West Coast Climate & Materials Management Forum

29 November 2018

Popular Material Attributes: How Well Do They Actually Predict Environmental Goodness?

West Coast Climate and Materials Management Forum

The West Coast Climate and Materials Management Forum is a collaboration of state, local, and tribal government

- Develop ways to institutionalize sustainable materials management practices.
- Develop tools to help jurisdictions reduce the GHGs associated with materials

West Coast Climate & Materials Management Forum

Check out the Forum's Resources

- Original Report Connecting Materials/Climate
- Research Summaries
- Turn-key Materials Management Presentation
- Climate Action Toolkit
- Food: Too Good to Waste Toolkit
- Climate Friendly Purchasing Toolkit
- Reducing GHGs Through Composting and Recycling

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West Coast Climate Forum
Webinar Series Disclaimer

This webinar is being provided as part of the West Coast Climate and Materials Management Forum Webinar Series. The Forum is a collaboration of state, local, and tribal governments. We invite guest speakers to share their views on climate change topics to get participants thinking and talking about new strategies for achieving our environmental goals. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Businesses, policy-makers, and the general public often rely on simple attributes to inform material selection. These attributes – such as “recyclable” or “compostable” – are widely assumed to result in reductions in environmental impacts. But how valid are these assumptions? The Oregon Department of Environmental Quality (DEQ) recently asked that question and was surprised to discover very little systematic assessment of them. So it commissioned a study – the results of which are being published this fall – that reviewed the last 18 years of global research into the environmental impacts of packaging and food service items with and without four popular attributes: recycled content, recyclable, bio-based, and compostable. Collectively, the literature identified the relative environmental impacts for thousands of comparisons, from which some important trends emerge that should inform product design, procurement, and waste management programs.

Thursday, 29 November 2018

West Coast Climate
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Today's Speakers

David Allaway is a Senior Policy Analyst at the Oregon Department of Environmental Quality's Materials Management Program. He leads projects related to sustainable consumption and production, materials (including waste) management, and greenhouse gases. He led efforts to develop and update Oregon's consumption-based greenhouse gas emissions inventory and contributed to the ICLEI US greenhouse gas accounting protocols for communities and recycling.

Peter Canepa joined the Oregon Department of Environmental Quality in January 2017, providing Life Cycle Assessment (LCA) expertise to Oregon's Materials Management program. Peter's primary role is to conduct/support projects, through the application of LCA, that advance Oregon towards achieving its 2050 vision. Prior to this role, Peter spent 8 years with Thinkstep, a consultancy specializing in life cycle assessment. Peter holds a Master's degree in Environmental Science and Management and a Bachelor's degree in Environmental Studies.

Today's Speakers

Moderator: Karen Cook has led Alameda County, California's green purchasing program for the last decade, greening tens of millions of dollars of bids for this 9500-employee organization. Karen works to accelerate market transformation by collaborating locally, regionally and nationally on green purchasing efforts. Prior to that she spent nearly a decade advancing green building operations, waste reduction, and recycling for local government and in the private sector. Karen enjoys spending her free time outdoors with her two boys in the San Francisco Bay Area, where she graduated from UC Berkeley with a Bachelor's degree in Environmental Studies.

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Massive ‘dead zone’ in Gulf of Mexico sets new record

By Janet McConnaughey The Associated Press

Dead zones in the Gulf of Mexico may be a factor in the deaths of marine animals.

Patrick Semansky/AP

OregonLaws.org 2017 ORS Legal Glossary

/ 2017 ORS / Vol. 11 / Chapter 459A / Section 459A.780

459A.775
"State agency" defined

459A.780
Prohibition against purchase or use of nonbiodegradable and nonrecyclable food packaging

459A.785
Effective recycling program

2017 ORS 459A.780[1]
Prohibition against purchase or u

Seattle.gov
Mayor Jenny A. Durkan

SOLID WASTE | WATER | DRAINAGE & SEWER | LANDSCAPES

For Businesses / Solid Waste / Food & Yard / Commercial Customers

- COMMERCIAL CUSTOMERS
- RATES
- COLLECTION GUIDELINES
- COMPOSTABLE ITEMS FLYER
- FOOD PACKAGE REQUIREMENTS
- FOOD & YARD WASTE FAQS

Food Serv

Current food packaging and serviceware requirements

The City of Seattle requires all food service businesses to find recyclable or compostable packaging and serviceware alternatives to all disposable food service items such as containers, cups, straws, utensils, and other products.

This applies to all food service businesses, including restaurants, grocery stores, delis, coffee shops, food trucks, and institutional cafeterias.

New Rules for Restaurants in Santa Cruz County

To protect the environment, reduce litter and to encourage the recycling and composting of food service waste, the following rules have been approved by the Santa Cruz County Board of Supervisors.

As of January 1, 2017:

All to-go food service ware provided to customers in the unincorporated areas of Santa Cruz County must be recyclable or compostable, as certified by the Biodegradable Products Institute.

This includes:

- **No plastic straws (paper is acceptable)**
- **No plastic stir sticks (wood is fine)**
- **All cups (hot or cold) must be certified compostable**
- **All to-go cutlery must be certified compostable**
- **No Styrofoam**
- **No #6 polystyrene products (including hot cup lids)**
- **All to-go containers must be recyclable or certified compostable**

These rules apply to restaurants, grocery stores, farmers markets, food trucks, special events and any other business or event where food is sold to go.

Ikea commits to phase out single-use plastic products by 2020

Global retailer with 363 stores says it wants to help customers live more sustainably

▲ Ikea has already inve
Wiegmann/Reuters

PepsiCo joins NaturALL Bottle Alliance

Posted by **Anne Marie Mohan** September 11, 2018
Filed in: **Bottles**, **Bioplastics**, **Beverage**

The alliance, a research consortium developed by Danone, Nestle Waters, and Origin Materials, is making progress on developing and introducing a 100% bio-based PET beverage bottle.

NATURALL
BOTTLE ALLIANCE

The NaturALL Bottle Alliance is a research consortium formed in 2017 by Danone, Nestlé Waters, and bio-based materials development company Origin Materials to accelerate the development of innovative packaging solutions made with 100% sustainable and renewable resources. On Sept. 11, NaturALL announced that PepsiCo, Inc. has joined the alliance to advance the shared goal of creating beverage containers with a significantly reduced carbon footprint.

The alliance also provided a progress report in its goal of developing and launching a PET bottle made from bio-based material. Launched a year ago in March, the alliance uses biomass feedstocks, such as previously used cardboard and sawdust, so it does not divert resources or land from food production for human or animal consumption. The alliance says the technology it is exploring represents a scientific breakthrough for the sector, which it aims to make available to the entire food and beverage industry.

BUT…

Does *Attribute* = *Environmental Benefit*?

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Q&A

Links for more information:

- www.oregon.gov/deq/mm/production/Pages/Materials-Attributes.aspx

West Coast Climate & Materials Management Forum

Q&A

David Allaway
Oregon Department of
Environmental Quality

Peter Canepa
Oregon Department of
Environmental Quality

Karen Cook
Alameda County, CA

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Next Up:

February 2019: Consumption-based emissions – Part 2: Actions

More to come in the Webinar series in 2019:

March 2019: Oregon DEQ's Sustainability Frameworks White Paper

April 2019: Food and Environment Product Footprint Research

May 2019: Preventing the Wasting of Food

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THANK YOU!

Please fill out the survey you receive after the webinar.

For more information, visit www.westcoastclimateforum.com

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& Materials Management Forum

material attributes

what they reveal about environmental outcomes

West Coast Forum on Climate and Materials Management

29 November 2018

David Allaway and Peter Canepa |Oregon Department of Environmental Quality

introduction

1. History and background
2. Attributes and impacts
3. Study approach and methodology

*** Short pause for questions ***

4. Select results: recycled content and recyclable

*** Short pause for questions ***

5. Select results: biobased and compostable
6. Concluding thoughts and next steps

*** Additional questions ***

project history

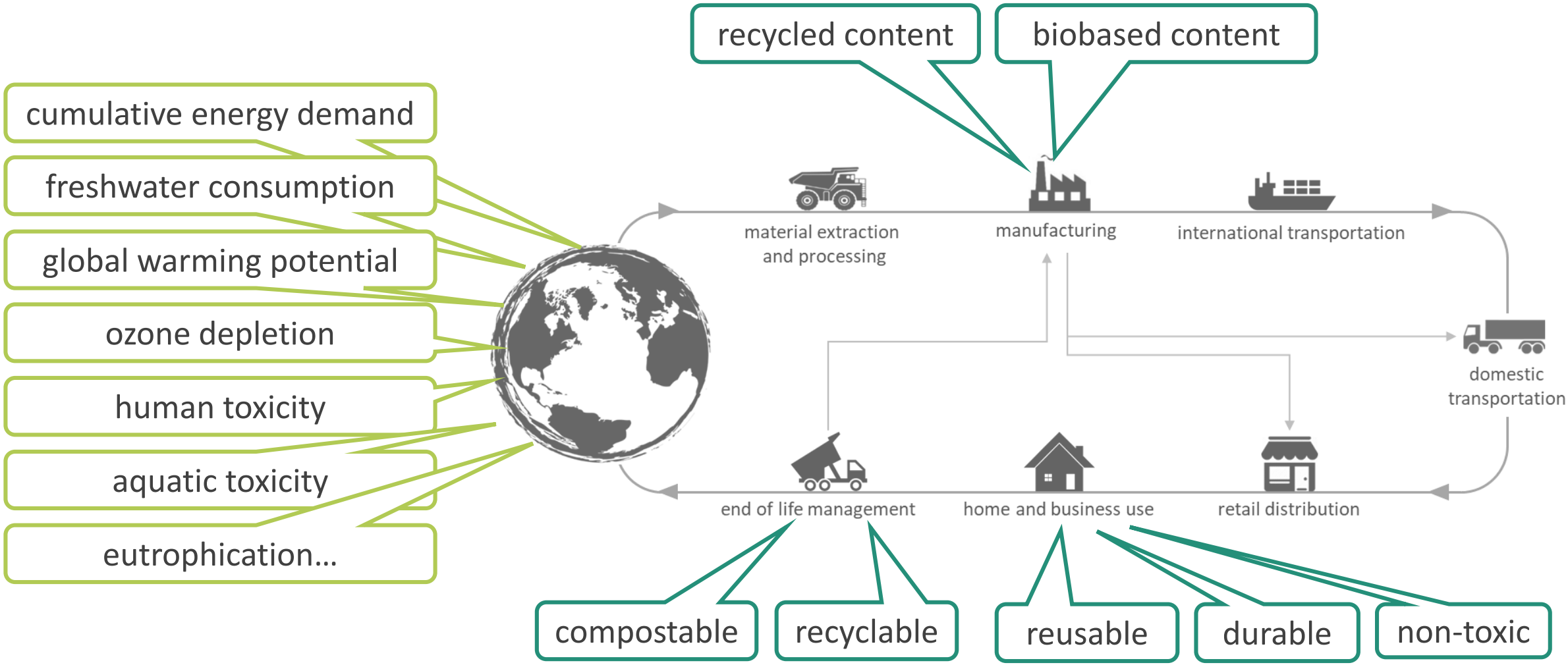
background and perspectives

a vision for materials management

By 2050 Oregonians produce and use materials responsibly

- **conserving resources**
- **protecting the environment**
- **living well**

materials attribute & life cycle impacts



research question

How well (and when) do popular material attributes correlate with reduced environmental impacts?

