Rethinking Recycling

Northeast Recycling Council

19 March 2020
overview of today’s webinar

• Review of environmental conditions and the overarching challenge
• Benefits – and limitations – of recycling and composting
• Alternatives: waste prevention and reuse
• Zero Waste and Circular Economy
• The limitations of “disposal aversion”
• A modest proposal
the materials “life cycle”
Gulf of Mexico ‘dead zone’ is the largest ever measured

June outlook foretold New Jersey-sized area of low oxygen

August 2, 2017 —

At 8,776 square miles, this year’s dead zone in the Gulf of Mexico is the largest ever measured.

(Courtesy of N. Rabalais, LSU/LUMCON)

Download Image
toxic chemicals
habitat and species loss

The Aggie Transcript; University of California, Davis
climate change
problem statement

1. We need to use resources below a level that our planet can provide in perpetuity.

2. We need to emit wastes below the level(s) that our planet can safely absorb/metabolize in perpetuity.
Oregon’s contribution to climate change 1990 – 2017

Consumption-based Inventory

Sector-based (in-boundary) Inventory

million metric tons of carbon dioxide equivalent

Oregon’s contribution to climate change 1990 – 2017

Consumption-based Inventory

- Materials: 41%
- Services: 26%
- Electricity and Fuels: 33%

million metric tons of carbon dioxide equivalent
Oregon’s 2015 consumption-based GHG emissions – materials only

- Disposal: 1%
- Production: 99%
energy and greenhouse gas benefits of recycling

- Recycling in Oregon in 2016 saved ~27 trillion BTUs of energy
  - ~2.8% of total statewide use
  - Equivalent of ~220 million gallons of gasoline

- Recovery in Oregon in 2016 reduced greenhouse gas emissions by ~2.9 million metric tons of CO2e
  - ~4.7% of total statewide emissions
  - Equivalent of 690,000 “average” passenger cars
  - Most benefits are upstream, not downstream
Oregon’s contribution to climate change 1990 – 2017

Consumption-based Inventory

- Materials: 41%
- Services: 26%
- Electricity and Fuels: 33%

Million metric tons of carbon dioxide equivalent

Oregon’s contribution to climate change 1990 – 2017

Consumption-based Inventory

- Electricity and Fuels
- Services
- Materials

90% Recycling & Composting

million metric tons of carbon dioxide equivalent
Drinking water options: dispose, recycle, or reduce?

Relative Impact (Plastic bottle, no recycling = 100)

- Energy Use
- Climate Change
- Acidification
- Ecotoxicity
- Human Respiratory Health

Plastic bottle, no recycling

Source: Oregon DEQ
Drinking water options: dispose, recycle, or reduce?

- Relative Impact (Plastic bottle, no recycling = 100)
  - Energy Use
  - Climate Change
  - Acidification
  - Ecotoxicity
  - Human Respiratory Health

- Blue bars: Plastic bottle, no recycling
- Red bars: Plastic bottle, 80% recycling

Source: Oregon DEQ
Drinking water options: dispose, recycle, or reduce?

Source: Oregon DEQ
2015 Food Waste Analysis

2015 food waste if no recovery

MMTCO2E (Million metric tons of CO₂ equivalent)

-0.5 0 0.5

Credits/Offsets  Disposal/Handling
food waste (Oregon)

2015 Food Waste Analysis

- 2015 food waste if no recovery
- 2015 food waste, actual recovery rate (8%)

MMTCO2E (Million metric tons of CO₂ equivalent)

- Credits/Offsets
- Disposal/Handling
food waste (Oregon)

2015 Food Waste Analysis

- 2015 food waste if no recovery
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- 2015 food waste if recovery rate were 25%

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Credits/Offsets
Disposal/Handling
2015 Food Waste Analysis

2015 food waste if no recovery
2015 food waste, actual recovery rate (8%)
2015 food waste if recovery rate were 25%

MMTCO2E (Million metric tons of CO₂ equivalent)

- Credits/Offsets
- Disposal/Handling
- Upstream
food waste (Oregon)

2015 Food Waste Analysis

- 2015 food waste if no recovery
- 2015 food waste, actual recovery rate (8%)
- 2015 food waste if recovery rate were 25%
- Food Waste, Generation 40% below 2012 levels, 25% recovery rate

MMTCO2E (Million metric tons of CO₂ equivalent)

- Credits/Offsets
- Disposal/Handling
- Upstream
“zero waste” and “circular economy”
Zero Wastes, or Zero Waste?

All Wastes, or just Solid Waste?
circular economy

**Design out waste and pollution**
A circular economy reveals and designs out the negative impacts of economic activity that cause damage to human health and natural systems. These costs include: the release of greenhouse gases and hazardous substances; the pollution of air, land, and water; and structural waste, such as underutilized buildings and cars.

**Keep products and materials in use**
A circular economy favours activities that preserve value in the form of energy, labour, and materials. This means designing for durability, reuse, remanufacturing, and recycling to keep products, components, and materials circulating in the economy. Circular systems make effective use of biologically based materials by encouraging many different economic uses before nutrients are returned to natural systems.

