



**Plant-based Packaging:
Understanding the Opportunities and Challenges**

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Plant Based Products Council

Sustainable Packaging Symposium

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About PBPC

- 🌱 Launched in January 2019; 95 members and growing
- 🌱 Represents companies who are committed to advocating for a shift toward a more circular economy through greater adoption of plant-based materials in consumer products and packaging
- 🌱 All links in the plant-based product supply chain represented, from feedstock suppliers to users and retailers
- 🌱 Supported by Advisory Board of leading environmental organizations, academics, and NGOs

Plant-based Products

Products derived from nature – renewable plant-based material
and organic waste matter



Agricultural Residues



Algae



Bamboo



Cassava (aka yucca)



Dent Corn



Palm Leaf



Rice husk



Soybeans



Sugar beet



Sugarcane



Wood



Hemp

And Others...

Benefits of Plant-based Materials

- 🌿 Less reliance on petroleum-based materials
- 🌿 Advancing a circular economy
- 🌿 Variety of end-of life options and performance characteristics
- 🌿 Environmental benefits:



Municipal
Waste



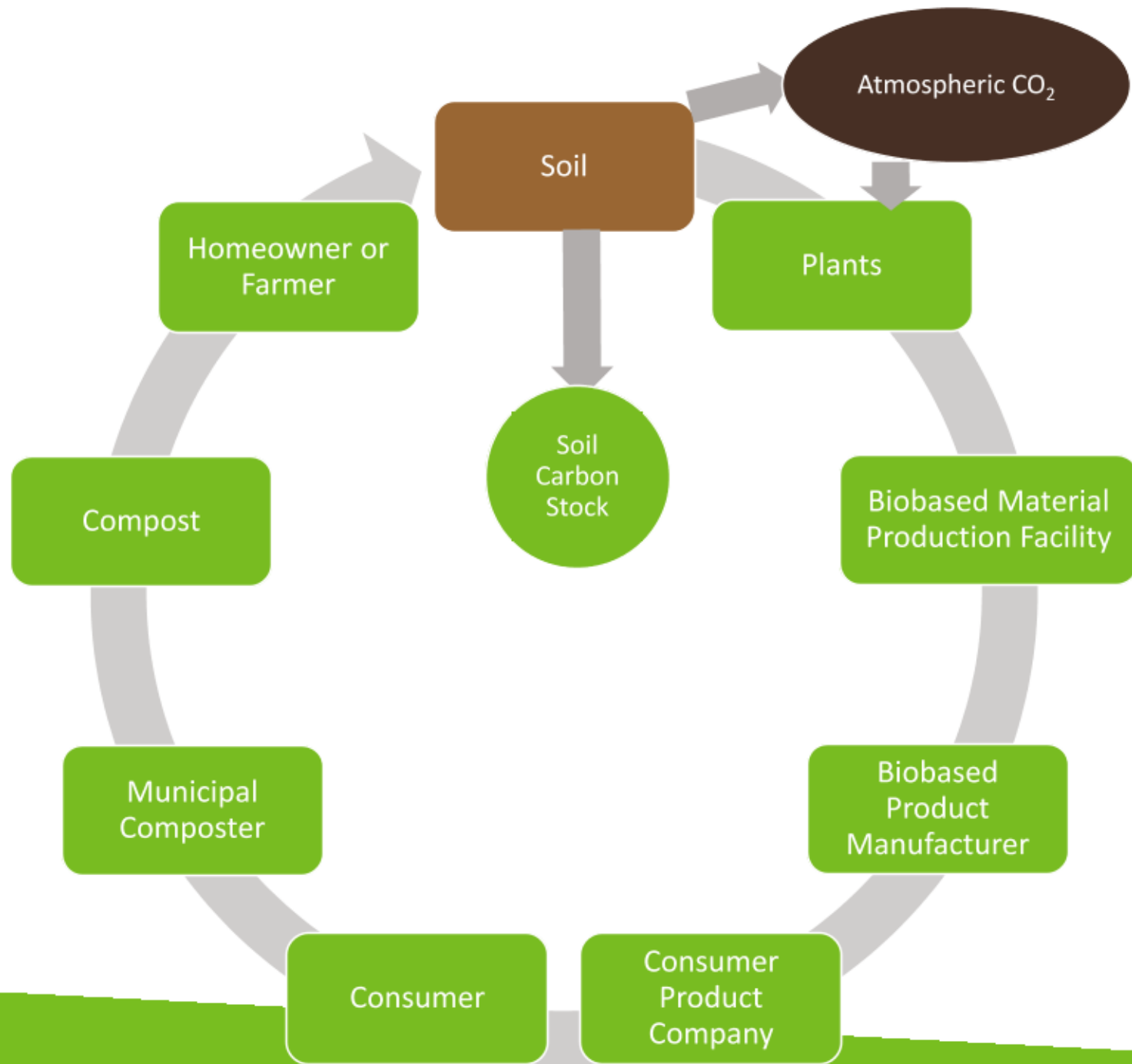
Soil
Health



Greenhouse
Gas Emissions



Water
Quality



Plant-based Products in the Circular Economy

Example:
Compostable Bioplastics



Photo: stonyfield.com

Bioplastics Used in Packaging

- 🌿 Almost 400 million tons of plastic produced annually
- 🌿 About 2.3 million tons of bioplastic produced annually
- 🌿 About 53% of bioplastic is used in packaging (rigid and flexible)
- 🌿 Plant-based bioplastics mainly derived from corn and sugarcane
- 🌿 Common plant-based bioplastics used in rigid and flexible packaging:
 - Starch Blends
 - Bio-PET
 - Bio-PE
 - PLA



Futamura



Back2Green USA



Club Coffee LP

Example Uses of Plant-based Packaging

Biopak Pty Ltd.



PSI



TIPA



Trends in Plant-based Products



Serveware

- Compostable cups and utensils (almost 200 different biobased serveware items certified as USDA Biobased products)



Films

- Film for shipping bags, garbage bags, or produce wrapping film



Beverage Packaging

- Bio-based PET
- Examples:
 - ✓ PepsiCo and the NaturALL Bottle Alliance developing bio-based PET beverage bottles
 - ✓ CocaCola's PlantBottle® is partial bio-based PET



Textiles

- Plant-based fibers (e.g., Reebok's plant-based running shoe)

The move toward plant-based products

Three powerful trends are converging to drive and accelerate the movement toward plant-based products:



Environmental Benefits



Consumer Trends



Corporate Pledges

Environmental Benefits



**Municipal
Waste**



**Soil
Health**



**Greenhouse
Gas Emissions**



**Water
Quality**



U.S. Municipal Waste Crisis

- 267.8 million tons of MSW/year
- 139 million tons to landfill
 - 30 million tons of food waste
 - 26 million tons of plastic
- Less than 10% of plastic has been recycled
- By 2050, plastic waste in the ocean will outweigh fish



Addressing the Waste Crisis

