Coupling waste feedstocks to microbial protein for a circular food system

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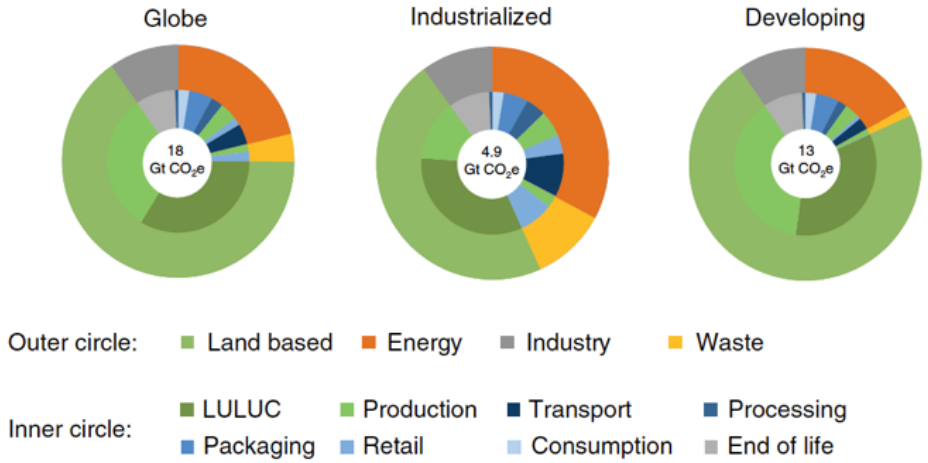
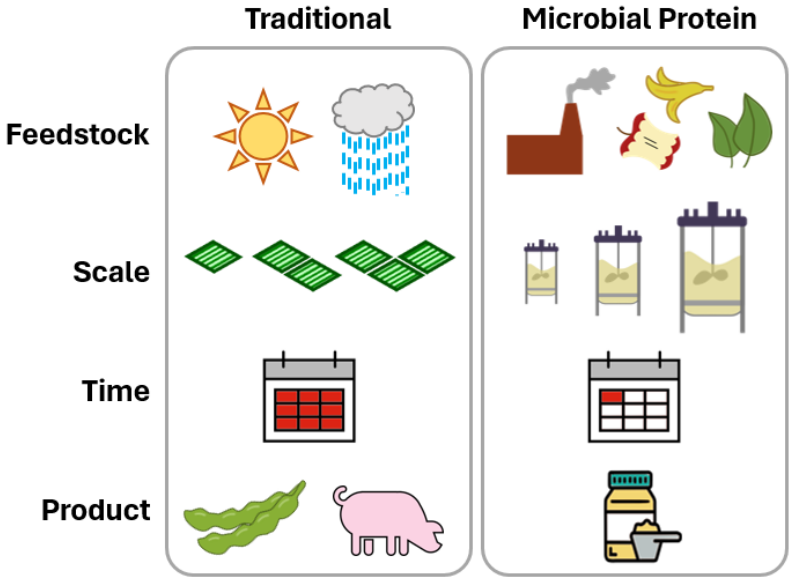
MRS Fall 2023

