

# Introduction to alternative proteins

This resource provides an at-a-glance introduction to “alternative proteins.” This term describes foods produced to provide the sensory experience of animal meat, dairy, and eggs using plants, fermentation, or cellular agriculture (Center for Strategic & International Studies 2023).<sup>A,1</sup>

## Theory of change: change the product, not human nature

The theory of change for alternative proteins analogizes to renewable energy and electric vehicles: Just as we need to change how energy is produced and vehicles are powered, we need to change how meat is made.

While campaigns focused on energy efficiency, improved public transportation, and reduced meat consumption are valuable, we are unlikely to convince a majority of consumers almost anywhere (let alone globally) to consume less energy, drive less, or eat less meat.

We need to meet consumers where they are— with price-competitive renewable energy, electric vehicles that satisfy consumer needs, and plant-based and cultivated meat that tastes as good as conventional meat and costs the same or less.

## Climate mitigation

Animal agriculture causes between 15 and 20 percent of direct climate emissions.<sup>2,3</sup> It misses out on 26 Gt of sequestration potential through vast land needs for grazing and feed crops,<sup>4</sup> and causes the plurality of methane emissions from ruminant digestion alone, which is roughly the same as oil and gas emissions combined.<sup>5</sup>

Animal agriculture is predicted to rise through 2050; the most conservative predictions suggest a 60 percent rise through 2050.<sup>6</sup> If this happens, it will be impossible to meet Paris Climate Agreement targets.<sup>7</sup>

According to McKinsey economists, the mitigation potential of alternative proteins is 5 Gt/CO<sub>2</sub>e per year by 2050, at roughly fifty percent adoption. The economic value of this climate savings is ~\$5.5T.<sup>6</sup>

This calculation does not consider the potential to use freed-up land for carbon sequestration or the production of renewable energy. The sequestration potential of shifting away from industrial animal agriculture is ~26 Gt/year.<sup>4</sup>

According to Boston Consulting Group (BCG), at 11 percent penetration, alt proteins would have roughly the climate mitigation impact of totally decarbonizing air travel<sup>8</sup>— and this also doesn't include the sequestration potential of land freed up by decreased grazing and feed crop production.

Another study from Nature Communications (2023) finds that 50 percent plant-based meat penetration would eliminate 3.1 Gt/year CO<sub>2</sub>e by 2050 in direct emissions and have the potential to sequester another 3.4 Gt. The study states, “Agriculture and land use emissions reduction in 2050 in the 90 percent scenario are 11.9 Gt CO<sub>2</sub>e reduction.”<sup>9</sup>

<sup>A</sup> “Alternative proteins” do not include animal feed or insect-based proteins. The former is not for human food at all, and the latter involves convincing consumers to eat insects; it does not involve turning insects into something indistinguishable from conventional animal meat, so it is different from “alternative proteins,” as used by CSIS, Climate Advisers, GFI, et al..

## Nature preservation

Animal agriculture requires eighty percent of agricultural land,<sup>10</sup> requires more than 1.25 billion metric tonnes of feed crops for farm animals,<sup>11</sup> and requires 77 percent of the global soy crop, mostly to feed chickens, pigs, and farmed fish.<sup>12</sup>

All of these numbers are rising year after year– and will continue to rise unless alternative proteins are successful.

According to the World Resources Institute, 9 calories of feed are required to produce 1 calorie of chicken meat and 40 calories of feed are required to produce 1 calorie of beef.<sup>13</sup>

Plant-based chicken requires roughly one-sixth the land of animal-based chicken, and plant-based beef requires roughly one-twentieth of the land of animal-based beef.<sup>14</sup> Cultivated chicken requires roughly one-fourth the land of conventional chicken, and cultivated beef one-twentieth the land.<sup>15</sup>

## Co-benefits: decreased AMR & pandemic risk

Two co-benefits of a shift from conventional meat production to alternative proteins are decreased risk of antimicrobial resistance (AMR) and decreased pandemic risk. These are both global scourges in their own right.

