



## Is Investing in Plant-Based Meat the Most Efficient Way to Address Biodiversity Loss?

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### Abstract

Biodiversity is in alarming decline and it is urgent to identify the main causes of this disaster for the planet, but also for the economy and all the activities based on its ecosystem services.

In this paper we identify habitat loss as the main cause of biodiversity loss, being among others responsible for 80% of global forest degradation. We establish the correlation between the loss of biodiversity habitat and the most space-consuming human activity, animal agriculture. The livestock industry alone requires 33% of all land on the planet for both livestock production and its feed. The expansion of animal agriculture in response to global over-consumption is responsible for 70% of the degradation and destruction of the world's forests, and is therefore the main factor in the loss of associated biodiversity. At a time when it is urgent to reconsider our model of meat consumption with regard to biodiversity conservation, we present ways to address the excessive consumption of meat, the main threat to biodiversity, by exploring the opportunities presented by the consumption of alternative meats.

Alternative meats represent by far the most effective and sustainable way to invest in biodiversity conservation by addressing the problem of biodiversity loss at its source. Developing alternative meats would enable the re-conversion of livestock industry' land to biodiversity habitat, reduce to almost null greenhouse gas emissions from the sector, and be significantly cheaper than investing \$722 billion per year in biodiversity conservation. It is becoming essential for public and private actors to see the investment and development opportunities in this area, taking into account the positive impact both economically and ecologically.

**Keywords:** Biodiversity; Agriculture; Plant-based meat; Biodiversity finance; Sustainable investment

### Introduction

Biodiversity refers to the forms of life on earth and is therefore important for the survival of all species, each species being adapted to

a set of environmental conditions requiring its own particular and different habitat. The modification of its environment can lead to behavioral changes, migration, and in the worst case, extinction of the species. The latest figures for biodiversity are alarming: Out of 8 million animal and plant species on earth, 1 million are threatened with extinction. The UN report on the biodiversity of the world's forests points out that since 1990, nearly 420 million hectares of forests have been lost due to human activity, destroying ecosystems that are estimated to be home to 92.2% of the world's population of living species, animals and plants. Nature is irrevocably, declining globally at unprecedented rates in human history. The conservation of the world's biodiversity depends on the way we interact with it and the use we make of it [1].

The loss of biodiversity has significant consequences for the ecosystems that constitute it, as well as climate change, pollution and other threats to the environment. While the causes and consequences of climate change and pollution have often been analyzed through the prism of human action, the loss of biodiversity is also dependent on it and has a major influence, the extent of which is still little known. Pollution, and particularly air pollution such as nitrogen deposition, but also plastic pollution, are becoming an increasing cause of biodiversity loss and ecosystem dysfunction. Climate change and the loss of biodiversity are intrinsically linked: global warming has effects linked to changes in species migration, causing chain reactions. On the other hand, the loss of forest biological diversity, that act as a sink for 365 billions tons of carbons worldwide and help mitigate the effect of climate change, have tremendous effect on global warming [2].

The effects of biodiversity loss are also critical for humans who are dependent on it. Changes in ecosystem services impact human health, affecting livelihoods, incomes, local migration and, on occasion, can even lead to political conflict, according to the WHO. Furthermore, it is estimated that biodiversity provides services for a value of 44 trillions of dollars in 2020, its loss therefor present a great threat to all activities dependent of its ecosystems, based on resources and services available for free [3].

While the urgency of the situation has been grasped by world governments, international institutions and market actors, and many studies on the risks of biodiversity' decline on political, economic and social activities have been developed, there is nevertheless little concrete action taken for a necessary change in the protection of biodiversity. In fact, the Paulson Institute estimates in 2020, that the gap in finance for biodiversity hovers between 598 billion dollars and 824 billion dollars. Biodiversity finance represents only 0.1% of the global GDP, a 124-143 billion dollars per year, with principally public funding. There is therefore an urgent need to revisit the financial instruments for protecting biodiversity and to integrate the risks and the need to protect the world's ecosystems into the decisions affecting it [4].