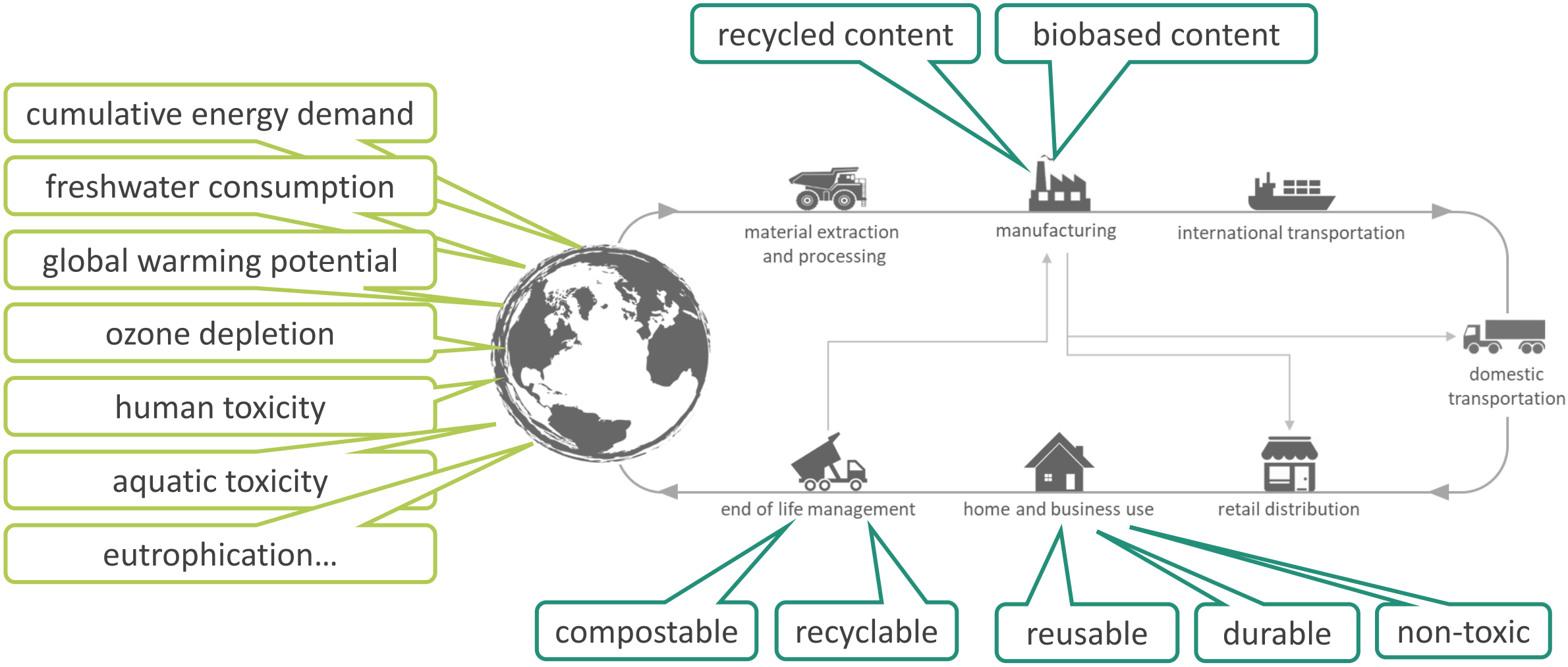
attributes vs. impacts

an overview

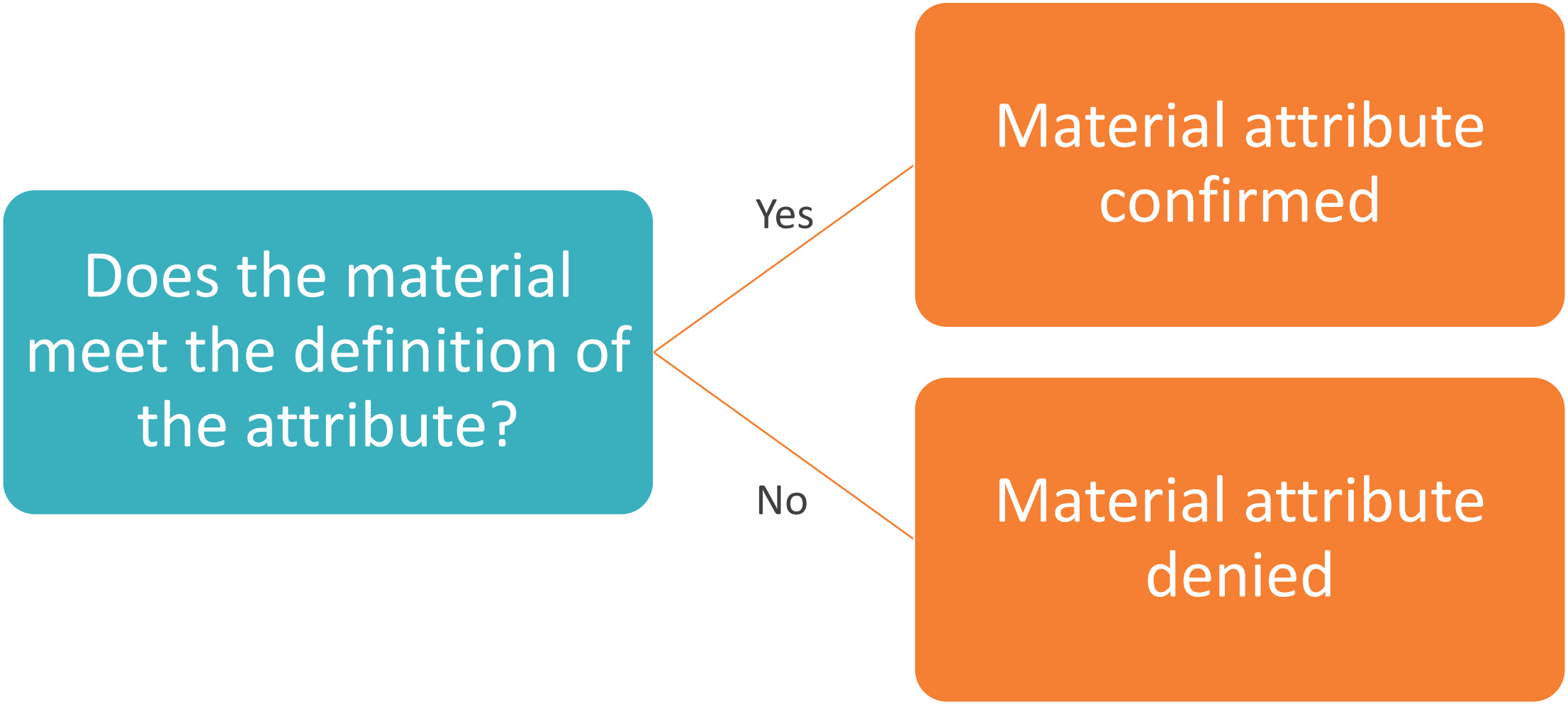
at·trib·ute – noun /ˈatrəˌbyo͞ot/

a quality or characteristic of a person or thing
thing

materials attribute & life cycle impacts



the process - attributes



an example: material attributes of corrugated board

- Attribute – Biobased
- Definition – materials made from biological and renewable feedstocks that can be replenished as they are used

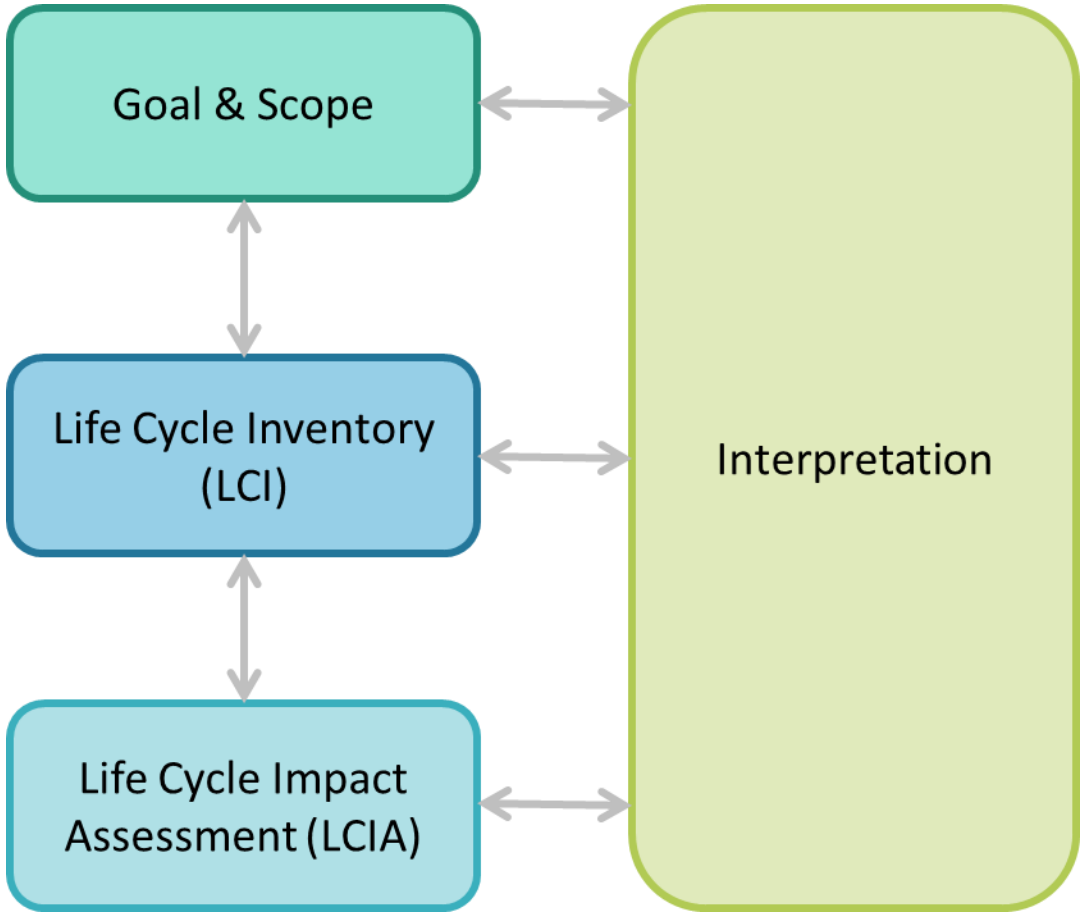
Evaluating impacts: life cycle assessment (LCA)

an overview

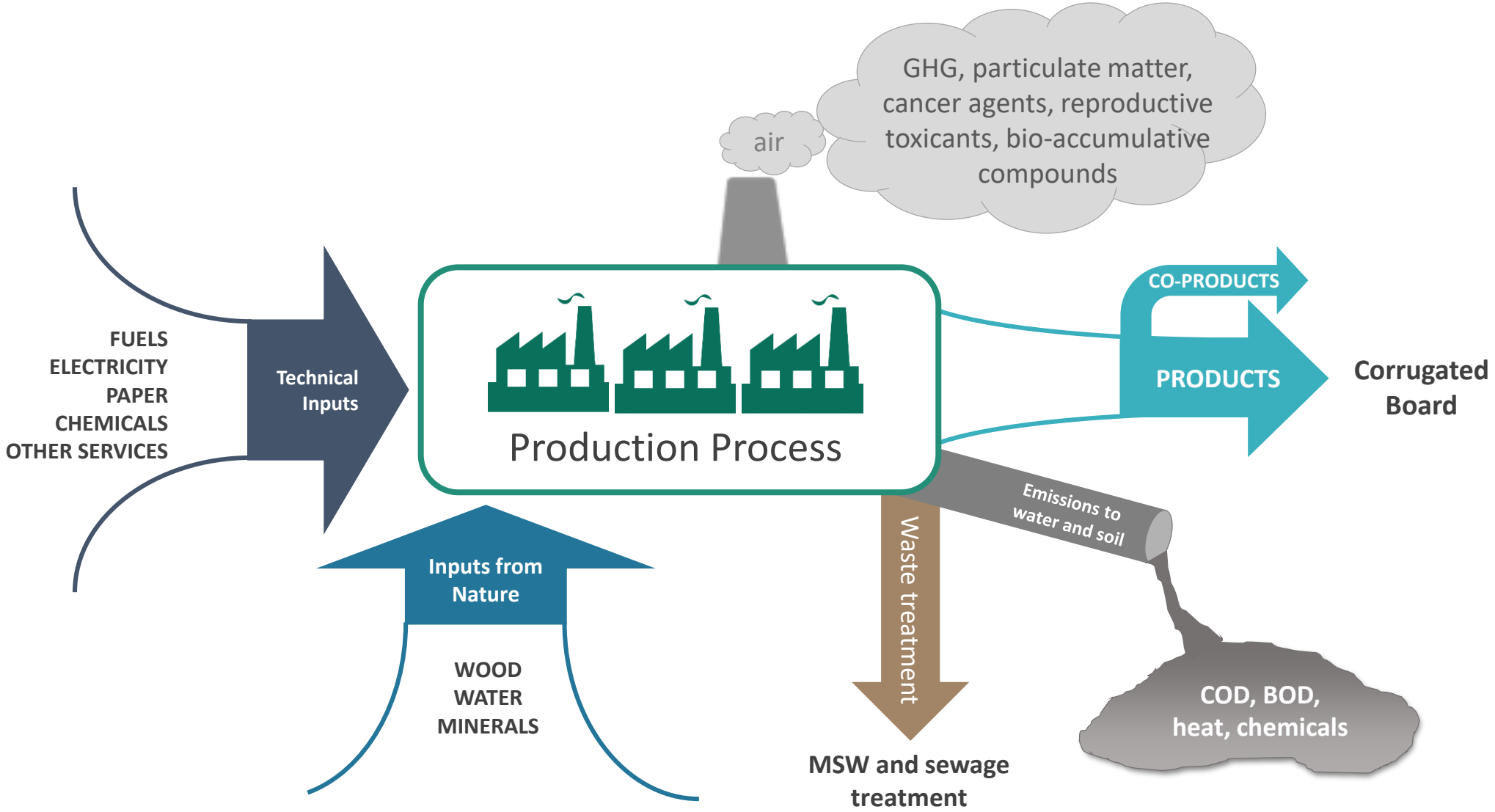
Life Cycle Assessment is

"the compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle."