Approximately 70-80 percent of medically important antibiotics are fed to farm animals, which increases AMR risk.<sup>16,17</sup> Resistant bacteria kill more than 1.3 million people annually and are on track to kill 10 million people per year by 2050.<sup>18</sup> Alt proteins do not require antibiotics.

According to a report from ILRI, CGIAR, & UNEP, two of the seven most likely causes of the next pandemic are increasing demand for animal protein and industrial animal farming.<sup>19</sup>

More animals means more potential disease vectors, and industrial animal farming involves vast numbers of genetically similar animals crammed into unsanitary conditions that suppress their immune systems. Alt proteins totally eliminate these two risk factors and mitigate four of the other seven.

## The global majority (smallholders, pastoralists, subsistence fishers)

The global populations that benefit the most from a transition to alternative proteins are those in the Global Majority for whom land pressures from animal agriculture are forcing them off their land (e.g., smallholder farmers, pastoralists), subsistence fishers who are seeing their catches vanish, and everyone for whom climate change, biodiversity loss, superbugs from antibiotic resistance, and another pandemic represent a true and existential risk. By alleviating land pressure, alternative proteins will be good for regenerative ranching, smallholder farmers, pastoralists, and subsistence fishing communities.

## Theory of change: The renewable energy + EV analogy

The only two options that appear to have a reasonable chance of decreasing animal agriculture are population-level diet change (the world eating less animal protein) and the success of alternative proteins; attempting to convince consumers in developed countries to eat less animal protein has not decreased even per capita consumption.<sup>20</sup> But if we can create the precise meat experience from plant-based or cultivated meat at a lower price, we can slash the external costs (food insecurity, climate change, land and water use, and more) of animal agriculture without requiring consumer sacrifice.

Of course, alt proteins are not a silver bullet for everything that's wrong with food production globally. No single solution will address all of the problems that stem from our current food system.

This is precisely why we need an “all of the above” approach. Alt proteins are a critical part of the solution, and as noted above, they are the only solution that is likely to cause industrial meat consumption to decline. They are one critical arrow in our quiver of food systems solutions.

## Jobs and economic value of government investment

Alternative proteins represent 98 percent of economic value (\$700 billion) generated by food system methane innovation according to ClimateWorks Foundation and the Global Methane Hub.<sup>21</sup>

They can also create 83 million jobs globally by 2050 - this is two-thirds of jobs created across all agricultural methane interventions.<sup>21</sup> These economic returns should make them especially appealing to the “finance ministers and policymakers who make budget decisions” - a key concern identified by the Kremer Commission.<sup>22</sup>

## Why government support is critical (i.e., why can't markets solve this?)

Just as the clean energy transition requires and deserves government support, so too does the alternative protein transition.

## About GFI

The Good Food Institute is a 501(c)(3) nonprofit working internationally to make alternative proteins like plant-based and cultivated meat delicious, affordable, and accessible. GFI advances open-access research, mobilizes resources and talent, and empowers partners across the food system to create a sustainable, secure, and just protein supply. GFI is funded entirely by private philanthropic support.

There are both scientific and scaling challenges involved in creating a similar or improved animal meat experience from plant-based or cultivated meat, and requiring that every single company solve all of these challenges independently is a prescription for delay and, in many cases, failure.

According to the modeling by McKinsey for ClimateWorks Foundation and the UK's Foreign, Commonwealth & Development Office, governments will need to invest \$4.4 billion/year in research and development and \$5.7 billion/year in private sector incentives in order to reach 50 percent market penetration by 2050, with the benefits in terms of climate mitigation and economic development described above.<sup>6</sup>

Cultivated meat has received less than \$3 billion in global investment in all of time (98 percent of which have been equity investments across more than 100 companies), even as the US Department of Energy (DOE) recently guaranteed a loan to Ford Motor Co. of \$9.2 billion to build just three EV battery plants.<sup>23</sup>

To date, plant-based & cultivated meat combined have received less than \$11 billion in public and private investment (all in the past 10 years),<sup>24</sup> even as clean energy received \$1.4 trillion in investment in 2022 alone).<sup>25</sup>

With government support, we can meet consumers where they are, providing them with price-competitive, environmentally-friendly alternatives that taste as good as conventional meat and cost the same or less.

## Endnotes

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