- 🌿 Over 60% of plastics used for packaging today could be replaced by bioplastic
- 🌿 Many bioplastics are compostable
- 🌿 Compostable food packaging and food serviceware presents an opportunity to support diversion of those materials and accompanying food waste to compost

Reduced Greenhouse Gas Emissions

Starting with the feedstock...

- 45% of global greenhouse gas emissions are associated with making products
- Plant-based materials use renewable feedstocks that pull CO₂ from the atmosphere
- The use of biobased alternatives to petroleum-based products in 2016 reduced the total GHG emissions of these products by up to 12.7 million metric tons of CO₂e.*
- Example:

Global Warming Potential; Cradle-to-Polymer Factor-Gate#	
NatureWorks Ingeo™: 0.6 CO ₂ eq/kg	Polyethylene Terephthalate (PET): 2.7 CO ₂ eq/kg

* Daystar, Jesse et. al. *An Economic Impact Analysis of the U.S. Biobased Products Industry*. United States Department of Agriculture BioPreferred® Program (2019) pp. xi.

Davies, Steve, and Vink, Erwin. *Life Cycle Inventory and Impact Assessment Data for 2014 Ingeo™ Polylactide Production*. Industrial Biotechnology. Vol. 11. No. 3. (2015).

Reduced Greenhouse Gas Emissions

Ending with end-of-life:

- Landfills are the **third largest** source of human-related methane (CH₄) emissions
 - Total landfill CH₄ is equivalent to emitting 107.7 million metric tons of carbon dioxide or 247 million barrels of oil
 - 30 million tons of food waste
- In 2017, only 2.6 million tons of food waste was composted (6.3% of total food waste generated).
- Increased use of compostable food packaging and food service ware presents opportunity to divert those products and food waste to compost.

Improved Soil Health



- 🌿 The FAO estimates that about **one third** of global soils are moderately or highly degraded
- 🌿 The incorporation of compost in soil helps improve soil carbon sequestration, water retention, water infiltration, as well as many other positive benefits

Improved Water Quality



Positive benefits of plant-based materials to water quality are two-fold:

1. Resulting compost improves soil physical characteristics that prevent nutrient runoff into waterways
2. The option to compost or biodegrade waste ideally prevents plant-based materials from entering or lingering in bodies of water




Consumer Trends

Millennials: Drivers of Food Industry

- Millennials represent roughly 1/4 of the American population
- With roughly \$20 billion to spend, Millennials are the living generation with the most spending power



2020 Polling

-  **93%** of Millennials are favorable of products and packaging made from plants
-  **84%** of all consumers would consider buying products and packaging made from plants
-  **40%** of Millennials are familiar with products and packaging made from plants

Corporate Pledges

Corporate Pledges

- Every one of the 25 largest consumer product companies in the world have committed to increasing recyclable content, minimizing packaging, or reusing material.
- 80% of those companies have pledged to produce fully recyclable, reusable, or compostable packaging by 2030 at the latest.