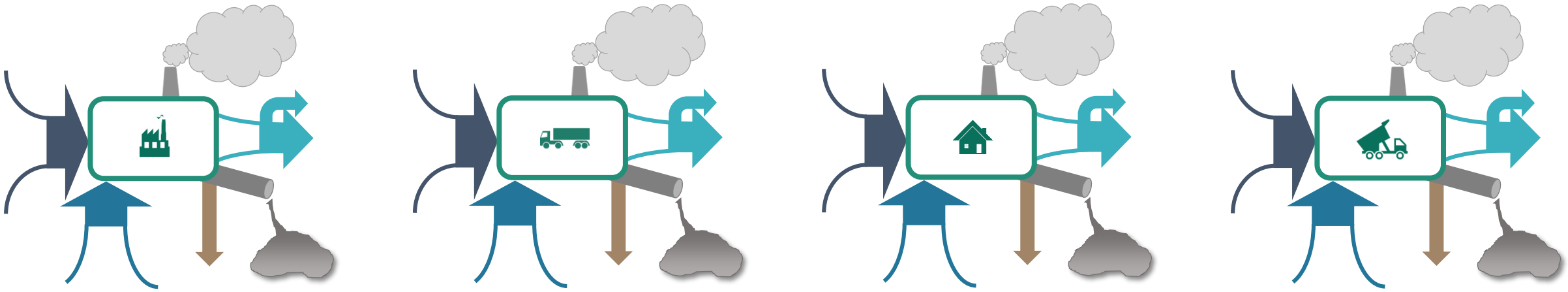
the process – LCA



an example: basic life cycle of corrugated board



an example: basic life cycle of corrugated board



Impact Assessment

Energy consumption, raw material consumption,
climate change, smog formation acidification, over fertilization,
water depletion, toxicity, ozone depletion

comparing attributes and life cycle impacts

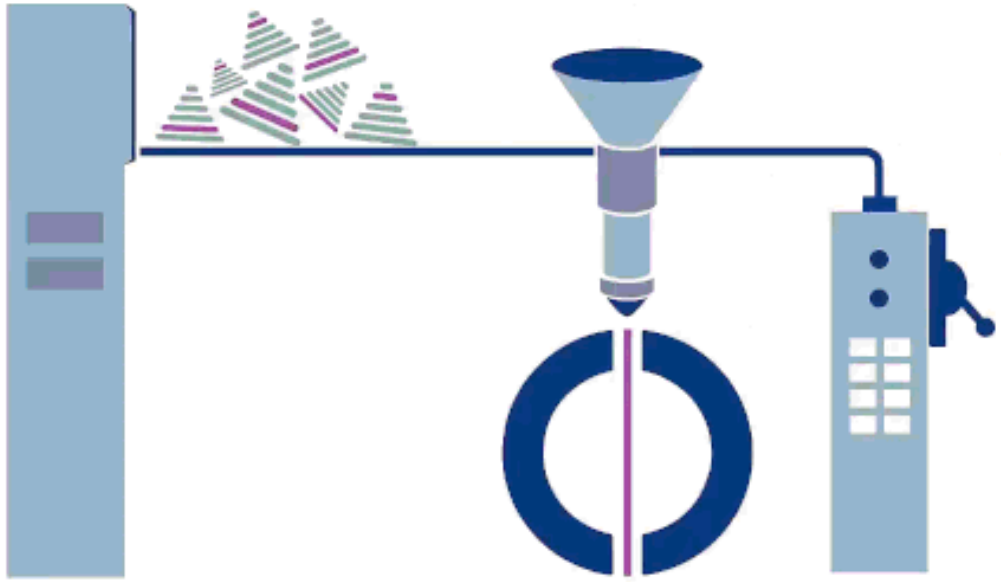
	Material Attributes	Life Cycle Impacts
Quantitative	Sometimes	Yes
Outcome-based	No	Yes
Methodology	No	Yes
Comprehensive	No	Mostly Yes*
Complexity	Low	High
Ease of Use	High	Low

*Human toxicity (during product use) and marine debris impacts are not currently well evaluated using LCA.

study approach and methodology

attributes in LCA literature

approach



- Develop LCA Models
- Systematic review of literature
- Hybrid of above two options

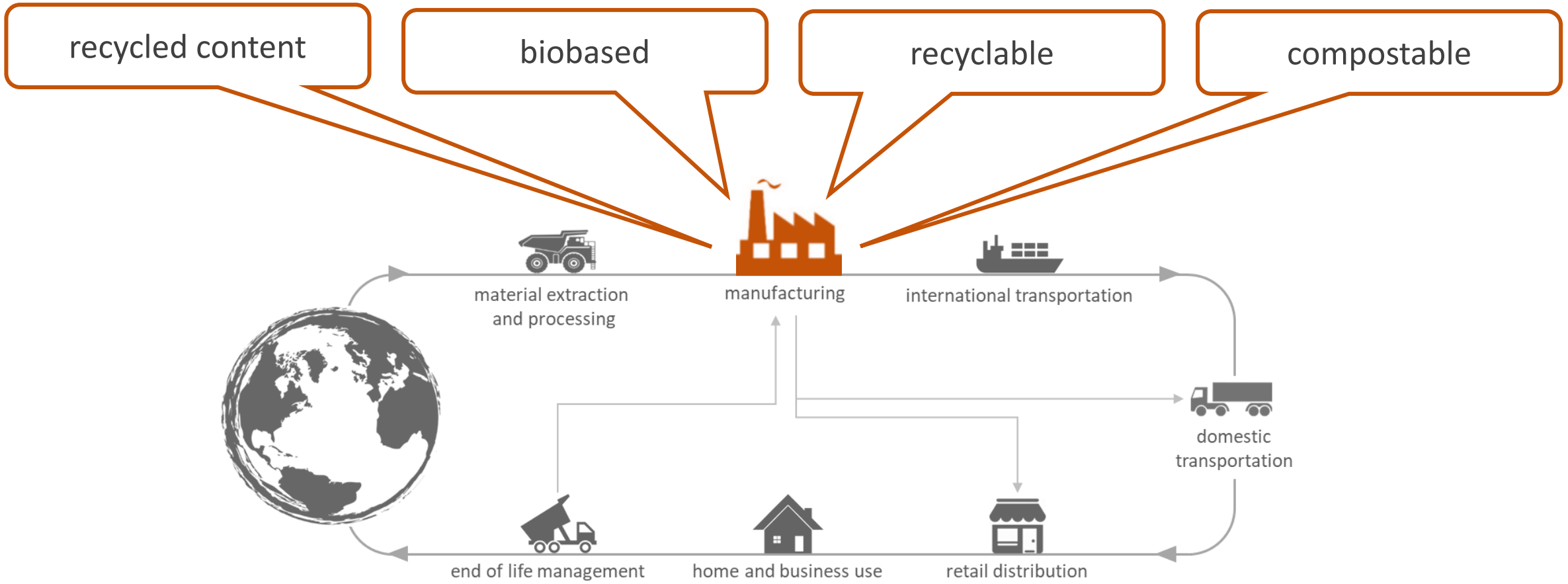
Source:*http://cccrg.cochrane.org/*

product categories

PACKAGING

FOOD SERVICE WARE

four materials attributes reviewed



literature sources

- International Journal of Life Cycle Assessment (IJLCA)
- Journal of Industrial Ecology (JIE)
- Journal of Cleaner Production (JCP)
- Environmental Science & Technology (ES&T)
- Packaging Technology and Science (PT&S)
- LCA studies published by other reputable sources including: Oregon DEQ, Franklin Associates, Quantis, thinkstep, dissertations, and published technical reports.

inclusion criteria

- Surveyed existing research between 2000-2017
- Limited to credible and publically accessible sources and journals
- Published and peer-reviewed studies that followed ISO 14040, 14044
- Must be comparative and include at least one attribute of interest

- NOTE: All comparisons reported are those found within studies, meaning that no harmonization across studies was conducted
  - Therefore all parameters remained consistent for comparisons (e.g. for system boundary, method, results, time, geography, technology)

evaluation framework

Ratio = Impact result with attribute A ÷ Impact result without attribute A		
Category	**Ratio**	**Interpretation**
Meaningfully Lower Life Cycle Impact	<0.75	Suggests the attribute is potentially a good indicator of environmental performance
Marginally Lower Life Cycle Impact	≥0.75 and <1.0	Marginal difference
No difference	1.0	No difference
Marginally Higher Life Cycle Impact	>1.0 and ≤1.25	Marginal difference
Meaningfully Higher Life Cycle Impact	>1.25	Attribute is potentially not a good indicator of environmental performance
The lower the ratio value, the lower the environmental impact of the material(s) being evaluated (*with* the attribute) compared to the equivalent material *without* the attribute.		

external advisory group

acgov.org
County of Alameda, CA

STOPWASTE
at home • at work • at school

DEPARTMENT OF ECOLOGY
State of Washington

Metro

City of Seattle

MINNESOTA POLLUTION CONTROL AGENCY

CalRecycle

SUSTAINABLE PACKAGING COALITION®
A PROJECT OF GREENBLUE

SUSTAINABLE PURCHASING LEADERSHIP COUNCIL

Eugene

U.S. GREEN BUILDING COUNCIL USGBC

CITY OF PORTLAND, OREGON 1851

NEWMOA
NORTHEAST WASTE MANAGEMENT OFFICIALS' ASSOCIATION

discussion pause

results

https://www.oregon.gov/deq/mm/production/Pages/Materials-Attributes.aspx

State of Oregon: Productio...

