Using Food Waste to Reduce Food Waste

Evaluating the Impacts of Sourcing Food Waste as a Raw Material for Production

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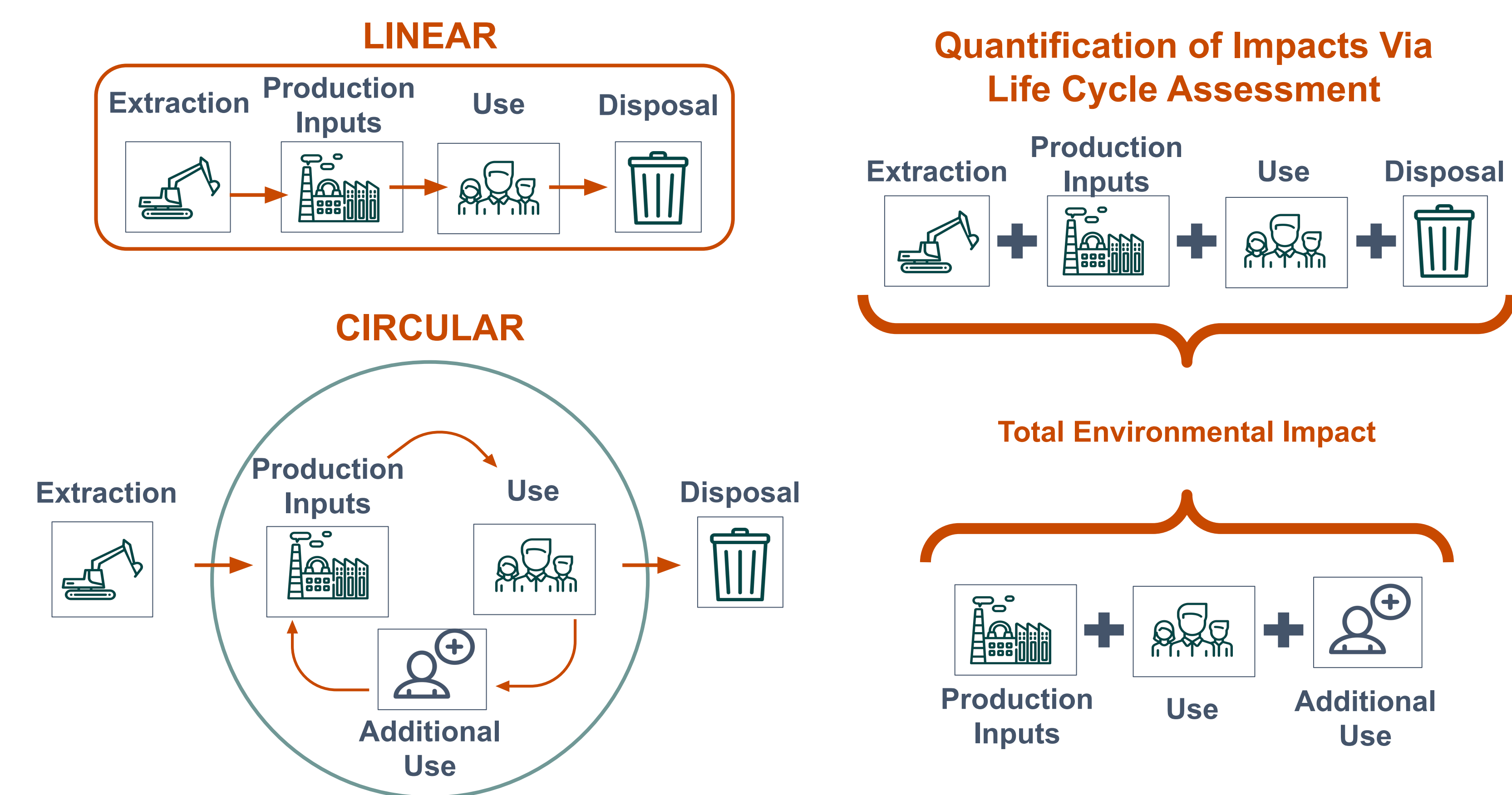## 1 BACKGROUND

Circular Economy: A solution to extraction

Most product cycles follow a linear process, in which resources are extracted, a product is made, and then the product is ultimately discarded. Circular economy suggests that the environmental impact of a product may be reduced by using wastes as inputs instead of virgin material. While businesses have embraced circular economy, it is not always clear if redesigning supply chains this way results in a net reduction of environmental impacts.