To inform how we should most efficiently react to the biodiversity crisis two questions need to be answered: What is the main human activity responsible for biodiversity loss? And what is the best way to address the cost of this activity? [5]

Many reports identify the main causes of biodiversity loss due to "human activities" without naming a specific cause. Indeed, according to the FAO 2005, it would be difficult to isolate precisely one main cause; however, it becomes necessary to take this step and to establish the correlations between the evidence presented to us. In fact, it is

indispensable to identify the single main or several key causes in order to adopt effective measures that will allow us to remedy the catastrophic situation of biodiversity loss [6].

## Literature Review

### Animal agriculture as the main source of biodiversity loss

#### In what kind of habitat is biodiversity lost?

The loss of biodiversity goes hand in hand with the death of the ecosystems that constitutes it. Either the ecosystems are destroyed directly by human intervention, or the key species that make up the ecosystem die with the destruction of the ecosystem. The loss of biodiversity may be natural, but we now see that human activity has played a major direct or indirect role, particularly in recent decades, with pronounced and long-lasting effects. Indeed, according to the MEA Report, the most important direct drivers of biodiversity loss and ecosystem service changes are habitat change; climate change; invasive alien species; overexploitation; and pollution. Ecologists agree that habitat loss is the main driver of biodiversity loss. The average abundance of native species in most major land-based habitats has fallen by at least 20%, mostly since 1900. More than 40% of amphibian species, almost 33% of reef-forming corals and more than a third of all marine mammals are threatened. The loss of biodiversity occurs in all inhabited or habitable areas of the planet, but particularly in areas that can be exploited by man, due to destruction, fragmentation or degradation. According to the IPBES report, it is considered that 75% of the land surface has been altered, 66% of the oceans are affected, and 85% of wetlands have been lost due to human activities. In addition, between 2010 and 2015, 32 million hectares of primary or recovering forests, biodiversity hotspots, would have been lost. The main cause of habitat loss would therefore be due to human activity [7].

Habitat degradation as accelerated since 1970, with direct exploitation, in particular overexploitation, of animals, plants and other organisms, mainly *via* harvesting, logging, hunting and fishing, that has had important negative impact for terrestrial, freshwater and saltwater ecosystems. Freshwater, such as rivers, lakes, wetlands, and seas and oceans are most impacted by pollution as well, with untreated sewage, mining waste, acid rain, fertilizers and pesticides that altered ecosystems equilibrium and eventually end up in the food web. Climate change, a direct consequence of human activities, is also becoming an emerging driver of habitat loss. In fact, alteration of temperatures provokes not only the deterioration of living conditions but also the destruction of habitat, engendering migration or even extinction of species. Fragmentation, that causes disruption in wildlife territory and migratory routes, occurs mainly on terrestrial wildlife because of roads and cities development [8]. Dams and other water diversions that siphon off and disconnect waters, are changing hydrology and water chemistry, fragmenting aquatic species' habitats [9].

Overall, it is land surfaces such as forests, that cover 31% of the global land area, that are most affected by the destruction of natural habitats, as 80% of the world's forests have been destroyed, especially because of land conversion, such as cities expansion, but also agriculture, cropland, invasive species or disruption of ecosystem processes. It is a total of 420 million hectares of habitat loss in term of deforestation that has been accounted for since 1990. Habitat destruction also comes in the form of drained wetlands, quarried

limestone hills, dredged rivers, mowed fields and razed coral reefs, with ever-growing numbers of plants and animals being chased out of their habitat. Habitat loss has terrible effects on global biodiversity, the loss of primary forests is particularly catastrophic, considering for example that 25 acres of rainforest in Borneo contains 700 different species of trees, the equivalent of the total tree diversity of North America. Human activity is therefore the main cause of biodiversity loss due to habitat degradation, fragmentation or destruction, but amongst all the activities that cause biodiversity loss, there is one specific industry that can be identified as the main responsible [10].