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Popular Packaging Attributes

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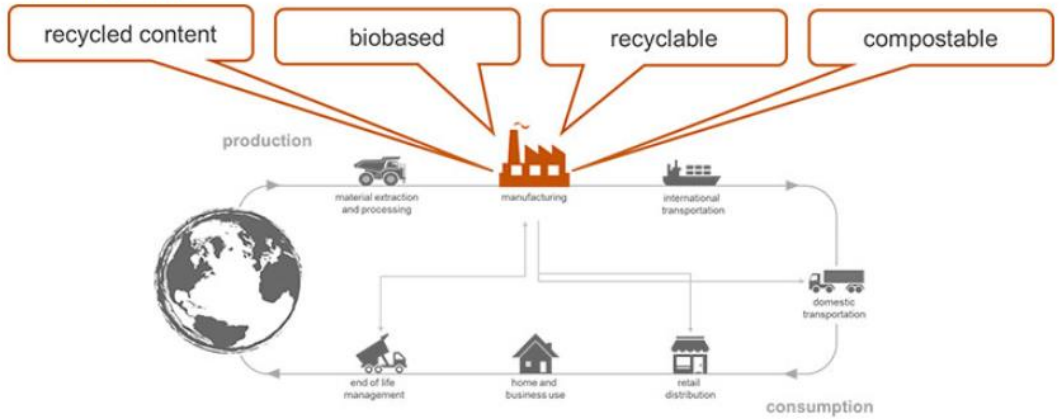
  - Packaging
  - ►**Popular Packaging Attributes**
  - Water Bottle Study
  - Single-Use Bags And Reusable Bags
- ⊞ Learn More

When making purchasing choices we often make assumptions about the environmental-friendliness of a product based on the descriptions on the packaging. It is common to see characteristics, or "attributes," describing the material used such as made from recycled or bio-based material, and what we can do with the package after the product is removed (e.g. whether it is recyclable or compostable). Many people assume that these attributes convey reduced environmental impacts relative to other options without that same attribute. But, how well do these descriptors actually predict lower impacts across the entire packaging life cycle? That is what DEQ wanted to understand because a lot of time, energy and money is spent on developing packaging to be fully recyclable or compostable, or to be made from biobased and recycled materials.

Research question: How well do popular packaging attributes correlate with net environmental benefit across the full life cycle of packaging from resource extraction to manufacture, distribution, use, and discard?

Four attributes were examined.

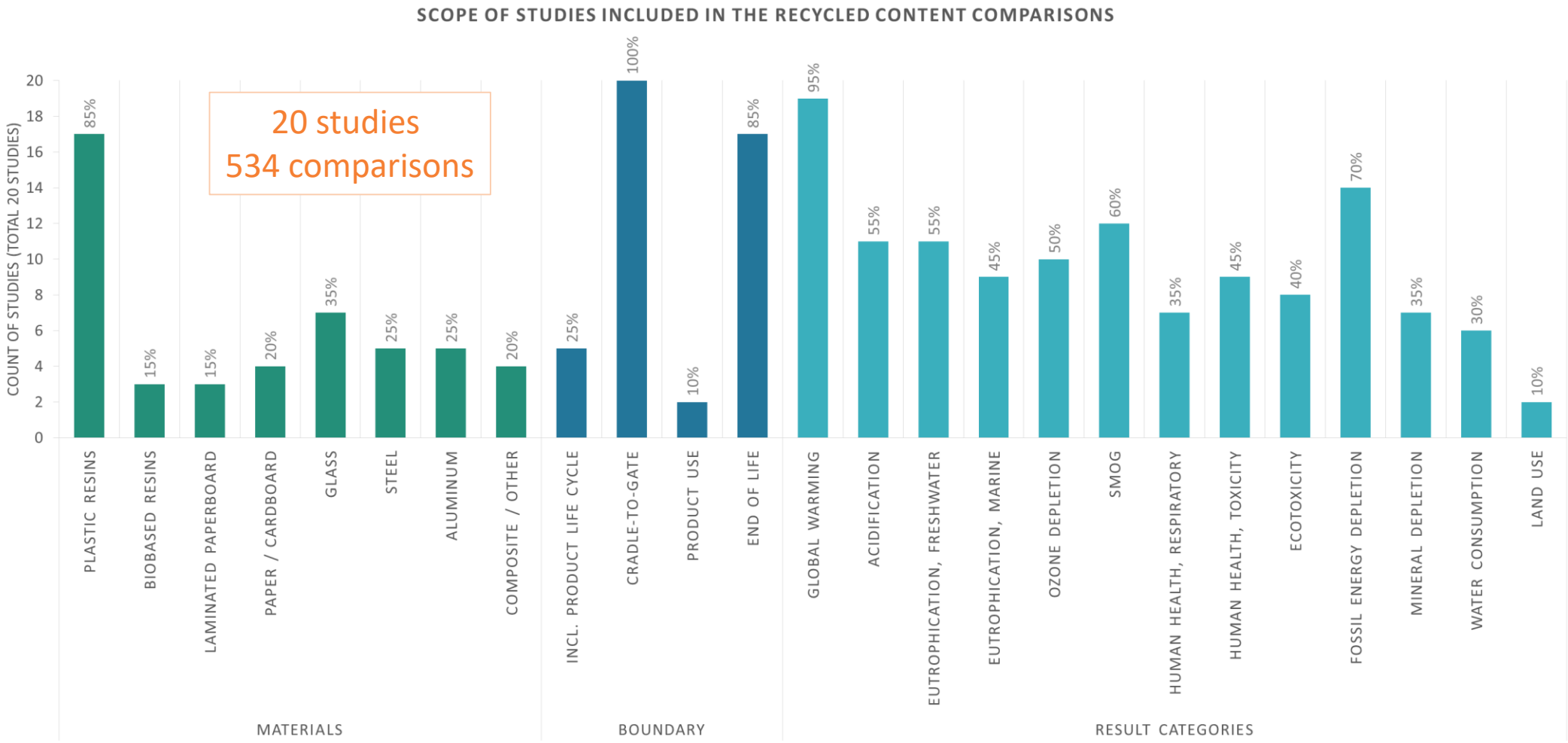


recycled content – packaging

The portion of materials used in a product that have been diverted from the solid waste stream.

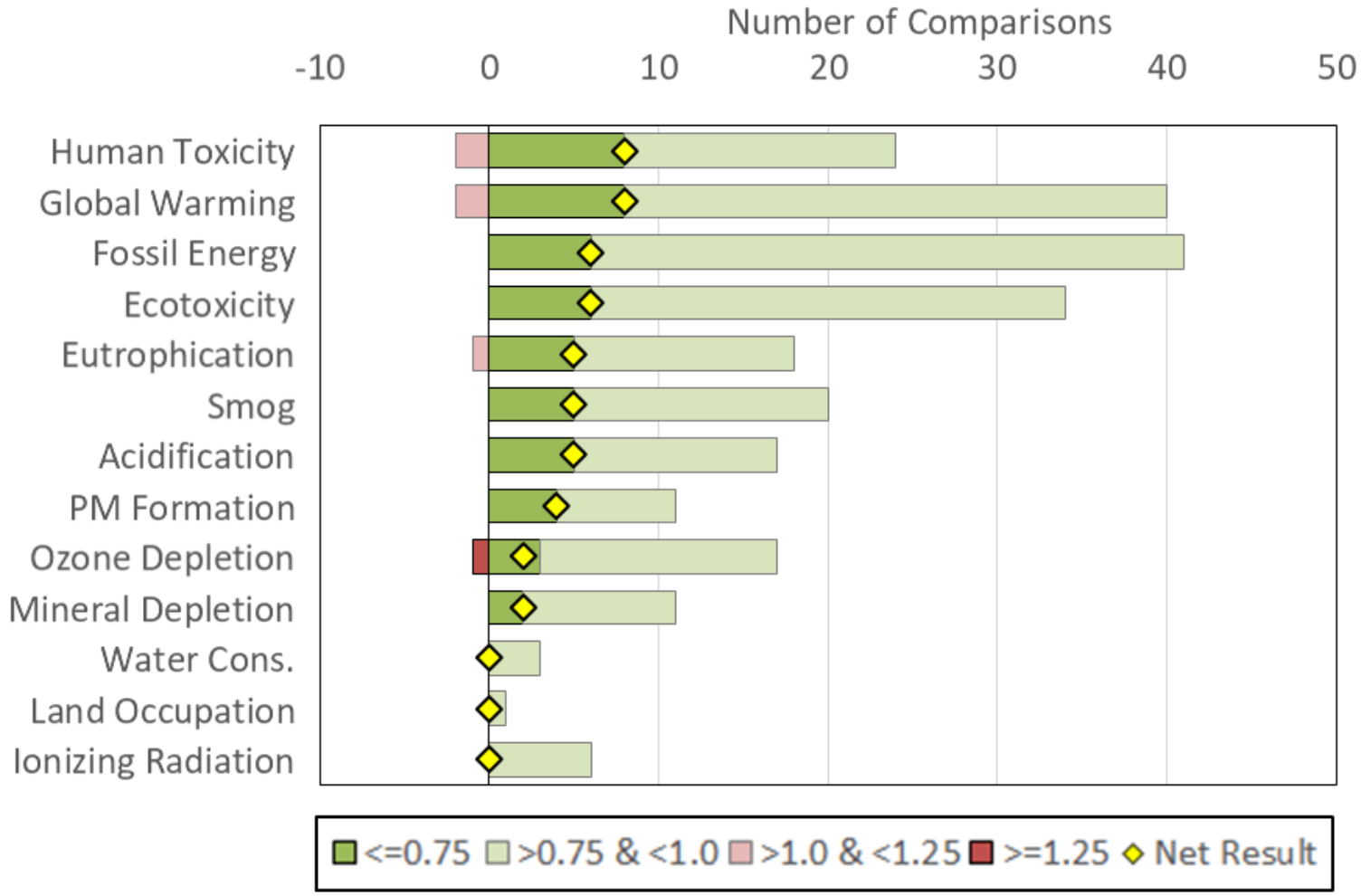
recycled content – packaging studies

recycled content



same material packaging with higher PCR vs. lower PCR

recycled content

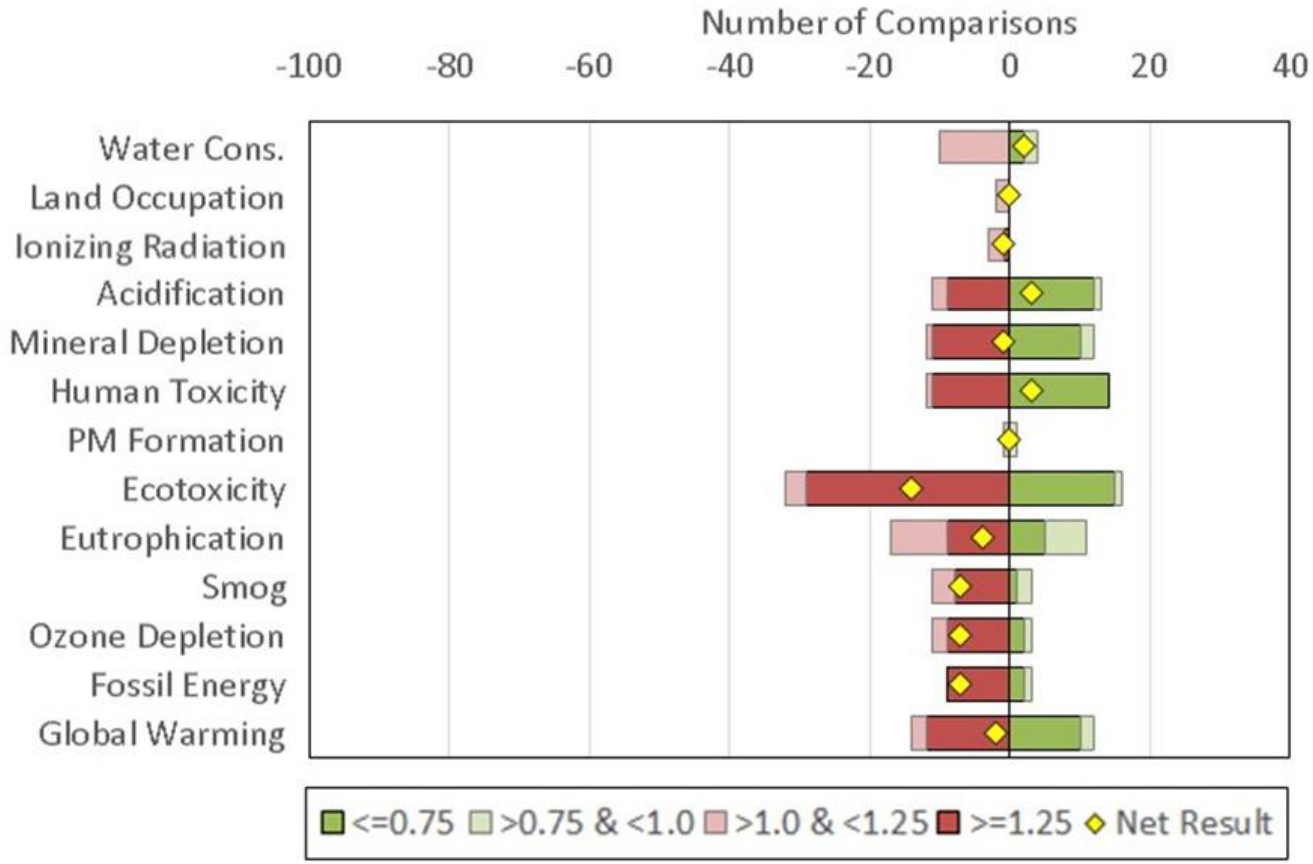


example: recycled content across different materials

steel container
with recycled content

laminate container
without recycled content

Comparing different packages based on PCR



When considering individual impact categories, the results comparing packaging systems made of a material with higher recycled content with a packaging system of different material with lower or no recycled content are mixed.