Photo Credit: Dion Beetson on unsplash

Evaluating supply chains using Life Cycle Assessment

Life Cycle Assessment (LCA) is a tool used to calculate a product's environmental impact by quantifying all of the environmental impacts caused by its creation, use, and disposal. Multiple LCA methodologies exist, with different underlying assumptions and degree of comprehensiveness. Businesses often have limited access to data and tools to analyze their supply chains, and may not be able to utilize the best method. This presents a problem because using one method over another may not capture all the environmental impacts of a particular scenario.

LINEAR
Extraction → Production Inputs → Use → Disposal

CIRCULAR
Extraction → Production Inputs → Use → Disposal, Additional Use

Quantification of Impacts Via Life Cycle Assessment

Extraction + Production Inputs + Use + Disposal

Total Environmental Impact

Production Inputs + Use + Additional Use
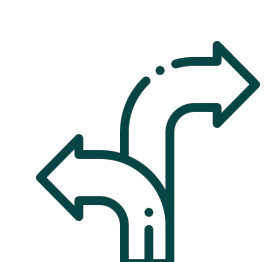
2 OBJECTIVES

OBJECTIVE 1: Develop Circular Sourcing Scenarios
Identify the process through which a particular waste is created, its method of disposal, and any alternative uses.

OBJECTIVE 2: Test Differing LCA Methods
Calculate the environmental impacts of sourcing a waste using differing LCA methods to assess how the results differ.

OBJECTIVE 3: Identify Key Parameters
Conduct scenario analyses to identify how key parameters affect the calculated results.

Case Study - Apeel Sciences

Apeel Sciences is a biotech startup with a strong environmental mission. Their product is a plant based, edible coating that extends the shelf-life of produce. Apeel identified an opportunity to source industrial food waste as an input to their product, thereby creating a more circular supply chain.

Oxygen stays outside, O₂

Moisture stays inside, H₂O
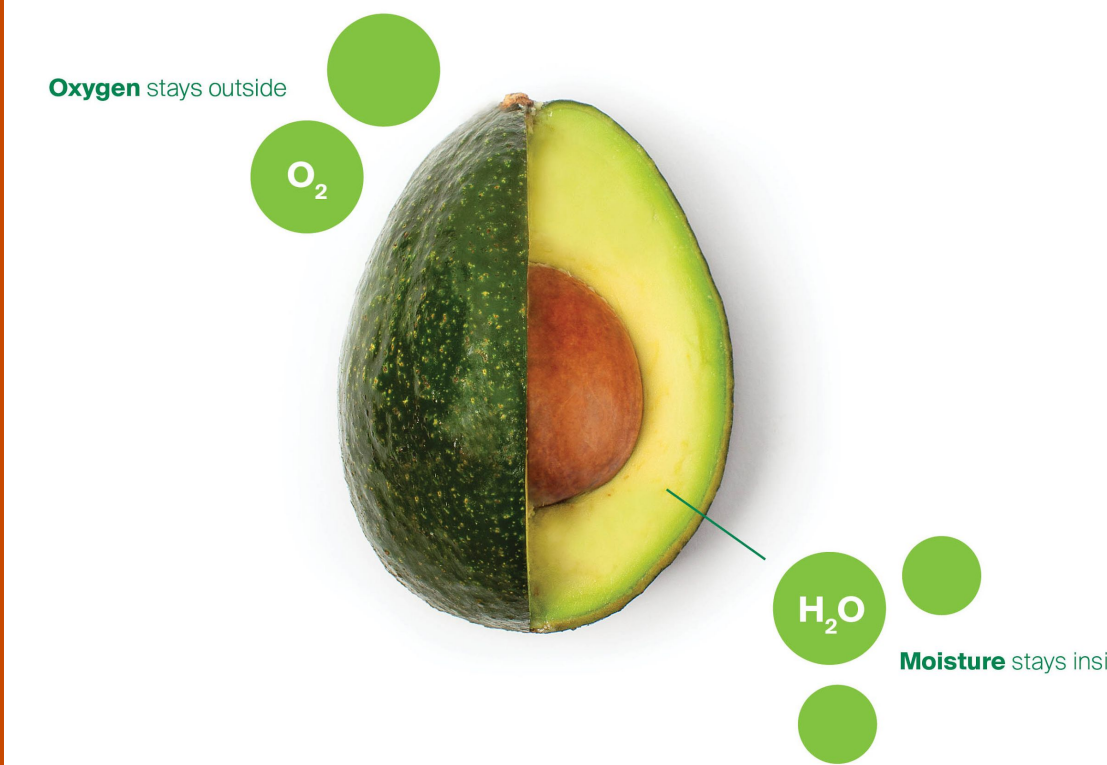
To achieve our objectives, we analyzed food wastes that Apeel could create their product with, and distilled findings from our analyses into a generalized framework and tool.