#### How much of biodiversity loss is from animal agriculture? Presumably more than from any single other source

The main human activity responsible for the loss of habitat and the consequent loss of global biodiversity is agriculture. Indeed, half of the world's habitable land (some 51 million square km) has been converted to agriculture, and about one-third of it is used as cropland, while the remaining two-thirds consist of meadows and pastures for grazing livestock. Additionally, the UN estimates that nearly 75% of freshwater resources are now devoted to crop or livestock production. According to experts, 70% of the world's deforestation is a result of stripping in order to grow animal feed, bearing consequential loss of biodiversity. In fact, for the Amazon forest only, 91% of the increment of the cleared area has been converted to cattle ranching since 1970. Kleemann and Schmidt argue that the constant reconversion of land to produce enough food in the world at the expense of biodiversity conservation would not be necessary in view of the current food needs of the world's population. Indeed, if we consider only crops directly produced for human consumption, less than half are produced for this purpose. On the other hand, if we consider the need to produce crops for animal consumption, they are growing in relation to the exponential demand for meat at the global level: there is the increasing need to grow feed crops to feed animals [11].

Meat constitutes the highest burden on the environment among all food products consumed, and it will take a growing toll as people clear more land for livestock and crops to feed these animals. Meat and dairy consumption accounts for more than half of the environmental impacts of all food products consumed in Europe. The average European consumes approximately 61 kg of protein-rich soy each year, largely indirectly through animal products like chicken, pork, salmon, cheese, milk and eggs. The biggest user of crop-based feed globally is poultry with 23 billion pieces produced each year, closely followed by the pig industry. If the global demand for animal products grows at the same rate it has, it's estimated that soy production would need to increase [12] by nearly 80% by 2050 in order to feed it. An area 1.5 times the size of the European Union would be saved from agricultural production if the amount of animal products eaten globally was reduced to only meet nutritional requirements [13].

Livestock now account for about 60% of the biomass of all mammals and outweighs wild mammals and birds by a factor of ten, while the earth's land surface that they now pre-empt was once habitat for wildlife. In all, livestock production accounts for 33% of the land surface of the planet according to the FAO 2015, which translate in consequential loss of biodiversity as the result of changes in land use. Thus the direct cause of habitat loss, which is the main cause of biodiversity loss, would be livestock production, both in terms of direct production and production of crops to feed them, making livestock production the single largest driver of biodiversity loss [14].

Both at the global and local levels, livestock therefore plays a primordial role in biodiversity crisis, as they contribute directly or indirectly to all the drivers of biodiversity loss: It accelerates environmental degradation through the many steps in the animal food product chain at which environmental impact occurs. It destroys or modifies ecosystems that are habitats for species, contributes majorly to climate change as animal agriculture is responsible for 18% of greenhouse gas emissions, with the known effect on ecosystems and species, and directly affects biodiversity with invasive alien species, potentially host and vectors of diseases. In fact, studies of the recent decades showed a positive correlation between the increasing number of cattle and the number of threatened species, and a positive correlation between the increasing number of cattle and the number of outbreaks of human diseases, demonstrating that the growing importance of livestock on the planet, while threatening biodiversity, increasingly puts [15] human and animal health at risk.

### **Addressing the problem of animal agriculture**

**Increasing efficiency of animal agriculture:** The health and environmental impacts of consuming animal products, the sustainability of farming systems and the status and welfare of the animal are questioned. While the global demand for animal products is growing very rapidly in several regions of the world, notably in China, it is necessary to redirect global meat consumption towards a demand for nutritional quality, animal husbandry practices that prioritize animal welfare and minimize the environmental footprint [16].

Sustainable agriculture refers to the management of agricultural practices taking into account the protection of ecosystems (and therefore the environment), the control of health risks, safety at work and animal welfare. Coupled with an improvement in feed efficiency, which can be achieved by selecting the most efficient animals, it would be possible to increase the sustainability of livestock farming: It should reduce the use of food resources and environmental impacts, by limiting the expansion of agricultural land responsible for habitat loss [17].

Animal agriculture not only contributes to a certain extent to poor population livelihood, but also to world food security as ruminants are key players in transforming resources that cannot be eaten by humans, such as grass, into edible resources for human consumption, such as milk or meat. In fact, biodiversity protection and animal protein consumption could potentially co-exist under strict conditions. Indeed, certain types of farming, conducted in an agro-ecological manner, also provide environmental services, by encouraging the completion of biogeochemical cycles, or by enabling the use of products from plant chains that cannot be directly consumed by humans by transforming them into products of good nutritional quality [18].