summary – recycled material

recycled content

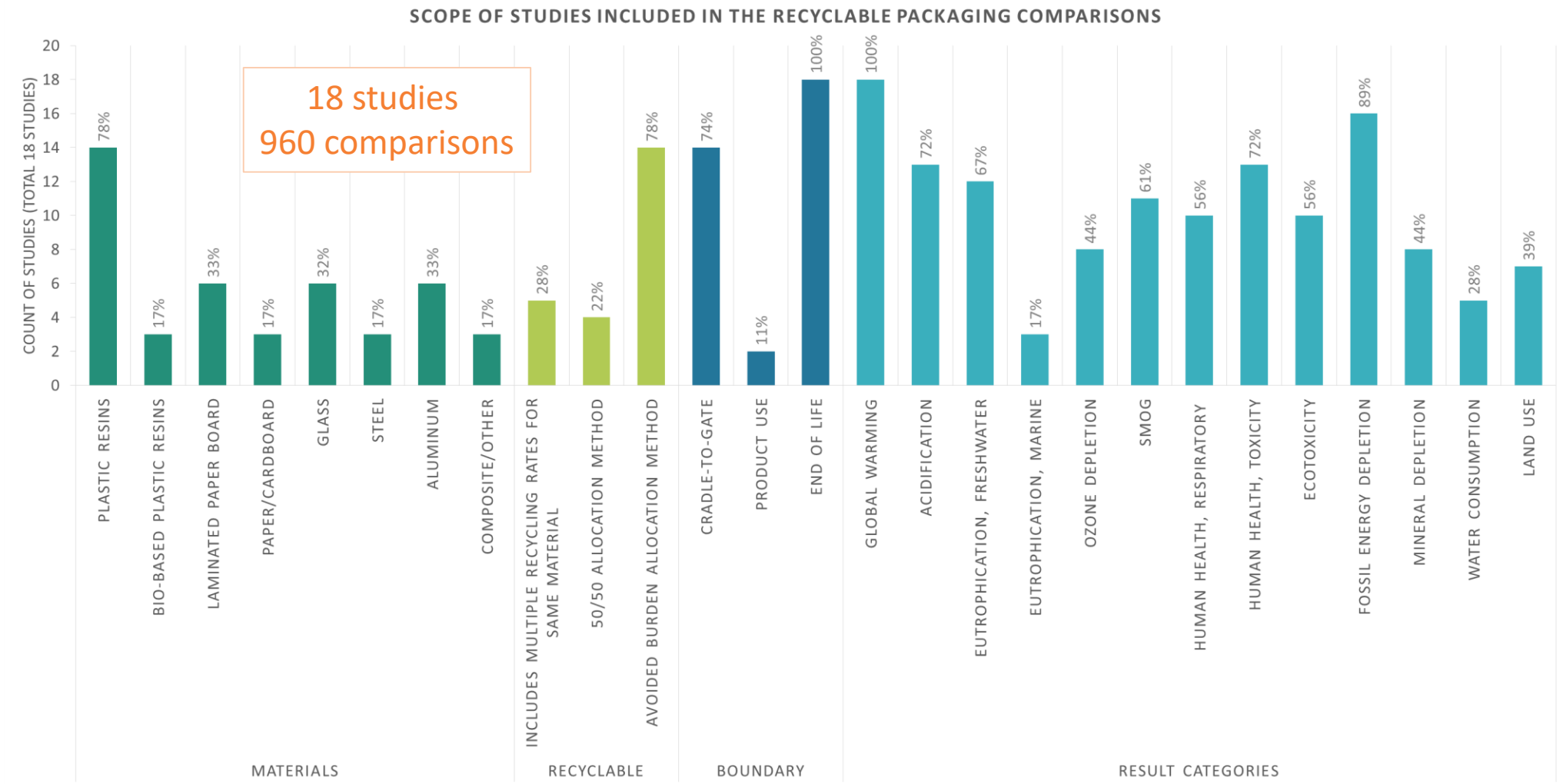
1. When comparing packaging of the same material, selecting the packaging with more recycled content is usually environmentally preferable.
2. The reductions in life cycle impacts associated with using recycled content can vary considerably in magnitude, by material type:
   - From 60-80% for aluminum packaging down to 10-15% for inkjet cartridges made of PET
3. Literature suggest that it is not possible to infer environmental preference for a packaging of one material type over another solely based on recycled content.

recyclable – packaging

The potential for a material to be recovered from the solid waste stream to be made into a new product at the end of a prior product's useful life.

recyclable – packaging studies

recyclable packaging

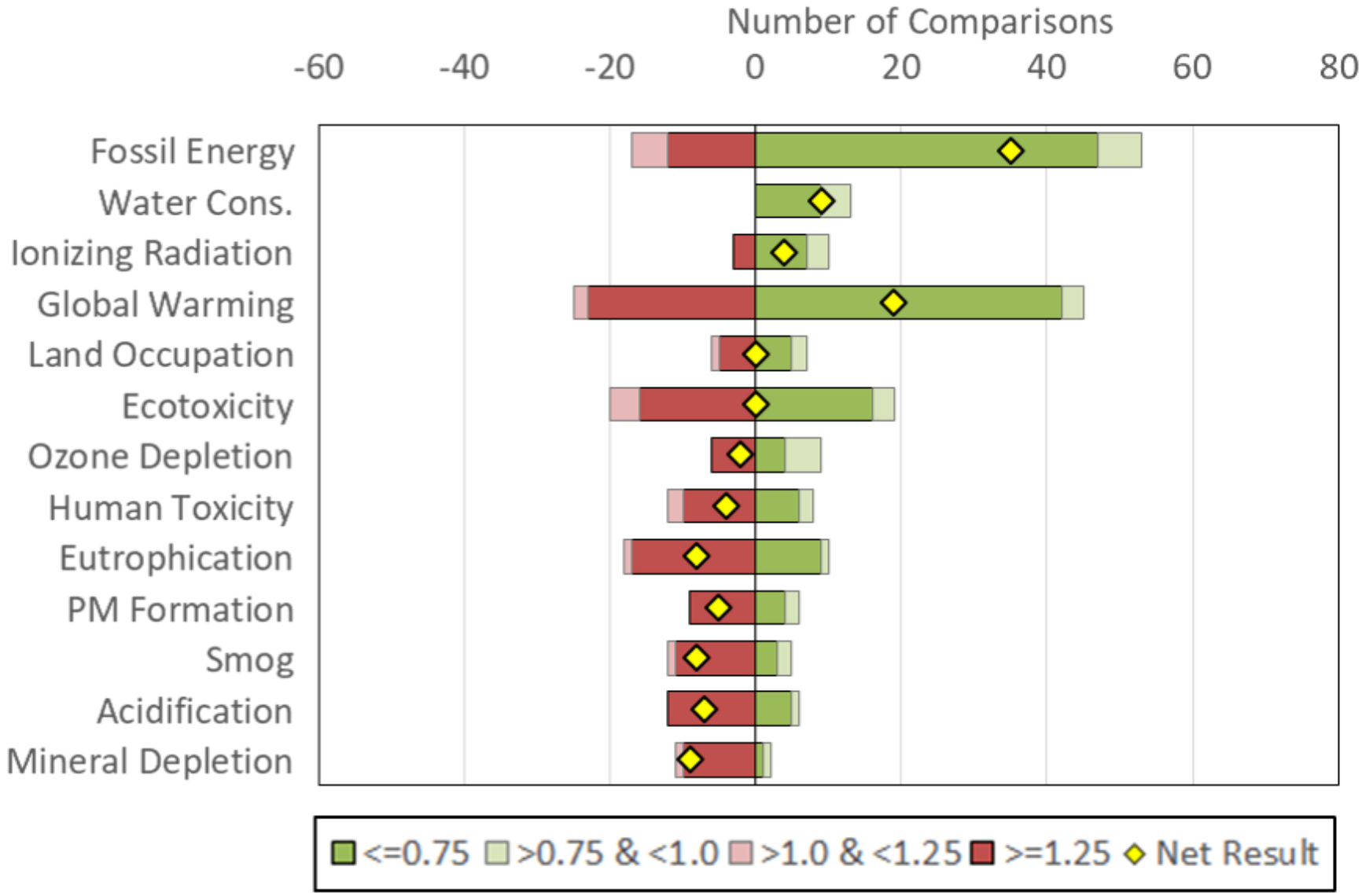


example: recyclable packages of different materials

glass container
that is recyclable

laminated container
that is not recyclable

Comparing different packages based on recyclability



summary – recyclable packaging

recyclable packaging

1. Generally: recycling results in fewer environmental impacts than landfilling or incineration, and higher recycling rates are generally preferable to lower recycling rates.
2. But, *recycling* and *recyclability* are different concepts.
3. Results of comparing packaging made from different materials suggest that packaging weight and material type considerations are a better predictor of environmental impacts than the attribute of recyclability.
4. LCA literature is inconclusive regarding the benefits of recyclability given differences in upstream impacts for functionally equivalent materials, market conditions and primary material replacement rates.

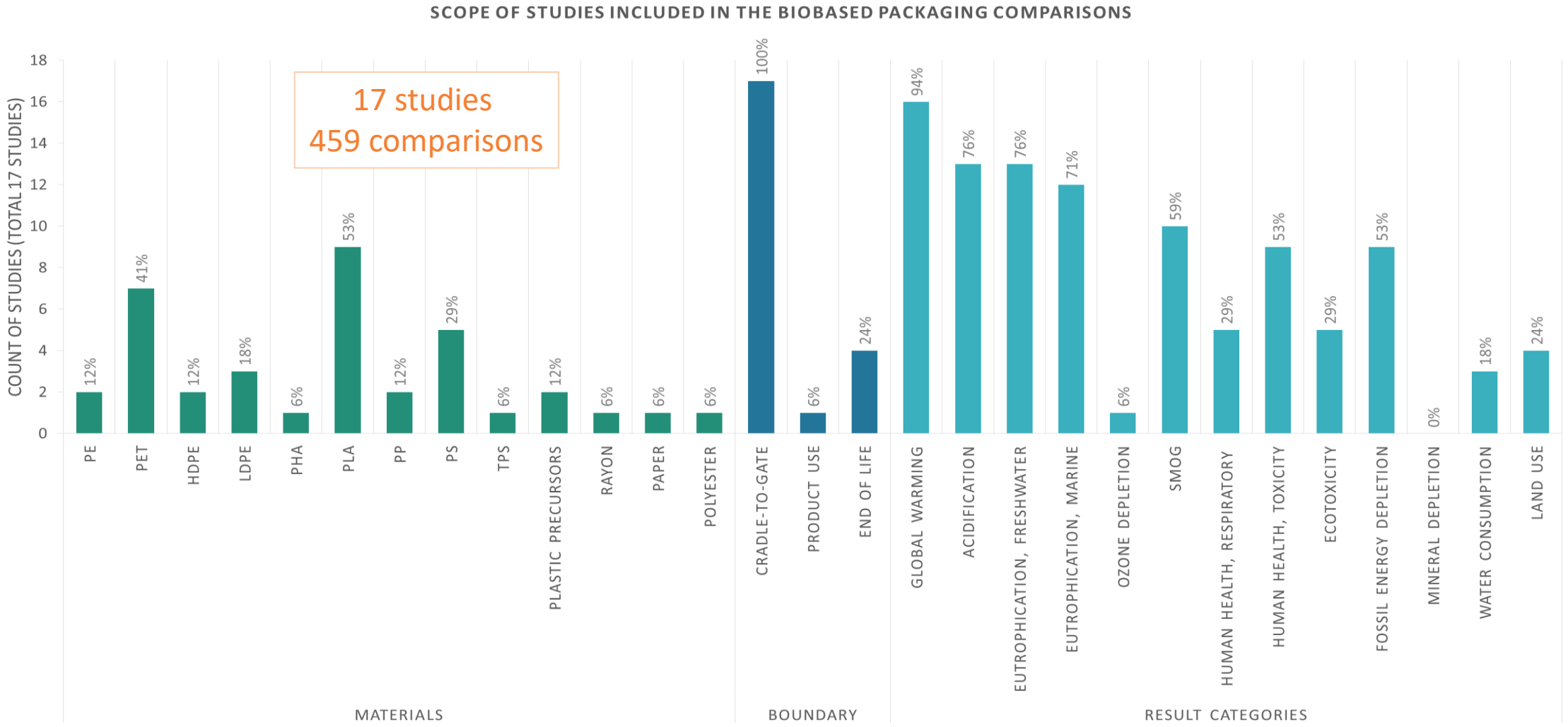
discussion pause

biobased – packaging and food service ware

Materials are made from renewable feedstocks that can be replenished as they are used or within short- or midterm timeframes.