3 APPROACH

Understanding origins of wastes

We selected 4 representative wastes to investigate in detail:

- Grape Pomace
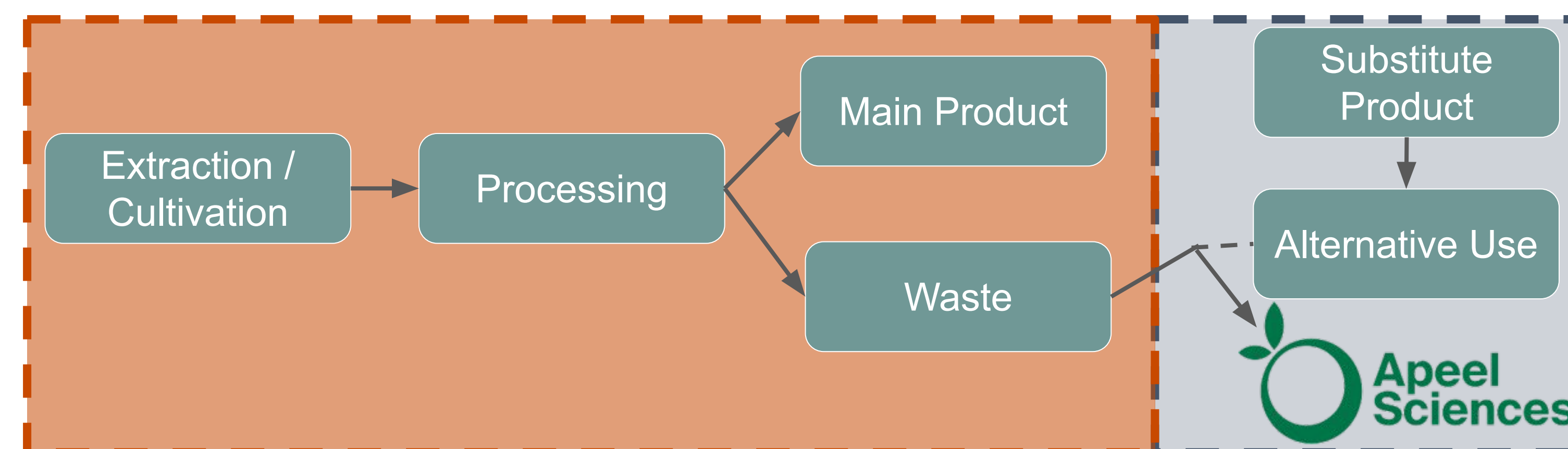- Olive Pomace
- Coffee Cherries
- Cocoa Husks

Collect quantitative data

To quantify the environmental burden of each selected waste, we started by collecting existing LCA data on the supply chains that produce these wastes: wine, olive oil, chocolate and coffee.

Economic allocation

How it works: Divide the environmental burden of the supply chain between multiple outputs based on each output's market price

The rationale: Replicate a common method businesses use to assess supply chains

Extraction / Cultivation → Processing → Main Product, Waste → Alternative Use → Substitute Product

Apeel Sciences

Substitution

How it works: Assign the environmental impacts from additional production of a substitute product (fertilizer, animal feed, etc.) caused by Apeel's sourcing decision

The rationale: Captures the consequence of the sourcing practice.

Scenario analysis

The scenario analysis investigates how key parameters of a scenario affect the calculated environmental impacts. These include:

Price: Affects economic allocation results
Amount of additional production: Affects substitution
Additional data: Do the results change when we include additional process like dehydration?