In addition to the improvement of animal agriculture efficiency, direct incentives can also be undertaken, such as the reduction or elimination of agricultural subsidies harmful to biodiversity or the integration of economic and environmental externalities into prices through selective taxation. Indirect incentives such as payments for ecosystem services can also be promoted, for example by remunerating livestock farmers/producers/owners for specific environmental services such as water regulation, soil conservation, conservation of natural landscapes and wildlife habitats, or carbon sequestration. Essential measures for the conservation of biodiversity must be adopted in the practice of animal husbandry, such as the promotion of sustainable agricultural and agro-ecological practices with good agricultural practices that preserve genetic diversity and

reduce pollution, in particular by making agricultural support conditional on the respect of ecological criteria; the strengthening of food security through the conservation of genetic resources of value for food, the strengthening of agro-environmental measures; the promotion of trade policies favorable to the respect of biological diversity [19].

### **Eating less meat**

Better efficiency in the use of resources would be the key to reduce livestock' long shadow, while ensuring economic and social development. Reducing meat consumption by all major consumer countries would be the most effective way of reducing the environmental footprint of livestock farming, particularly the conversion of land at the expense of biodiversity, while at the same time redirecting arable land towards human food, thereby reducing greenhouse gas emissions and saving more water resources. It is therefore important to strengthen each country's capacity to adopt best practices in resources management; adopt measures to promote conservation financing and corporate social responsibility; develop new legal and binding instruments; and implement and enforce global agreements for responsible livestock production and consumption [20-28].

In fact, one way to tackle the overproduction and consumption of livestock might be the implementation of a tax on meat. In November 2020, the UK government actually state an intention to levy such a measure if the food industry does not remedy to its impact by 2025. As it was the case for plastic bags before, a tax on meat would take the conception of the "Polluter Pays Principle" (PPP) which imposes a cost on those who do something contrary to the public interest as determined by government policy both producers and consumers, as polluters, would pay a higher, dissuasive price for [29] their meat. It would therefore be possible to internalize the negative externalities of meat production on both the climate and the biodiversity, and even leverage more funds for biodiversity conservation, as long as it does not impact negatively the people least able to afford it [30-35].

But as developing countries get richer, the demand for animal protein gradually increase: poor population everywhere are eating more animal products as their incomes rise above poverty level and as they become urbanized. Annual meat production is projected to increase to 376 million tons by 2030, and mainly in the direction of developing countries consumption. It appears difficult to counter-act the negative effect of biodiversity lost while answering the demand for animal meat, even with sustainable agriculture, taxes and meat-consumption awareness campaigns.

## **Discussion**

### **Replacing animal meat with plant-based meat**

The IPBEs report considers that biodiversity conservation, alongside societal goals including those related to food, water, energy, health and the achievement of human well-being for all, can be achieved in sustainable ways through the rapid and improved deployment of existing policy instruments and new initiatives that more effectively mobilize individual and collective action for transformative change [36].

The main transformative change that would have a direct impact on biodiversity conservation is the replacement of animal meat by plant based-meat. A few companies have moved to the next level in recent



years by using sophisticated technologies to mimic the taste, texture and even blood of meat. They use beets, chickpeas or coconut oil to make burgers, steaks, sausages, and other products [37].

Additionally, although lab-grown meat is still relatively undeveloped compared to plant-based meat, it is nevertheless important to mention this alternative, which is becoming increasingly important and also represents [38] a real opportunity. Lab-grown meat is still in its infancy, the prototypes produced are still too expensive to match the market, however, the more the demand for alternatives to [39] traditional meat will increase, the more profitable it will be to produce these lab-grown meats in large quantities and to achieve economies of scale that will lower their production price. This meat is produced directly from animal cells with little need to raise and no need [40] to slaughter actual animals. It is a technology that could significantly replace the way meat is produced now with a kinder and less environmentally damaging alternative [41]. This new method of production concerns all categories of meat such as chicken, beef, or even fish and is intended for both human and animal consumption [42]. If the advances are promising, it is worth noting that much progress still needs to be made in this sector, in terms of technology, costs, and above all transparency with regard to the production process [43].