biobased – packaging studies

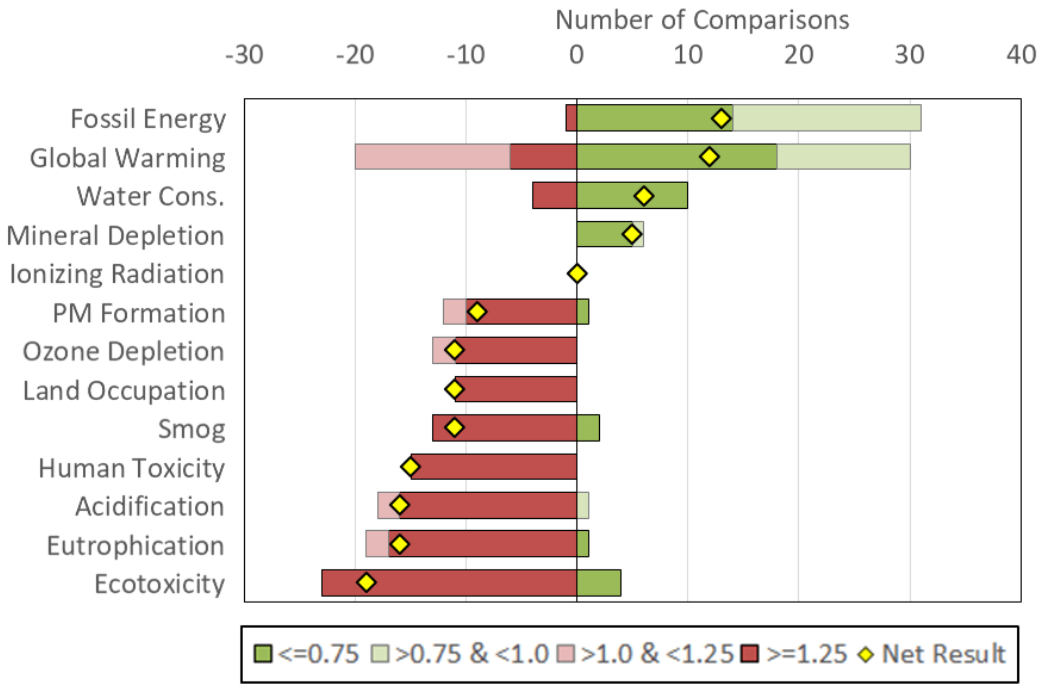
biobased content



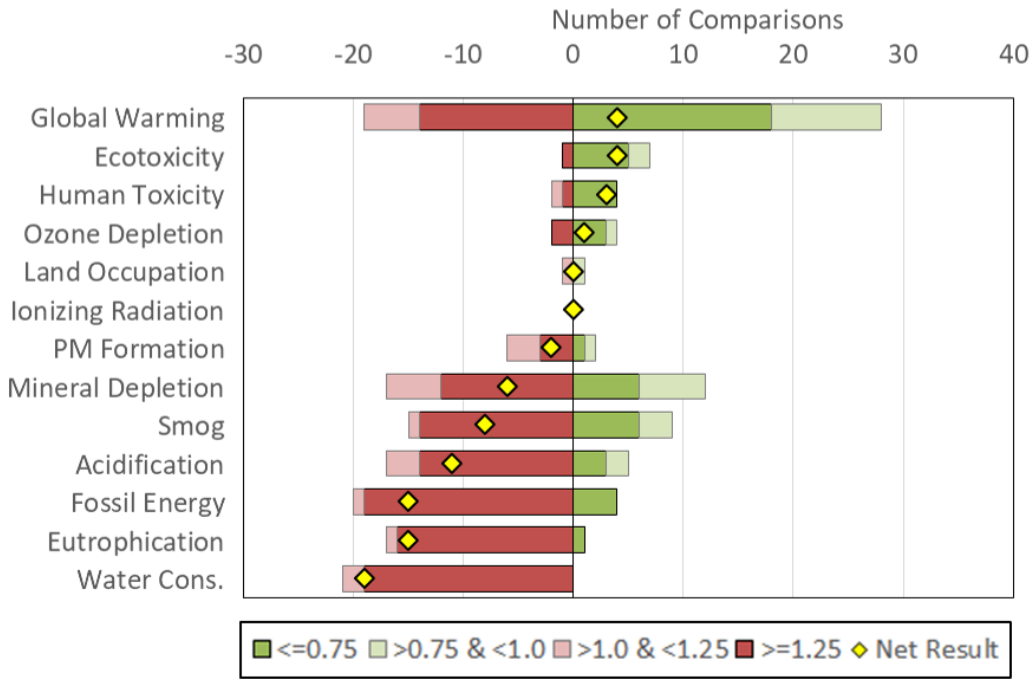
comparing different materials, biobased vs. not

biobased content

Same packaging materials
(e.g., bio-PET vs. conventional PET)