Generalizing methodology

We distilled our findings from this analysis into a tool any business can use when considering the environmental impacts of sourcing a waste.
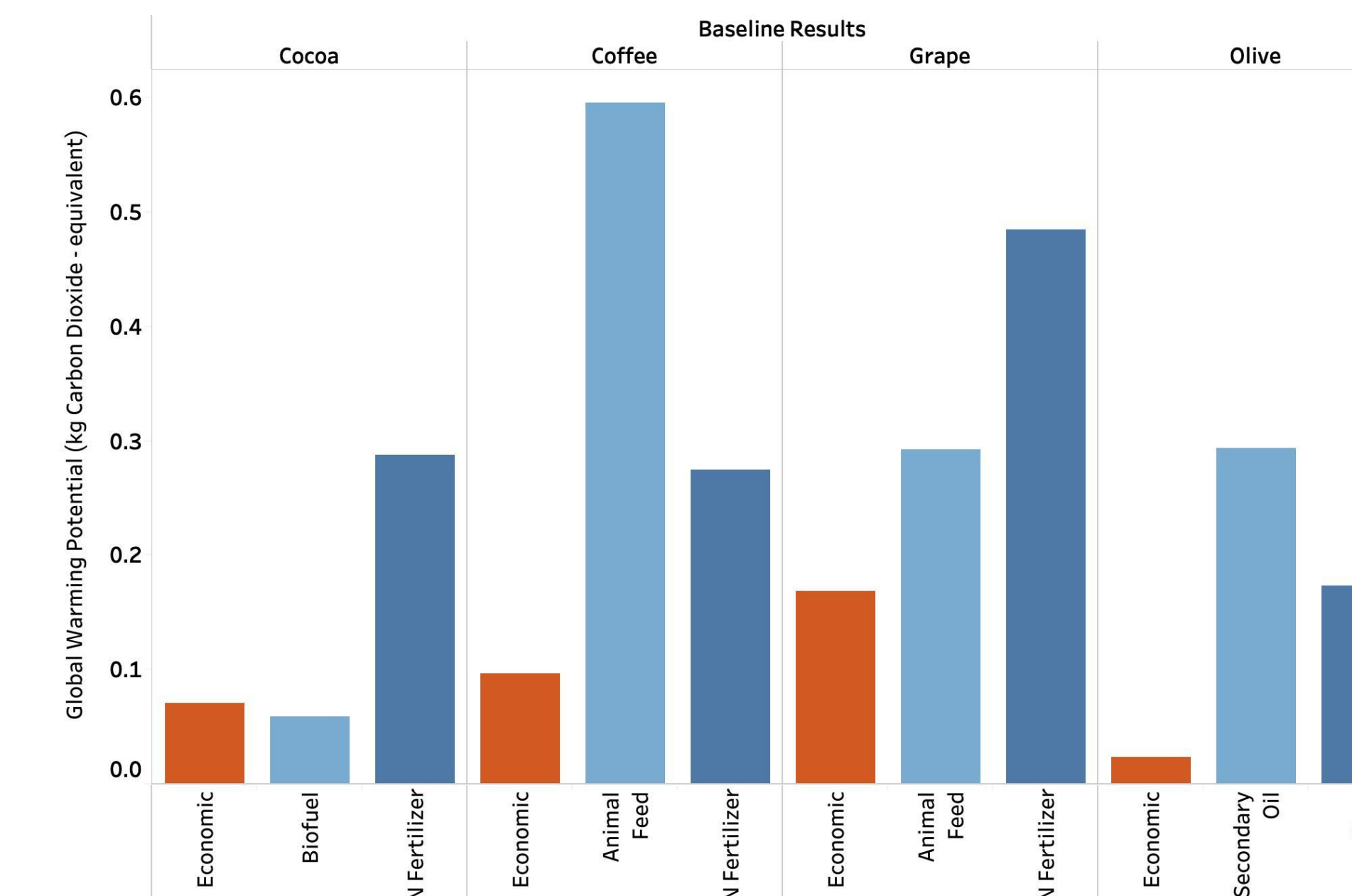
4 RESULTS

All wastes studied had alternative uses

	Grape Pomace	Coffee Cherries	Cocoa Husks	Olive Pomace
Primary Product	Wine	Coffee	Chocolate	Olive Oil
Potential Use	Animal Feed & Fertilizer	Animal Feed & Fertilizer	Biofuel & Fertilizer	Secondary Vegetable Oil & Fertilizer

All four materials we investigated had alternative uses, suggesting they are not always wastes. We chose the above scenarios for our quantitative analysis.

Different methodologies resulted in different choices

We analyzed 4 different environmental impact categories, including global warming potential (above). Results varied widely based on what method was used: importantly, the material with the lowest impacts differed if one method was used over another.

