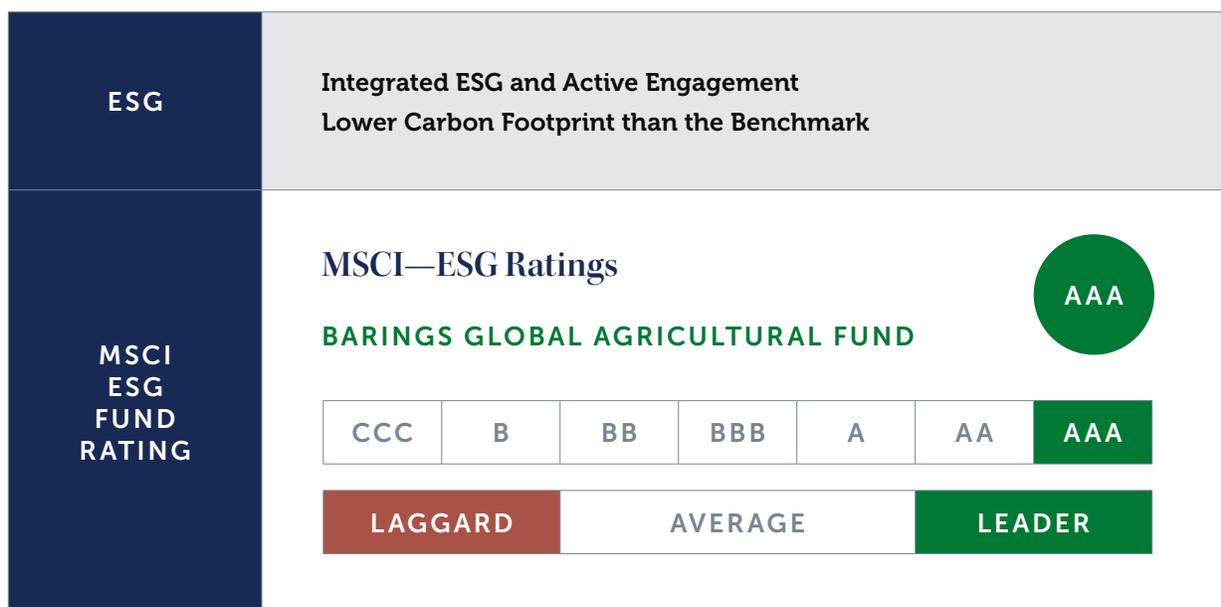
In the circular economy/bio-products theme, companies such as Neste provide a biologically-based alternative to fossil fuel-based products such as renewable biodiesel. Finally, wood is a green building material that can be produced on an endlessly renewable cycle. Wood-based companies that responsibly source their timber and maintain their resources, such as Weyerhaeuser, are providing a sustainable alternative to some less environmentally friendly materials such as steel and concrete.

## Our Approach to Investing in the Agriculture Industry

At Barings, we believe both the risk and opportunities highlight why investing in agriculture is so necessary. Focusing on our approach, we refrain from speculating on food prices (which can stoke food inflation). Instead, we concentrate on the components within the infrastructure that support the industry do more with less, increasing productivity to support a growing global population by increasing yields and sustainability in the process, and doing so with a lower carbon footprint than the universe’s average.

This focus on companies with strong sustainability and ESG credentials has helped the Global Agriculture strategy achieve strong external validation of its approach, rating highly against MSCI’s ESG ratings universe.

Figure 7: Barings Global Agriculture Fund



Source: MSCI. As of May 2022.

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