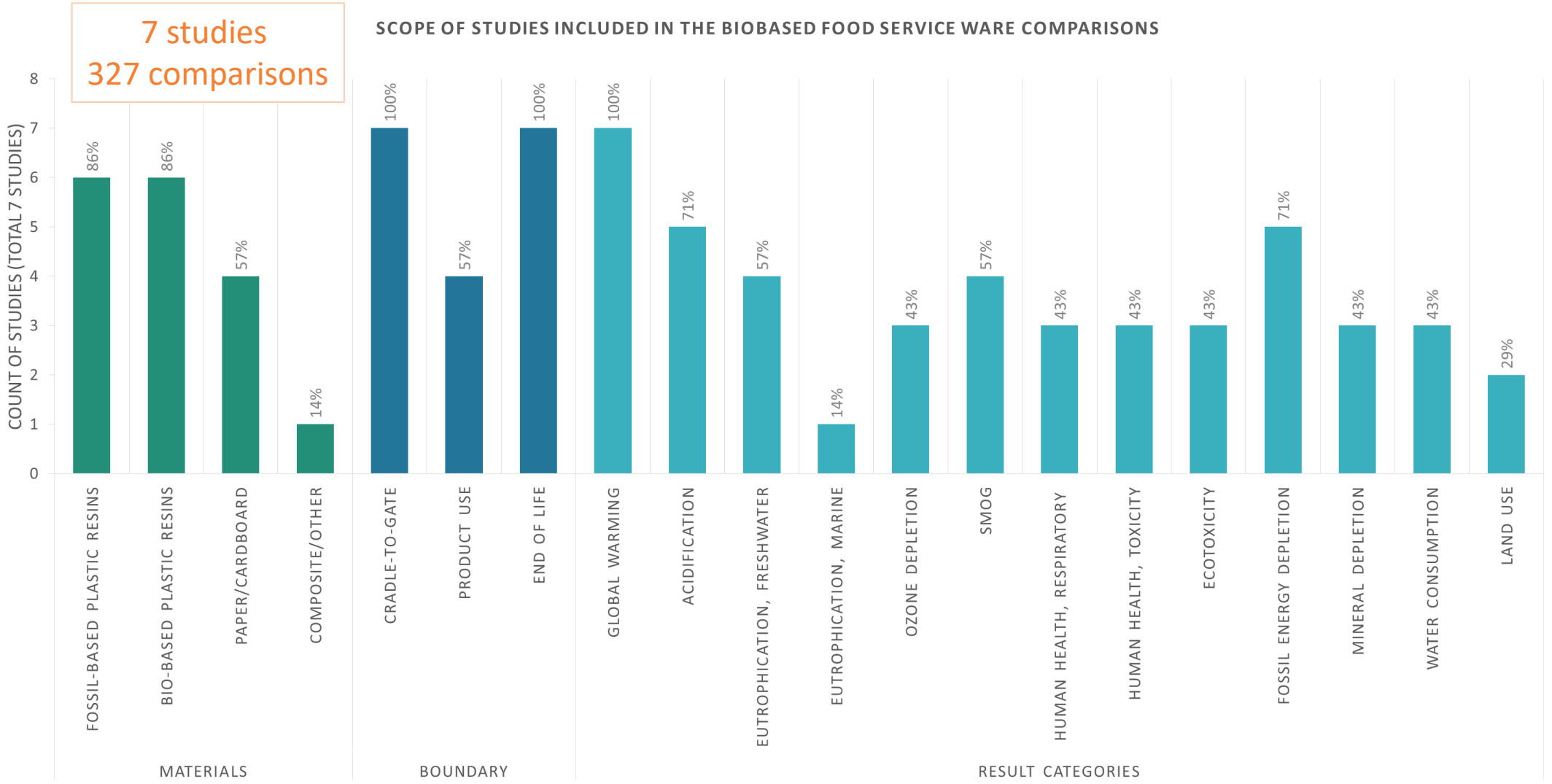
Different packaging materials



biobased – food service ware studies

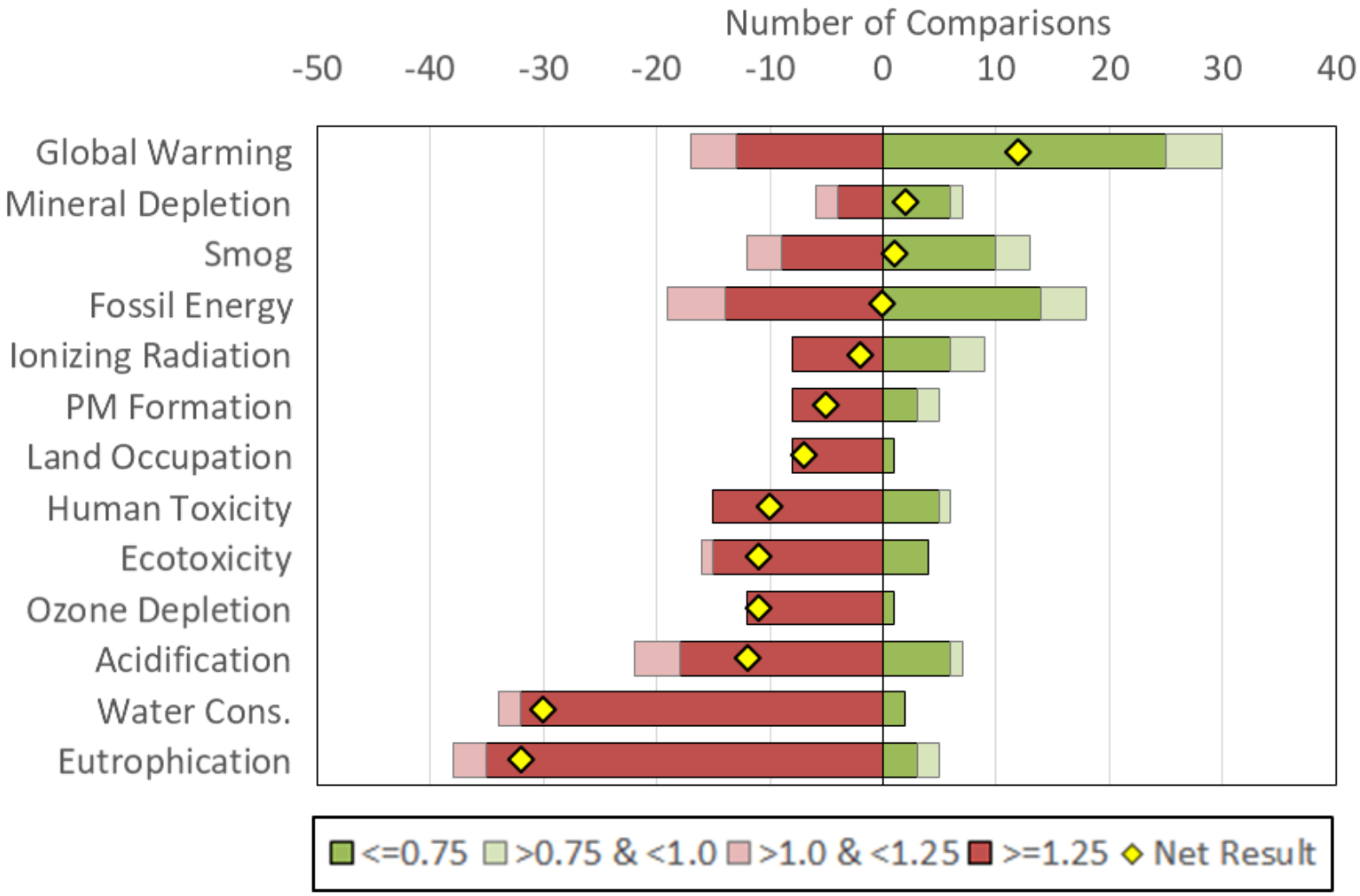
biobased content

7 studies
327 comparisons



comparing different FSW, biobased vs. not

biobased content



summary – biobased packaging and food service ware

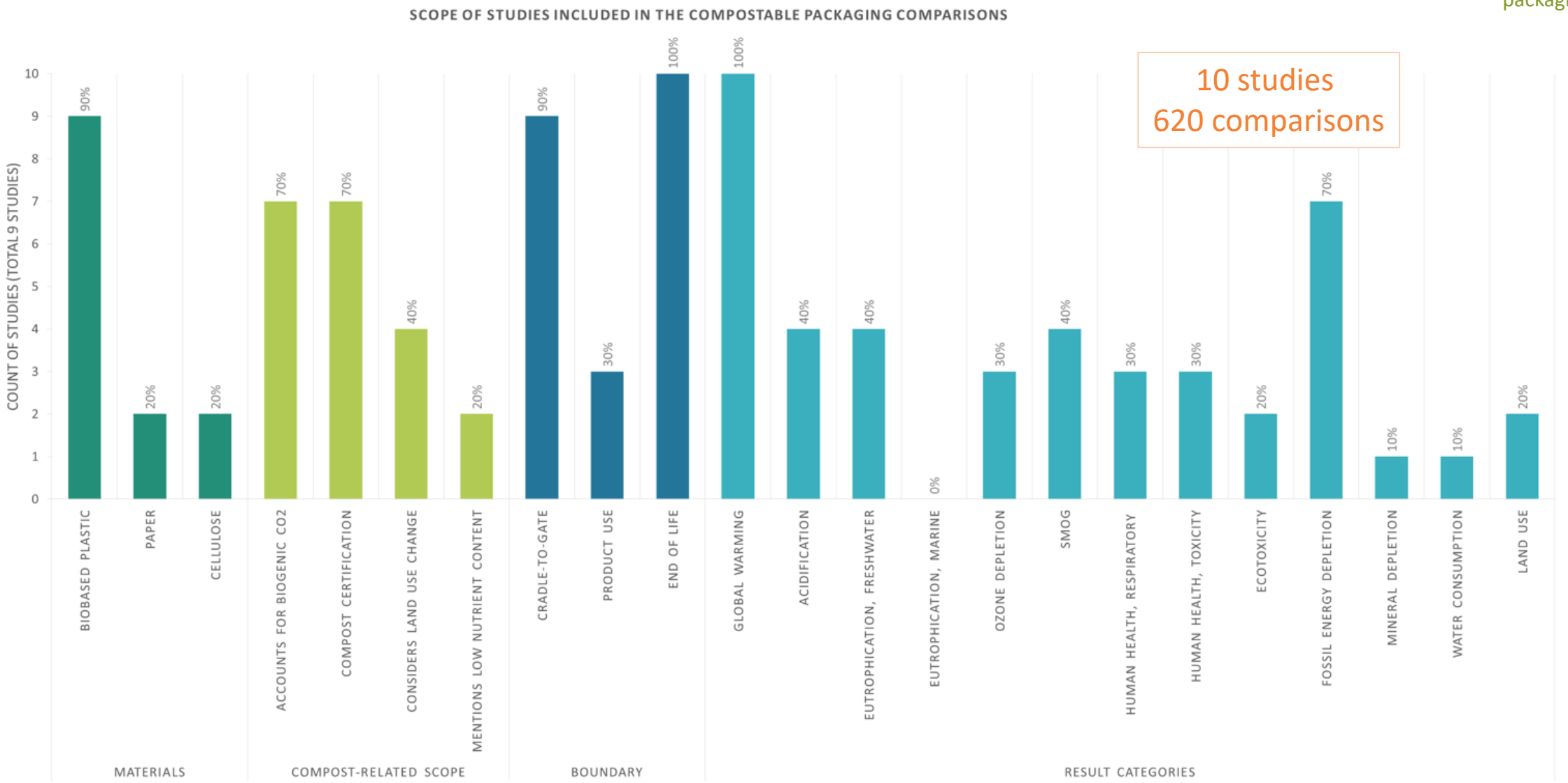
1. Most comparisons show significant environmental trade-offs between biobased and non-biobased packaging and food service ware.
2. Biobased materials had their best performances in the global warming category yet these improvements are not consistent across all materials and formats studied.
3. Agricultural production drove consistently meaningful increases in the acidification and eutrophication categories.
4. Fossil-based inputs play a central role in current practices to produce biobased feedstocks.

compostable – packaging and food service ware

Materials that degrade by biological processes to yield CO2, water, inorganic compounds, and biomass at a rate consistent with biodegradation of natural waste while leaving no visually distinguishable remnants or unacceptable levels of toxic residues.