Plant based meat for its part, is [44] one of the main alternative diets that is already on the market, is proven to offer substantial [45] health benefits and could, if widely adopted, significantly reduce global agricultural [46] greenhouse gas emissions, reduce land clearing and resultant species extinctions. As the following figure shows, compared to beef which is one of the least efficient foods to produce for the amount of calories it confers, plant-based food have the least impact on greenhouse gases emissions, land use and freshwater consumption [47-53] (Figure 1).

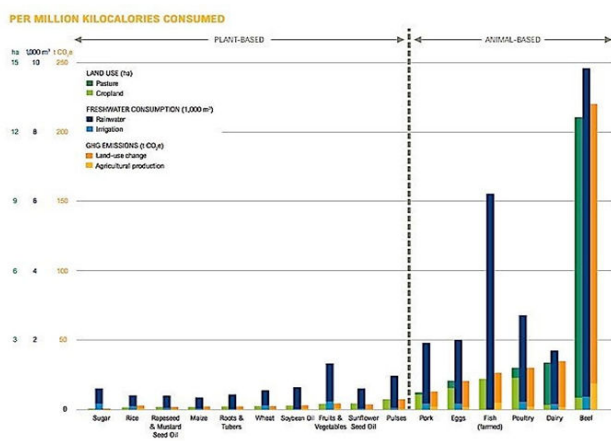


Figure 1: Production of animal-based foods is generally more impactful on the planet than plant-based food.

Indeed, much of already [54] cleared agricultural land could be used to grow plant-based foods for people instead of for animals [55]. More importantly, given that 80% of all agricultural land is dedicated to livestock and livestock feed production, a plant-based regime could be used to reforest most of this land and create new natural habitats to recover biodiversity previously lost in the same place. If reforestation is a necessary initiative to effectively contribute to the fight against global warming, as far as biodiversity is concerned, it would even be enough to let nature do its work once agricultural activity has been abandoned on these lands. It would take only a few decades for a spontaneous forest to establish itself. In 70 years, European forest

cover has increased by 300,000 km<sup>2</sup> of which a large part is spontaneous forest, much of it as a result of the abandonment of agricultural areas. It is estimated that an area equivalent to the land-mass of Australia might be saved by [56] 2030, if we change our meat based regime toward alternative meat consumption. On a more granular estimation of the number of meals replaced, including a faster adoption of alternative proteins in Asia than expected, the estimated land savings would be up to 4 million km<sup>2</sup>.

Reducing animal product [57] consumption worldwide could also greatly reduce the amount of water used, and alleviate the ever-increasing water crisis that various countries face. Similarly, adopting a [58] low-meat, Mediterranean-type diet could reduce carbon emissions by a third, pescetarianism could lead to 50% reduction and no-animal source food to almost null emissions in the future [59] (Figure 2).

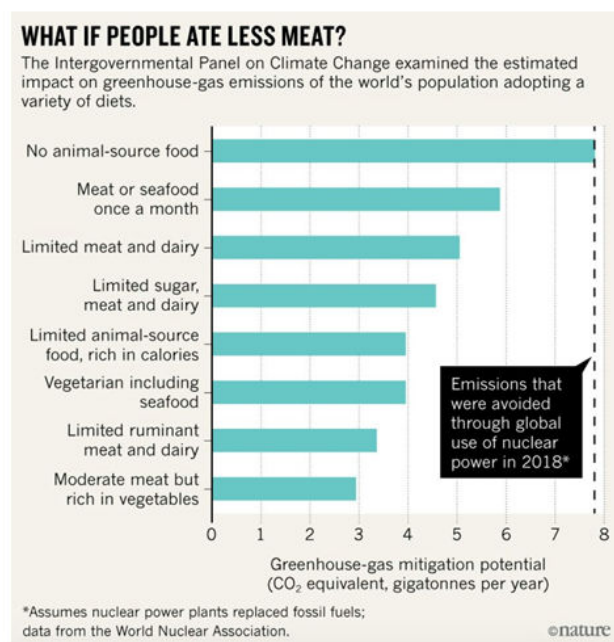


Figure 2: What if people eat less meat.

