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# Creating a Sustainable Food Source for the Future Health of People and the Planet

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The COVID-19 crisis has shined a light on the myriad of global and interconnected challenges humanity faces today and tomorrow. One of the most critical is access to nutritious, sustainable food. Although projections for global population growth have long pointed to future food supply issues, the pandemic has created a new urgency around these issues. According to an estimate made by the U.N. World Food Programme (WFP), at least 265 million people are at risk of going hungry in 2020, almost twice as many as in 2019. The pandemic has added fuel to an already growing hunger crisis, and it has become explicitly clear that our food system must evolve to meet global challenges in a way that serves the greater health of both people and the planet.

Thankfully, innovations in food production, especially protein, are aiming to address these challenges. Protein is an essential part of any diet, but the way in which we produce and consume protein has significant impacts on both the environment and human health that are truly unsustainable<sup>2</sup>. While the shift toward plant-based diets has accelerated as consumers become more aware of the environmental impact of animal protein and the associated agricultural processes, animal protein continues to dominate human diets for a variety of reasons. One such reason is the lack of a truly scalable alternative protein source to meet global demand. However, a sustainable nutrition narrative is beginning to emerge for plant-based protein, driven by the emergence of technologies that can address supply shortages and meet scalability needs to make a meaningful impact on overall protein supply.



This white paper explores how innovation in plant-based protein production holds the potential to create long-term solutions to sustainably feed future generations in the face of resource shortages, biodiversity loss, and climate change.

## **The Power of Innovation**

While many innovations have emerged in the analogue protein space, the world still relies on just three crops - rice, wheat and maize - for more than 50 percent of its plant-derived calories.<sup>3</sup> This contributes to a dramatic loss of biodiversity - over 60 percent in the last 40 years - and increases vulnerability to diseases and pests while creating a greater reliance on chemical inputs.<sup>4</sup>

These plant-derived proteins are taken from an already in-use food supply chain that is unable to support the growing global population. To combat these challenges, innovators in the space are looking for renewable, readily available resources that have not historically been a part of the food supply chain. Wood represents one of the most promising sources of renewable, sustainable foods and materials for future generations, especially in light of expanding forest lands, sustainable forest management practices, and the forest products' industry's integrated supply chains.<sup>5</sup>

Wood waste and residues are an undervalued resource which can be upcycled to produce a sustainable, natural, and nutritional protein ingredient. Arbiom's technology enables wood to be transformed into a protein-rich ingredient, SylPro®.

SylPro is a single-cell protein composed of dried inactive yeast microorganisms, which are grown using wood substrates to feed the yeast via a fermentation stage of the production process. The protein ingredient is produced using wood-derived media in fermentation and final downstream processing to achieve appropriate properties as a viable alternative to plant and animal protein sources used today. Not only is Arbiom's technology differentiated with wood as the feedstock, but its microorganism (a strain of *Torula* yeast) is already approved for use in feed and food applications. Other sources of new proteins in development, such as insects, bacteria, fungi, and algae, are still in the process of seeking regulatory review and approvals.

Arbiom's SylPro® has also demonstrated positive impacts on gut health, which has been an ongoing interest for animal and human nutrition, as microbes in the digestive tract play a key role in the health and growth of animals. For this reason, it is important to know how feed ingredients and additives compare in their protein content, digestibility, and amino acid profiles. In numerous animal trials – hybrid-striped bass, salmon, tilapia weanling pigs and more – SylPro® exhibited a high digestibility of about 90-95 percent. These trials also demonstrated that the protein ingredient has an equivalent nutritional performance to other conventional protein sources up to a 20 percent inclusion rate in feeds.

Alongside the animal trials, Arbiom has also conducted proof-of-concept studies to evaluate SylPro's environmental impact and its use in human food formulations compared to plant-based proteins.

Recently, Arbiom partnered with a leading extrusion company on a proof-of-concept study to evaluate SylPro for use in human food applications and existing meat alternative products. In the study, SylPro was used in meat analog product prototypes in place of conventional plant-based protein ingredients. Results showed SylPro successfully replaced critical ingredients including soy, pea, and wheat gluten without compromising taste or product quality. This demonstrates the potential for SylPro to replace ingredients that play a functional role in the final product, such as binding, but may have restrictions due to allergen concerns in the case of wheat or soy, or sourcing concerns in the case of egg.

### **Traceability and Sustainability**

An important aspect in food and feed is the traceability of ingredients, because now more than ever, people want to know where their food is coming from to ensure the safety and sustainability of the ingredients used. Current food production methods are 'linear' in nature, meaning they extract finite resources, which is wasteful and harms natural systems. The agrifood industry is responsible for almost a quarter of greenhouse gas emissions globally, and degrades the natural resources on which it depends while polluting the air, water, and soil. Furthermore, livestock production contributes<sup>6</sup> to 14.5 percent of GHG emissions globally, and animal feed production and processing accounts for 45 percent.

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By providing a sustainable, upcycled protein source, Arbiom addresses the issues presented by the livestock and animal feed industries. Preliminary data from a Life Cycle Analysis (LCA) show that when compared to other protein sources, such as fish meal and soy protein concentrate, SylPro® has the lowest impact on climate change.

The LCA study was conducted by NORSUS (formerly Ostfoldforskning), a Norwegian consultancy with experience evaluating the environmental performance of materials, fuels and feeds. The methodology used for the study calculations was designed to focus on six particularly relevant environmental impact categories as identified in The Product Environmental Footprint Category rules (PEFCR) for “Feed for food-producing animals” (FEFAC, 2018). The study accounted for all unit operations in Arbiom’s production process including wood sourcing from forests to a representative Arbiom commercial unit and all energy and material used in each production step. The last step accounted for transportation to end use in aquafeed. Among various environmental impact indicators, climate change was scrutinized according to IPCC2013 100 yr v.1.03 (Reference IPCC 2013). This data further supports the viability of SylPro as a sustainable solution to the looming global protein gap.

### Pointing the Way Forward

If the COVID-19 pandemic has made anything clear, it’s that we must begin preparing today for the challenges tomorrow may hold. Meeting future protein supply safely and sustainably is urgent, especially as the impacts of climate change become more predictable by the day and require innovative approaches to drive sustainable answers. By looking to wood as a resource to help solve both of these issues, Arbiom is laying a foundation for a solution that could well yield benefits for generations to come.

To learn more, visit [www.arbiom.com](http://www.arbiom.com).

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## About Arbiom

Arbiom is committed to meeting the sharp increase in global food and resource requirements with technology that transforms the most sustainable and readily available carbon source in the world – wood – into intermediate materials for a range of applications in the feed, food, and chemicals industries. Arbiom’s technology platform integrates the company’s proprietary biomass processing and fermentation expertise to convert wood into a nutritional, sustainable protein source. Arbiom is partnering with biomass stakeholders and leading firms in aquaculture, biotechnology and bio-based industries to continue developing and scaling up its technology. Headquartered in Durham, North Carolina, Arbiom also has an office in Paris, France.