compostability – packaging studies

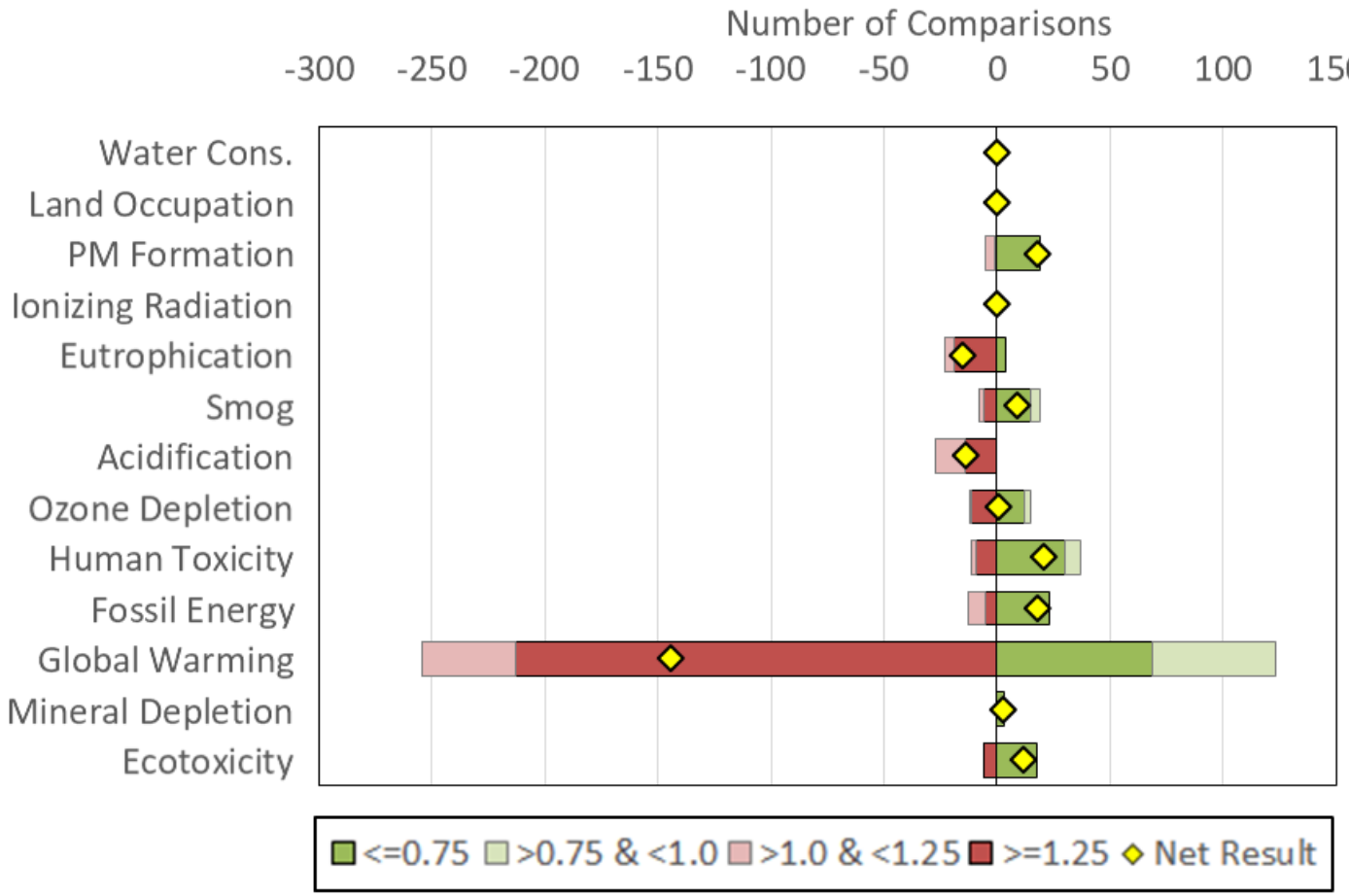
compostable packaging



10 studies
620 comparisons

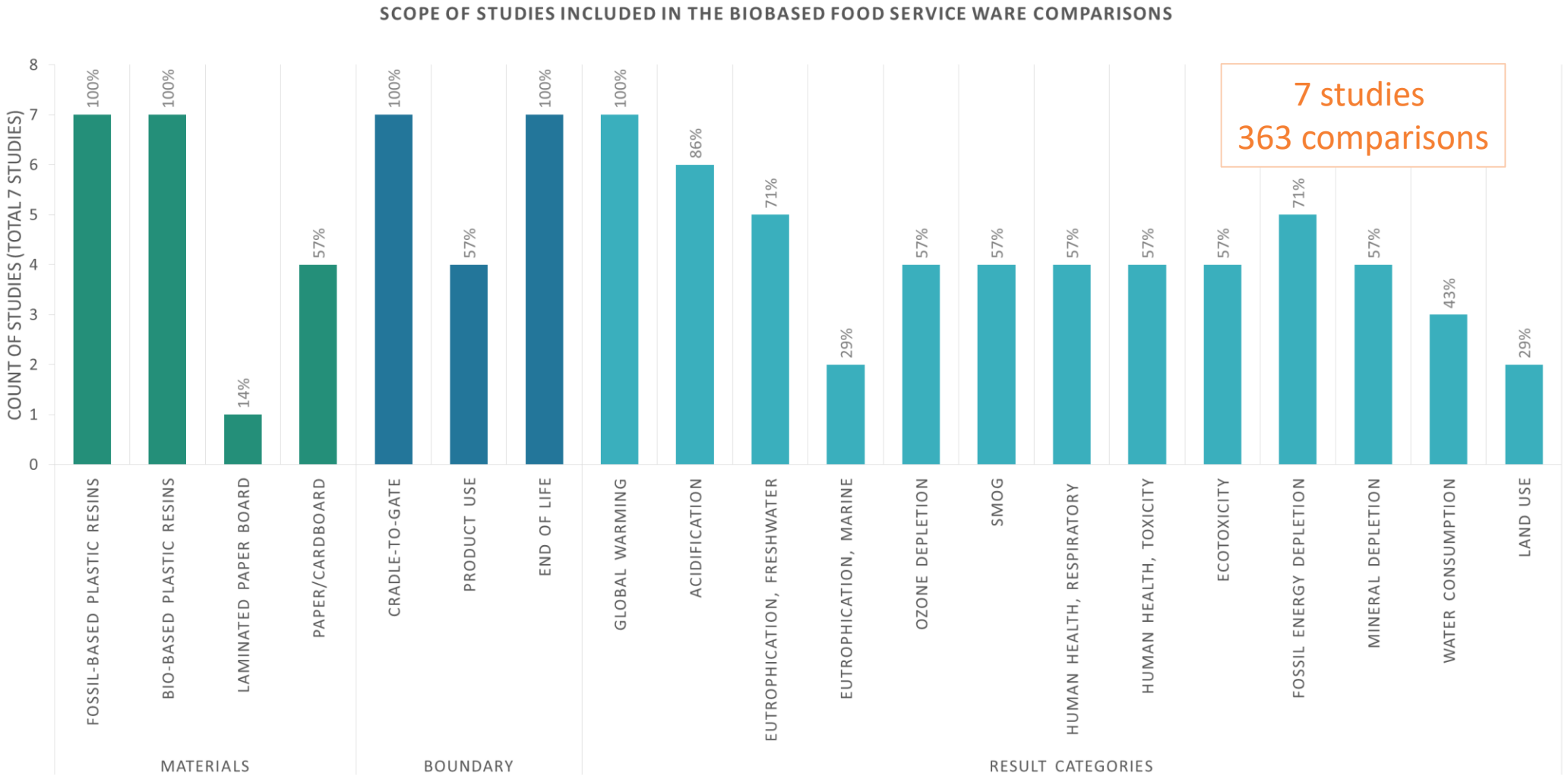
compostable packaging vs. non- compostable packaging

compostable packaging



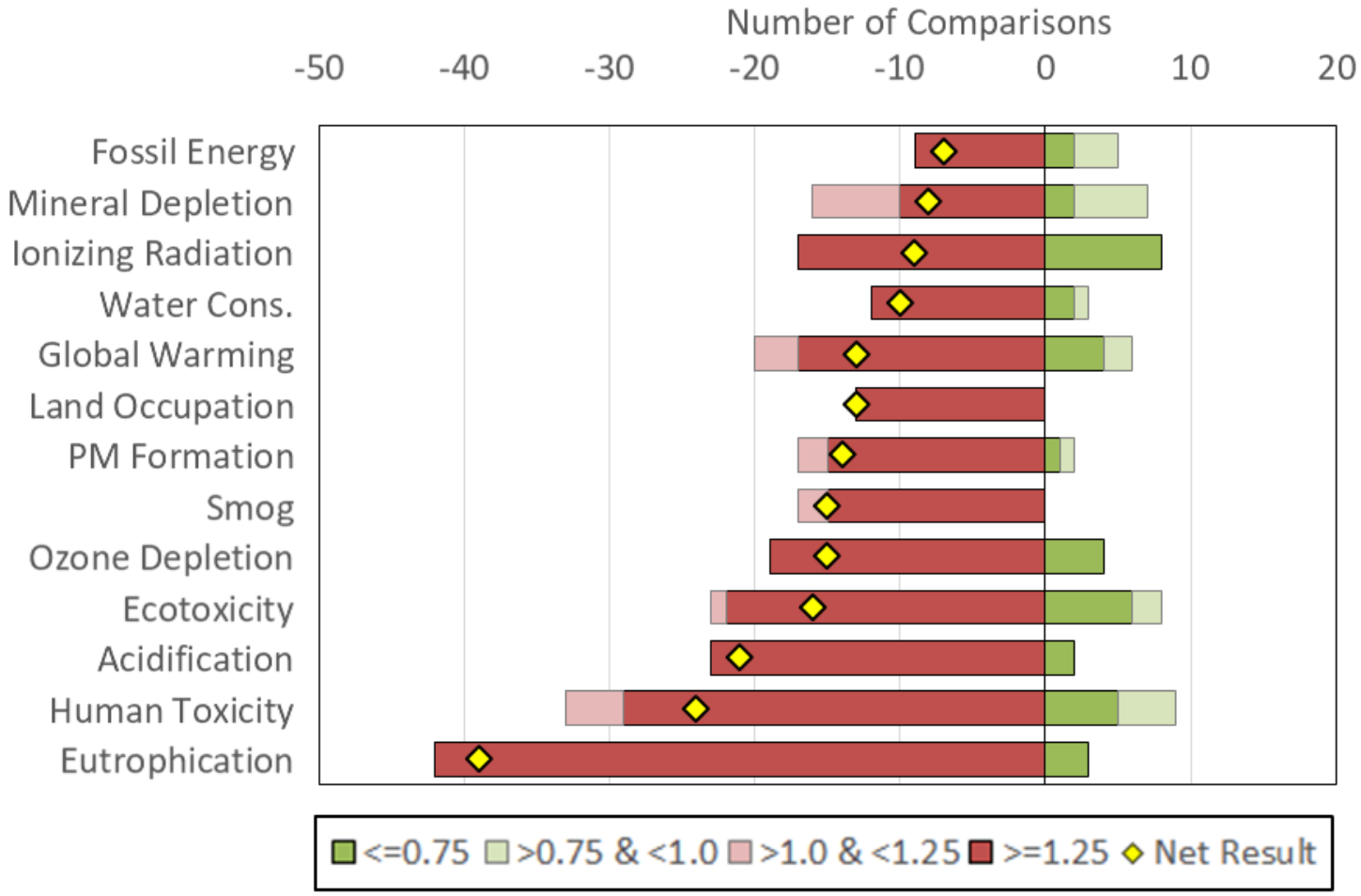
compostability – food service ware studies

compostable
food service ware



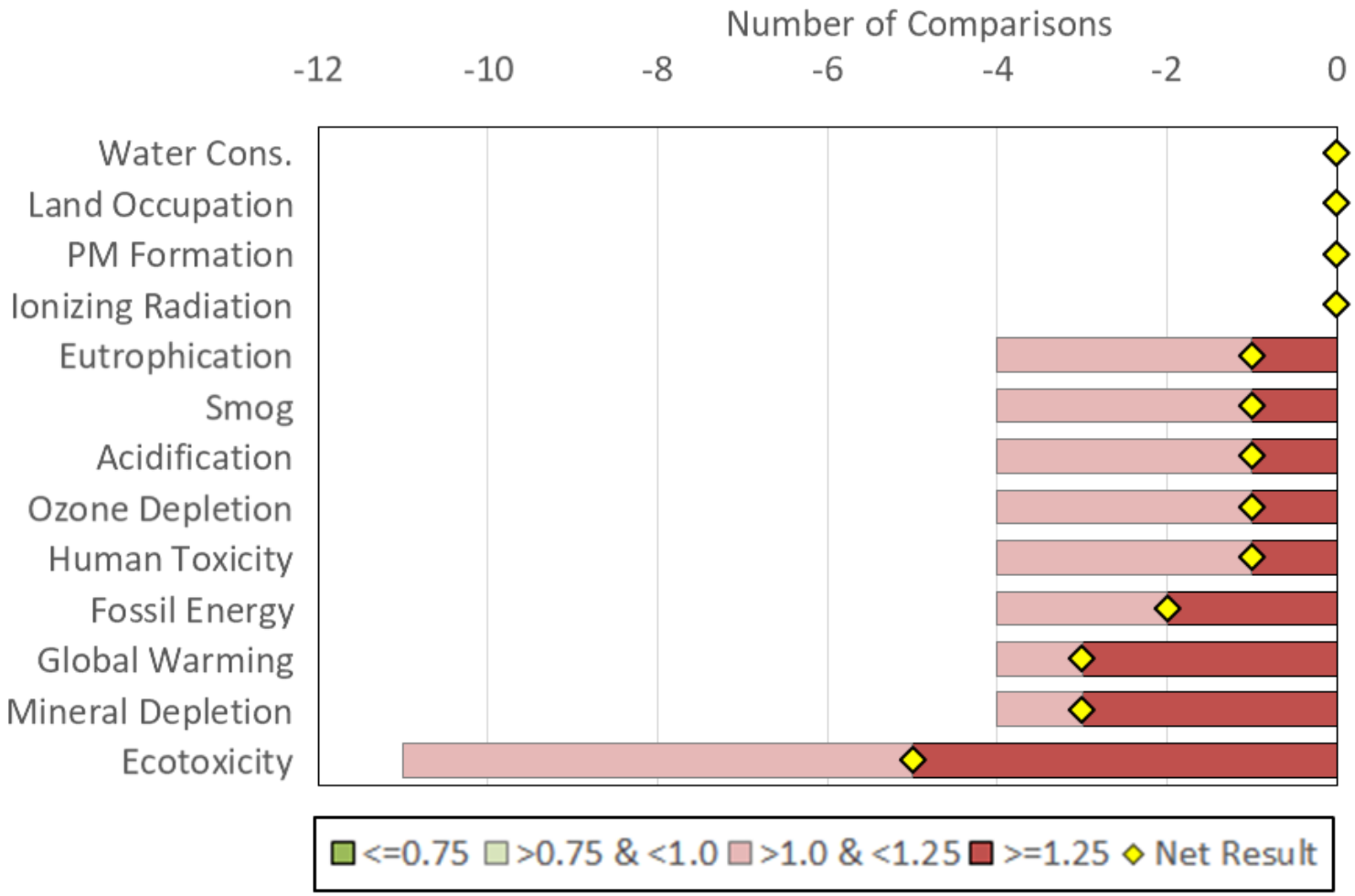
compostable FSW vs. non- compostable FSW

compostable
food service ware



compostable FSW composted vs. compostable FSW not composted

compostable
food service ware



summary – compostability

1. Compostable packaging and FSW is typically biobased and is subject to the same high variability in upstream (feedstock) impacts.
2. Compostable packaging is not consistently preferable to non-compostable packaging.
3. Compostable FSW is generally not preferable to non-compostable FSW, as it is generally biobased (often resulting in higher production impacts than fossil-based materials) and there is less benefit recouped through composting than through other waste management options.
4. A “carrier benefit” (resulting in higher food waste recovery) might change the directional results of #3 above, but has not been well quantified.
5. Compost quality and contamination are also significant issues.

implications and next steps

Some high-level implications

- Design
  - Attribute-based design strategies (e.g. design for recovery) may be increasing environmental impacts across the life cycle as end of life is typically a minor portion of the overall burdens.
- Marketing
  - Sustainability programs based on attributes often present unsubstantiated claims, teetering on greenwashing.
  - Worse, they may create a demand for higher impact items and behaviors.

Purchasing:

- Institutional buying is guided by material attributes and the approach may have unintended programmatic outcomes (e.g. USDA Bio preferred).

Policy:

- A great deal of energy is devoted to material substitution (biobased), material recovery (recyclable, compostable), and secondary markets (recycled content).
- Perceived environmental benefits do not consistently match actual environmental burdens.

next steps

- Share results
- Targeted summaries
- Workshops
- Scale through partnerships

final thoughts

materials management

conserving resources · protecting the environment · living well

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peter canepa | canepa.peter@deq.state.or.us

Report at: https://www.oregon.gov/deq/mm/production/Pages/Materials-Attributes.aspx