November 29th, 2023

Microbial protein: an efficient alternative to conventional agriculture



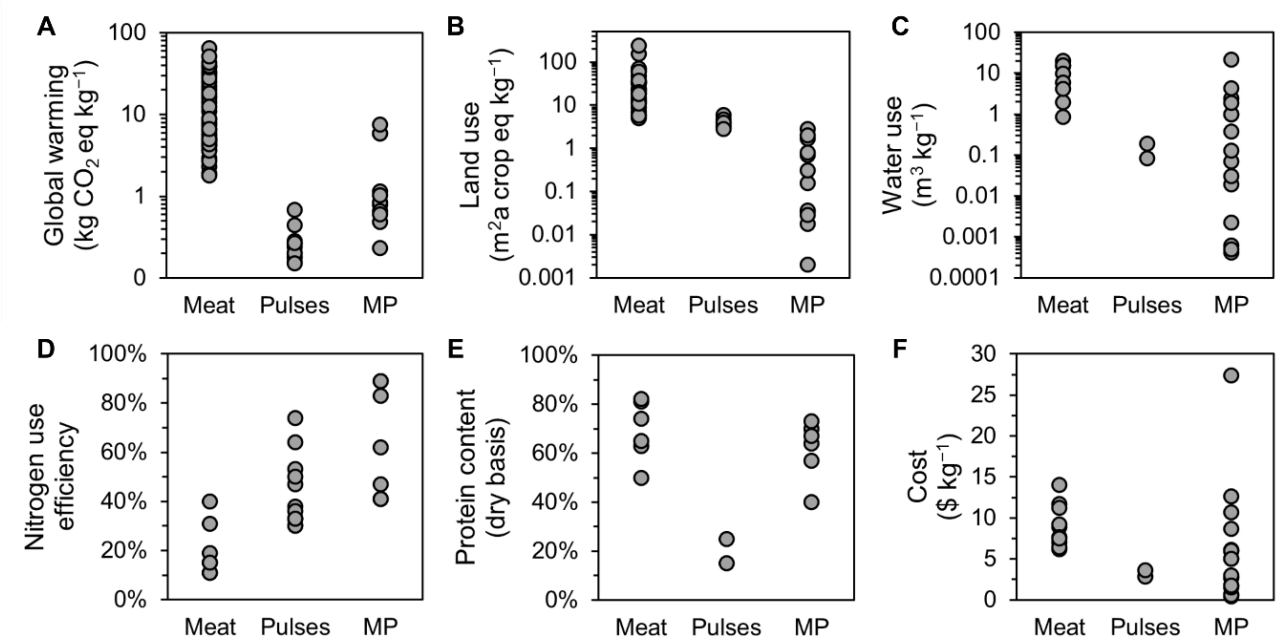


- The global food system accounts for ~33% of annual greenhouse gas (GHG) emissions.
- >70% of these emissions stem from land use and land use change (LULUC).
- Food production processes are far less efficient than other industrial sectors, e.g., industrial chemicals.

Crippa *et al.*, *Nature Food* (2021); Uekert , Bleem *et al.*, submitted

Waste-derived microbial protein: a sustainable alternative to conventional agriculture

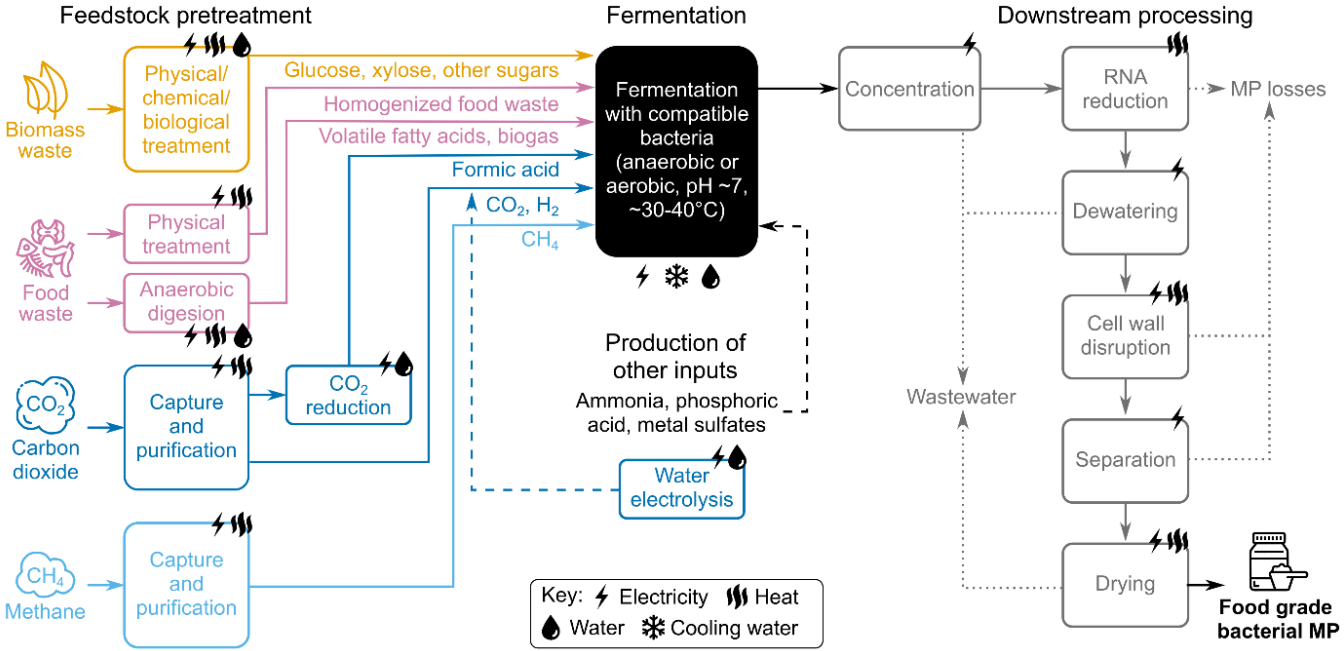
- Cultivation of microbial protein (MP) may offer a more efficient, environmentally compatible, and reliable solution than conventional agriculture.
- Commercial MP processes today mostly rely on glucose and ammonia, limiting their potential.