The adoption of plant-based meat would therefore be the best way of fighting biodiversity loss and its consequences, while significantly reducing mortality related to chronic diseases (cardiovascular disease, diabetes and cancer, etc.)

Indeed, diets rich in beef and other red meat can be equally bad for a person’s health [60], as for Earth’s biodiversity. Today’s high-fat, animal-based diet has led to an increase in chronic nutritional diseases such as obesity, diabetes, cardiovascular disease and cancer. To prevent cancer and cardiovascular disease, it is recommended to limit the consumption of saturated fats to less than 10% of total calories consumed daily and even to less than 5%-6% for people with high cholesterol, however, and especially now in emergent countries, meat-consumption habits long exceed the health recommendations. Urgent measures to remedy our consumption habits are therefore needed, and plant based meat could be the answer to help prevent diet-related chronic non-communicable diseases [61].

In fact, eating habits can change over the course of a lifetime. Face with all the advantages for human health, biodiversity conservation

and price, a great numbers of people would actually consider trying plant-based meat, as polls shows. A survey shows that 35% of the participants have already tasted the plant-based meat and almost all of them would be willing to try it again, while 42% who have not tasted it would be willing to do so. Recommendations should, but do not need to separate health effects from personal preferences. Data shows that plant-based alternatives are more popular among meat eaters seeking to replace their preferred foods with plant-based alternatives [62].

The main challenge concerning taste is indeed solved by numerous start-ups, such as "Impossible burger" which has partnered with "Burger King" which has found a way to use vegetable heme by fermenting genetically modified yeast and using it to make meat-like patties. This process generates 87% less greenhouse gases and 75% less water than cow burgers [63].

As it is inherently more efficient to make meat directly from plants rather than cycle feed crops through animals, and as Covid-19 upends the traditional meat supply chain, startups focusing on plant-based protein have continued securing millions in funding amid the pandemic. Demand for vegan meat soared this year, with sales up by 264% in the 9 weeks up until May 2020. Plant-based industry is seeing unprecedented growth, and JP Morgan's analysts' projections foresee that the market for plant-based meats will reach the \$100 billion mark within the next fifteen years [64].

The technology is maturing as plant-based meat businesses proliferate in the U.S. Europe, and Asia. As it represents an economic opportunity on top of the environmental benefit, plant-based meat businesses like Beyond Meat reached net revenues of \$406.8 million in 2020. An increase of 36.6% year over year even amidst the crisis. In developing countries, the trend is also confirmed, since [65-75] in Beijing, the start-up Zhenmeat has collected in its first year of existence, about \$723,1800 by producing a vegetable alternative to minced meat from pea protein for meatballs and dumplings. However, they face the stigma of plant-based diets in Asia, where meat consumption is considered a sign of wealth [76-83]. The only way to significantly reduce global meat consumption in the face of these behavioral barriers would therefore be to create new experiences, novelty and emotion around plant-based alternatives, as well as technological and culinary innovation [84-91].

If plant-based meats represent a real alternative to meat consumption, not only in terms of taste, price but above all in terms of environmental impact, awareness of its consumption is nevertheless very timid [92-100]. In fact, in the latest reports on the lack of funding for biodiversity conservation, none of them mention this solution, even though it is the most effective way to address the main cause of biodiversity loss. The recently published Dasgupta review recognized that more than half of the current agricultural land could be saved from animal agriculture by shifting diets but does not count alternative meat as a necessary measure for biodiversity conservation. Similarly, the Paulson Institute estimates that we need \$722 billion financings per year for biodiversity conservation without mentioning the potential of plant-based meat. The report from the think-tank Chatham House points out animal agriculture as the leading cause of biodiversity loss, recommending a shift toward plant-based food, only briefly mentioning alternative meat's need for development. A research team from the University of Oxford recently recognized that a change in diet is the single most significant way to reduce one's impact on the planet without expressly mentioning alternative meat (Figure 3) [101-106].