Adding additional processes to the analysis resulted in different choices
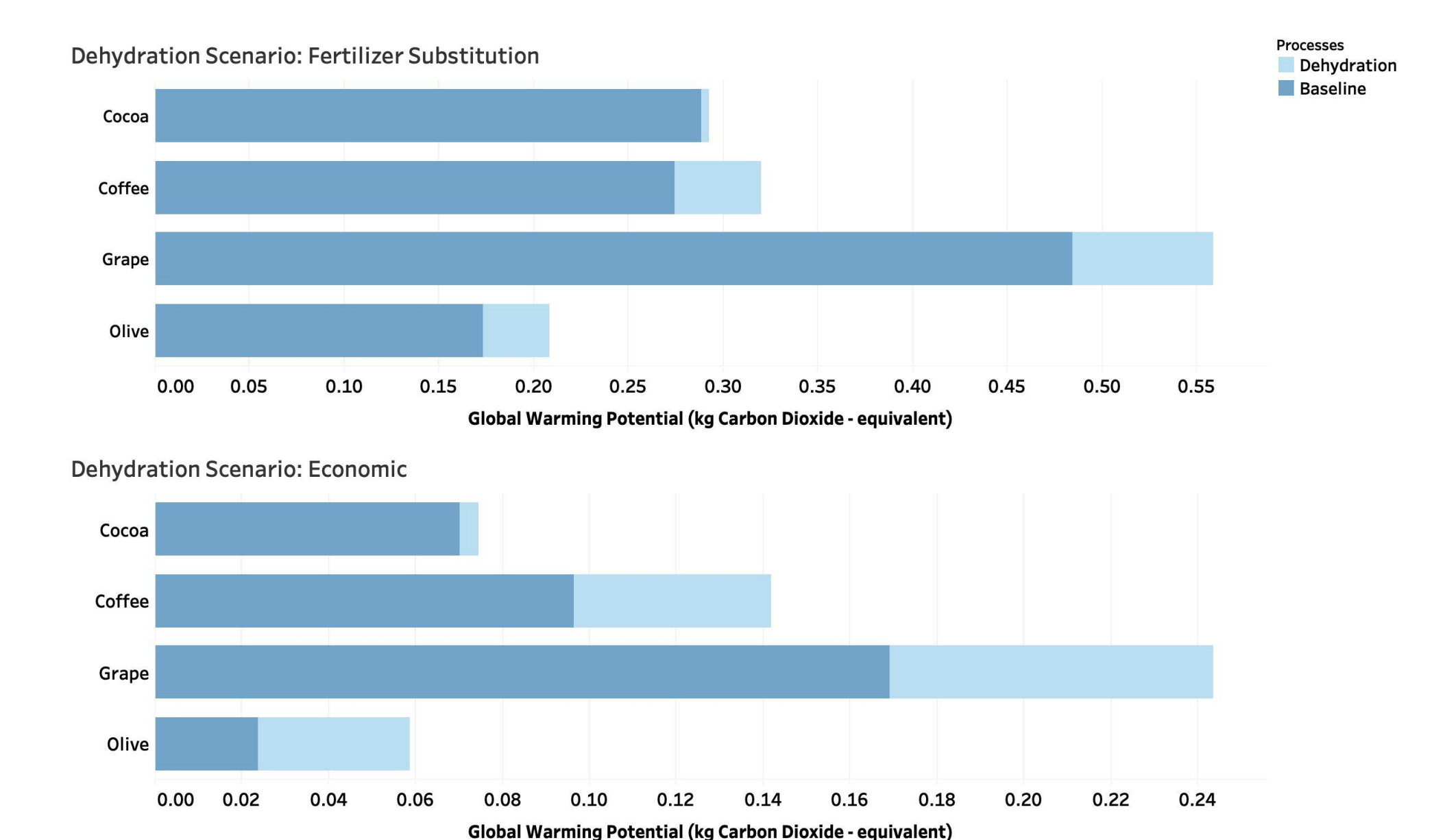
Adding additional processes to the analysis also caused the material with the lowest impacts to change from the baseline results. This shows the importance of including as many scenario specific processes as possible.

5 FINDINGS & RECOMMENDATIONS

Key Findings

Materials thought of as wastes may have alternative uses
A business may cause unintended environmental impacts by sourcing materials not destined for the landfill.

Choice of method affects the decision outcome
Different LCA methods may result in different recommendations. Additionally, different alternative uses considered may change the final recommendation.

Recommendations

Use substitution methodology in cases where a waste or byproduct material is being used by another industry
Will help capture negative environmental impacts that occur is other supply chains that results from a sourcing decision

Identify specific sources of materials, not just the material itself
Businesses should identify specifics for each waste of interest, including what it would alternatively be used for.

6 ACCESS THE TOOL

To access our tool and evaluate environmental impacts of a waste please scan this code!

bit.ly/WasteWatchersTool

7 ACKNOWLEDGEMENTS

Apeel Sciences

DIPAOLA foundation