Individual data points were sourced from the literature.

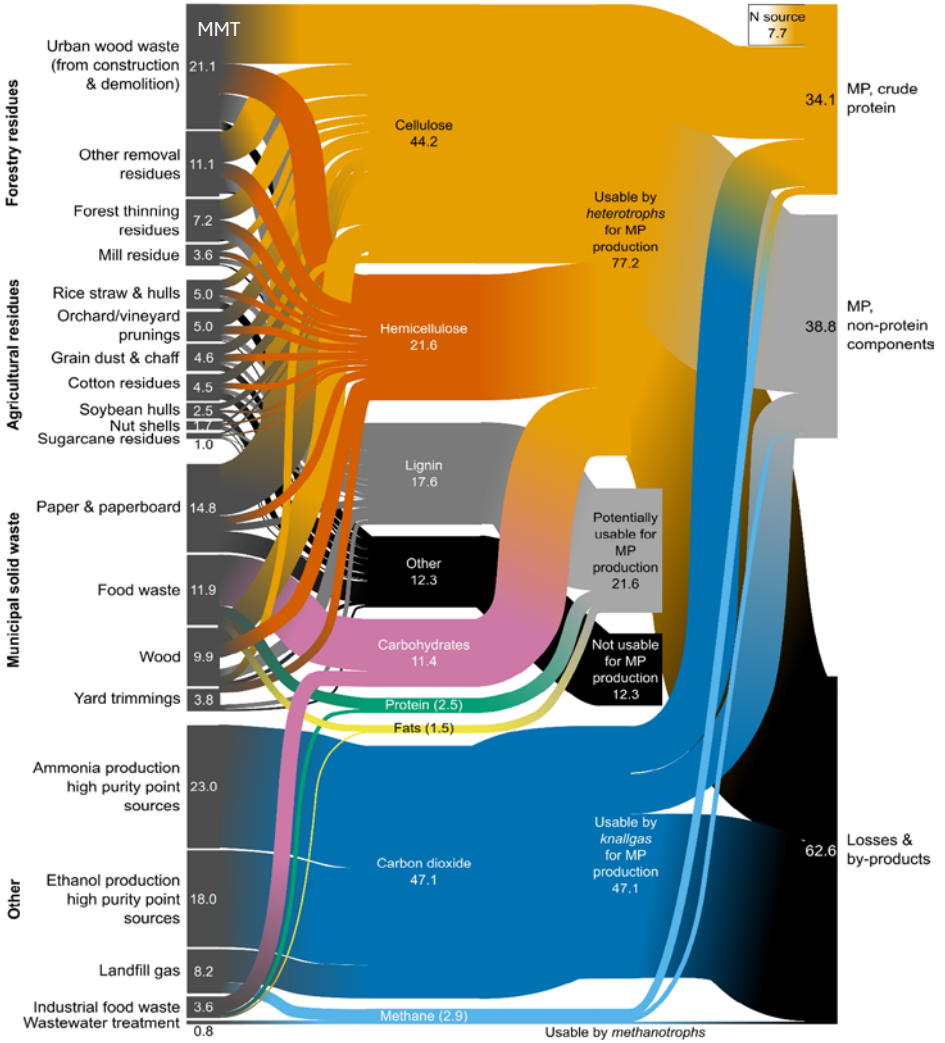
Uekert , Bleem *et al.*, submitted

Our goal: lab-scale demonstration of MP production from waste



Uekert , Bleem *et al.*, submitted

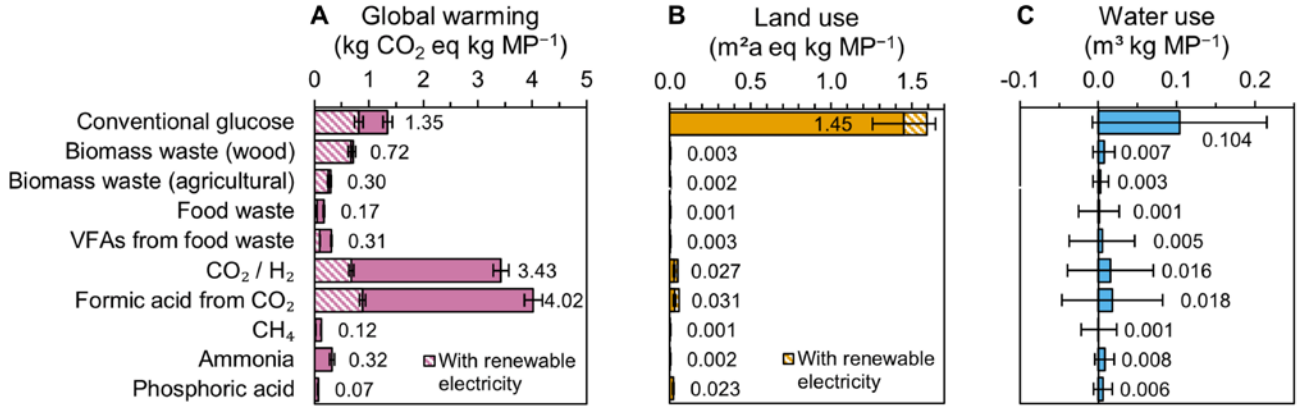
Waste carbon feedstocks are available for microbial protein production in the U.S.



Uekert , Bleem *et al.*, submitted

Some waste feedstocks offer environmental benefits

- Leveraging solid waste streams can reduce the GHG emissions, land use, and water use of microbial protein by 2-10x, 500-1500x, and 10-100x relative to a conventional glucose feedstock.
- Global warming impacts from CO_2 waste streams remain high predominantly due to electricity demand.