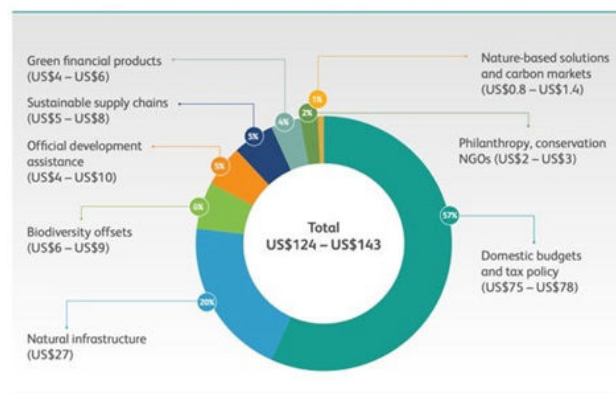


Figure 3: Global biodiversity financing in 2019, summary of financial flows into biodiversity conservation

Similarly, with regard to the need for funding for biodiversity conservation, alternatives to meat consumption have not received much attention in recent studies, even though it would be objectively cheaper than 722 billion dollars per year to directly address the problem of biodiversity conservation at its source by developing alternatives to meat consumption, the main cause of biodiversity loss (Figure 4).



Figure 4: Global biodiversity conservation funding needs (in US\$ billions per year).

It is not a question of investing in an expensive sector whose evolution and repercussions cannot yet be really evaluated, such as the geo-engineering sector in terms of climate. It is a question of investing in a viable and sustainable solution that directly addresses the primary cause of habitat loss and thus combats the loss of biodiversity.

Indeed, if a commercially successful plant-based meat is developed, not only would it be cheaper than investing in solutions to adapt or mitigate the action of animal agriculture, but it would also render obsolete the financing needs in most biodiversity conservation sectors, while developing a new market with flourishing economic opportunities. This makes the development of plant-based meat by far the most efficient way to use the funds for biodiversity conservation.

At the same time, it is necessary to shed light on the responsibility of current government funding in the mixed development of alternative meats. Indeed, the reason why the price of plant-based meats is higher than that of meat is partly due to government subsidies and financial bailouts that prop up industrial animal agriculture and cheap meat. These funds are used to lower prices, distort market

demand, and encourage excessive production. The U.S. government spends up to \$38 billion each year to subsidize the meat and dairy industries, with less than 1% of it directed to the fruit and vegetable industry. A redirection of public funding to plant-based meats would help equalize prices and increase demand for this biodiversity friendly solution.

## Conclusion

Habitat loss is the first cause of biodiversity loss, especially in the 80% of degraded or destroyed world forest. Animal agricultural expansion is the main driver of deforestation and forest degradation and the associated loss of forest biodiversity, as it accounts for 70% of the world deforestation. The livestock sector has such deep and widespread environmental impacts that it should be a major international concern. As livestock production accounts for 33% of the land surface of the planet, it is necessary to reconsider the actual model where the demand for food is resulting in large-scale conversion of land to agricultural production and the loss of related biodiversity.

Feeding humankind and improving the conservation and sustainable use of nature are complementary and closely interdependent goals that can be achieved through sustainable agriculture and livestock systems, the safeguarding of species and their habitats, and ecological restoration. It is fundamental that environmental considerations, as well as human health issues, become a priority for international policy considerations. Alternatives like plant-based meat represent a real opportunity to combat the loss of biodiversity at a lower cost while preserving the quality of life and health of the population currently consuming meat. But while sales of plant-based products replacing conventional meat have evolved, they still represent only a small share of the total meat market, as investment in the sector are still miniscule. In 2018, \$673 million was invested in companies that use plants to develop the equivalent of meat, egg or milk-based foods in the United States, compared with \$96.6 billion in the agricultural technology sector; if the same amount was redirected toward the development of alternative meat, there would not even need for the \$722 billion financing per year for biodiversity conservation. It is therefore essential for companies to see the investment and development opportunities in this area, taking into account the positive impact both economically and ecologically, and to consider that their interests in biodiversity conservation are not antithetical to their economic profit. Finally there is an urgent need to put in place appropriate institutional and policy frameworks at local, national and international levels, so that the suggested changes for biodiversity conservation can take place not only on the market but also at the level of animal husbandry industry.

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