Corporate Packaging Goals - Examples

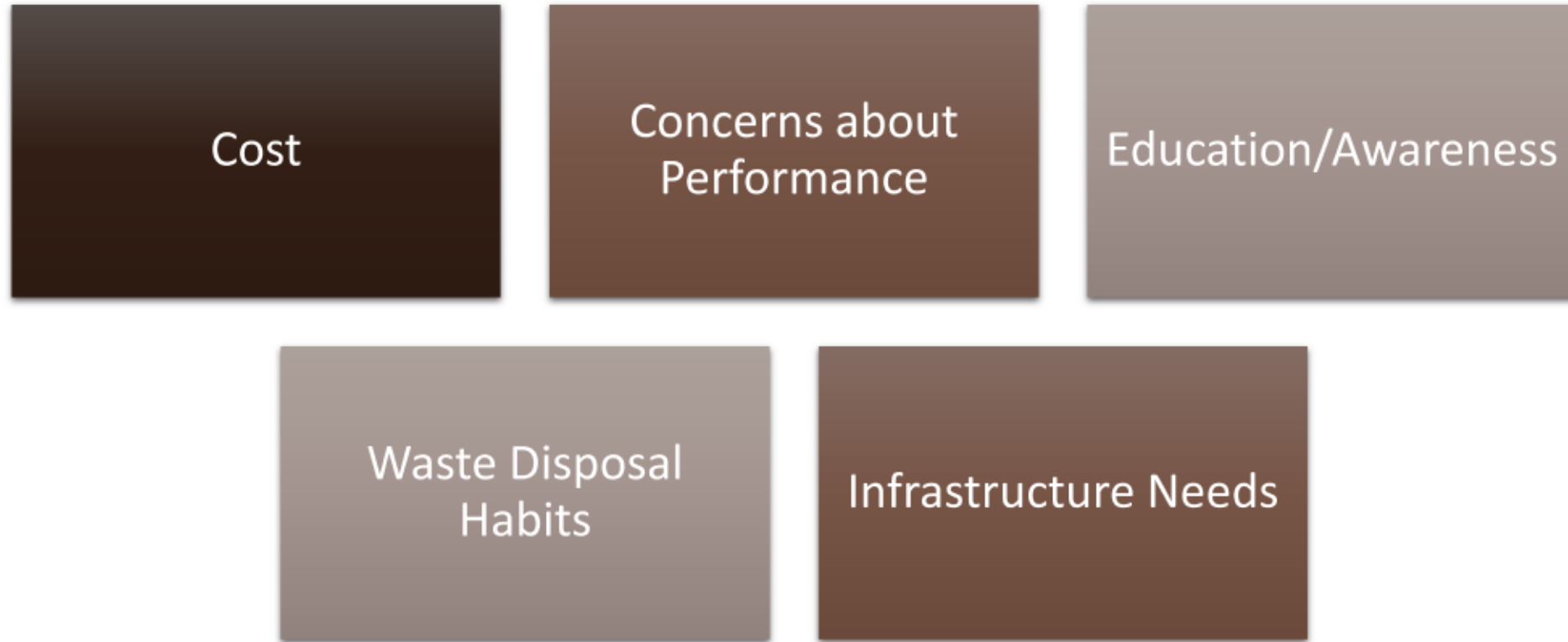
Company	Goal
PepsiCo	By 2025, 100% recyclable, compostable or biodegradable packaging
Unilever	By 2025, 100% of plastic packaging designed to be reusable, recyclable or compostable
Nestlé	100% recyclable or re-usable packaging by 2025
Mattel	100% recycled, recyclable or bio-based plastics materials in both its products and packaging by 2030
Kellogg	100% reusable, recyclable or compostable packaging by the end of 2025
SC Johnson	100% of plastic packaging can be easily and safely reused, recycled or composted by 2025

Considerations and Challenges

Additional Considerations

- Does not compromise food availability or require a significant amount of agricultural land to grow.
 - 0.05% of the world's arable land is used to produce plant-based plastics.
 - With current market trends, will only increase to ~0.07% by 2024.
 - Large diversity of plant-based feedstocks.
 - Some products are derived from non-edible plants/plant parts or ag residue.
- Employment of sustainable management practices such as no-till and cover cropping reinforce the positive environmental merits of the industry.
- Check for certifications (e.g., USDA BioPreferred, bluesign)

Challenges to Plant-based Products





Questions?

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