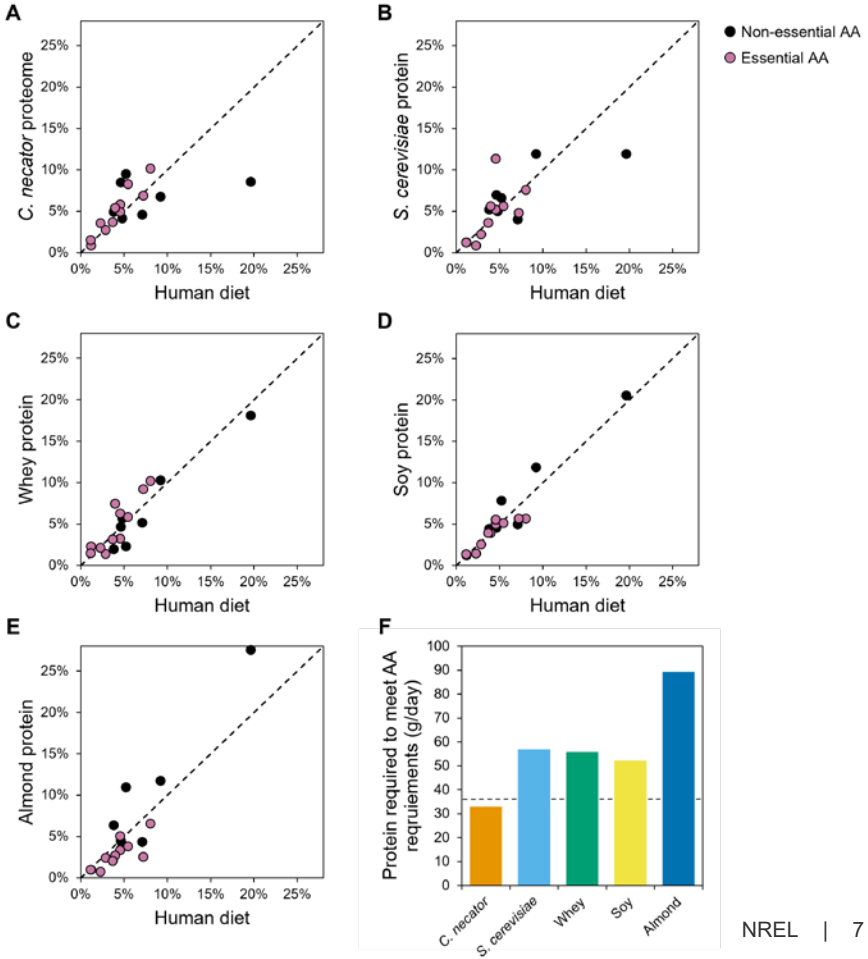


*VFAs = volatile fatty acids

Uekert , Bleem *et al.*, submitted

Some hosts offer nutritional benefits

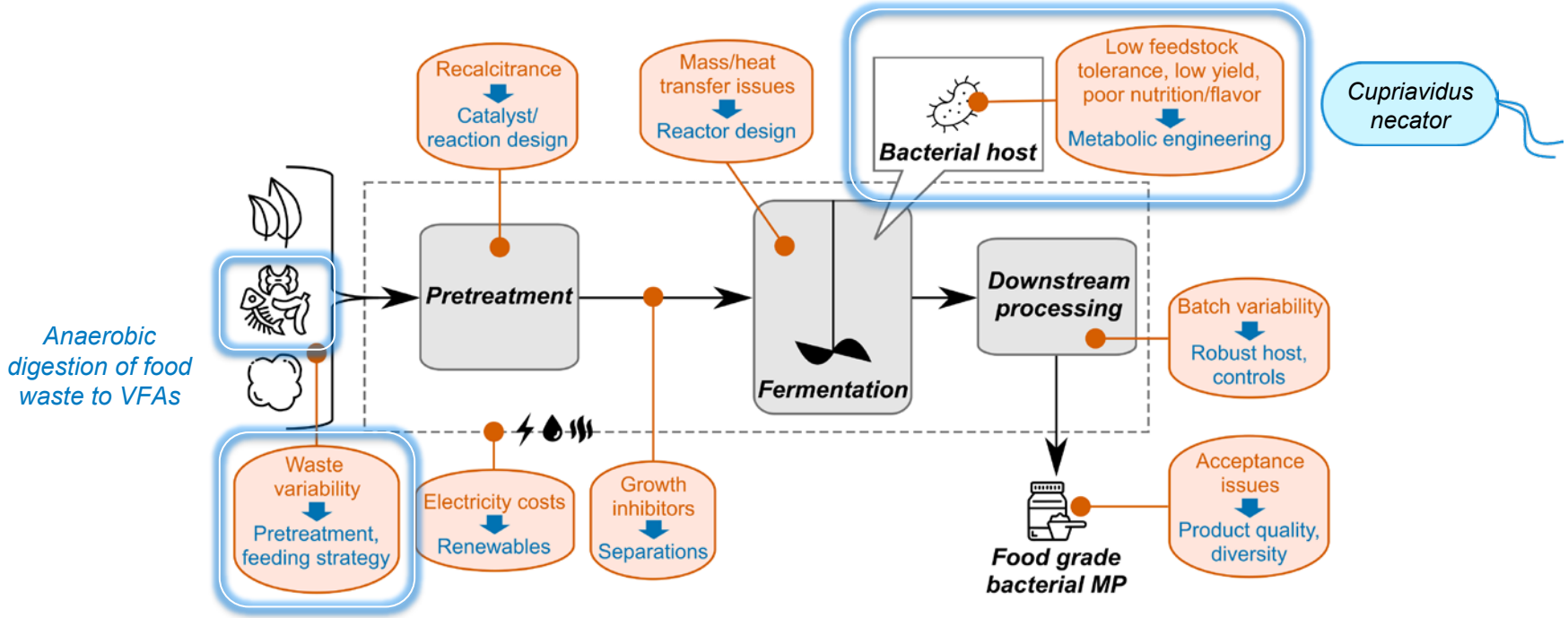
- *Cupriavidus necator* and *Saccharomyces cerevisiae* amino acid profiles closely match the requirements of a human diet.



Uekert , Bleem *et al.*, submitted

Looking forward to overcome microbial protein production challenges

- Multi-prong approach combining **metabolic engineering** of bacterial strains for waste use and better protein production, **bioprocess engineering** for lab-scale demonstrations, and **analysis** for economically viable and sustainable innovation



Uekert , Bleem *et al.*, submitted

Thank you! Questions?

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NREL/PR-6A20-88093