**Regenerate natural systems**
A circular economy avoids the use of non-renewable resources where possible and preserves or enhances renewable ones, for example by returning valuable nutrients to the soil to support natural regeneration.
challenges of “landfill aversion”

1. Frames the problem as a “waste” problem
2. Appears to deactivate/undermine solutions in the upper tiers of the hierarchy
3. Contributes to “wishful recycling” (= contamination)
4. Encourages “design for recovery” at the (potential) expense of “design for environment”
the “disposal problem” is much smaller than the “production-consumption” problem
Potential to undermine/disactivate other solutions
the “waste management” hierarchy

Reduce
Reuse
Recycle
Compost
Energy Recovery
Landfill

Equals?
the “waste management” hierarchy

- Landfill (Bad)
- Compost
- Recycle
- Reuse
- Reduce
- Not Disposal (Good)
Oregon’s approach (goals)

- **Reduce Generation** (Reduce, Reuse)
- **Increase Recovery** (Recycle, Compost, limited energy recovery)
landfill aversion → contamination
NORPAC (Longview) pulper rejects as suppliers switched to commingled collection
Recycling, if not done well, can cause harm

Photos: Megan Ponder
“Recyclable” not always lowest impact
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.”
## US EPA coffee study

<table>
<thead>
<tr>
<th>Coffee Packaging (11.5 oz product)</th>
<th>Recyclable postconsumer?</th>
<th>Energy Consumption (MJ/11.5 oz.)</th>
<th>CO2 eq Emissions (lbs/11.5 oz)</th>
<th>MSW Waste Generated (lbs./ 100,000 oz. of product)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel can – yes Plastic lid – no</td>
<td></td>
<td>4.21</td>
<td>0.33</td>
<td>1,305</td>
</tr>
<tr>
<td>Plastic container – yes Plastic lid - no</td>
<td></td>
<td>5.18</td>
<td>0.17</td>
<td>847</td>
</tr>
<tr>
<td>Flexible pouch - no</td>
<td></td>
<td>1.14</td>
<td>0.04</td>
<td>176</td>
</tr>
</tbody>
</table>
life cycle impacts

cumulative energy demand
freshwater consumption
global warming potential
ozone depletion
human health
aquatic toxicity
eutrophication...
life cycle impacts and material attributes

[impacts]
- cumulative energy demand
- freshwater consumption
- global warming potential
- ozone depletion
- human health
- aquatic toxicity
- eutrophication

[attributes]
- biobased content
- recycled content
- recyclable
- compostable

Diagram showing the life cycle impacts of material extraction, manufacturing, international transportation, domestic transportation, end of life management, home and business use, and retail distribution. The diagram links these processes with the material attributes and impacts listed above.
DEQ attributes study (2017 – 2018)

Research question:

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

Source: http://cccrg.cochrane.org/
Evaluation: an example

Tuna

12 oz. steel can with recyclable

12 oz. laminate pouch not recyclable

Reported GWP (global warming potential) Value
(lb CO2e per 100,000 oz)

- Tuna 12 oz. steel can with recyclable: 1946.8 lb CO2e
- Tuna 12 oz. laminate pouch not recyclable: 485.8 lb CO2e

GWP for packaging with attribute = \( \frac{1946.8}{485.8} = 4.01 \)

GWP for packaging without attribute = 1.0

Worse (higher impact): 1.25  Better (lower impact): 0.75

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

**Ratio** = \( \frac{{\text{Impact result with attribute A}}}{{\text{Impact result without attribute A}}} \)

<table>
<thead>
<tr>
<th>Category</th>
<th>Ratio</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>Meaningfully Lower Life Cycle Impact</td>
<td>&lt;0.75</td>
<td>Suggests the attribute is potentially a good indicator of environmental performance</td>
</tr>
<tr>
<td>Marginally Lower Life Cycle Impact</td>
<td>≥0.75 and &lt;1.0</td>
<td>Marginal difference</td>
</tr>
<tr>
<td>No difference</td>
<td>1.0</td>
<td>No difference</td>
</tr>
<tr>
<td>Marginally Higher Life Cycle Impact</td>
<td>&gt;1.0 and ≤1.25</td>
<td>Marginal difference</td>
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<tr>
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<td>&gt;1.25</td>
<td>Attribute is potentially not a good indicator of environmental performance</td>
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same packaging material with higher PCR vs. lower PCR
comparing different packages based on PCR
“recycling” ≠ “recyclability”

Recycle \rē’-si-kəl\ vt 1: to collect and treat used objects and materials that are ready to be thrown out in order to produce materials that can be used again

Recyclable \rē’-si-klə-bəl\ adj 1: able to be recycled
comparing different packages based on recyclability

Fossil Energy  Water Cons.  Ionizing Radiation  Global Warming  Land Occupation  Ecotoxicity  Ozone Depletion  Human Toxicity  Eutrophication  PM Formation  Smog  Acidification  Mineral Depletion

Number of Comparisons

Net Result

<=0.75  >0.75 & <1.0  >1.0 & <1.25  >=1.25
popular attributes
LCA “what if” scenario assessment: coffee packaging

• Lightweight, non-recyclable plastic-foil bag

• Compare against 4 “recyclable” containers

LCA “what if” scenario assessment: coffee packaging

• Bias study to favor recyclable containers
  • Recyclables:
    • Assume that all components will be separated and recovered with no additional effort
    • Assume that all components will be recovered at the same rate
    • Assume that very high recovery rates will be achieved with no increase in contamination or marginal increases in inputs (energy, water, time, etc.)
    • Assume that all recovered material will displace virgin material at a ratio of 1-to-1
  • Assume no recycling, recovery or other improvements for the flexible bag

• Consider variable recycling rates (0 – 100%)
  • Calculate the “break-even” point where recyclable/recycled has equal (or lower) impact as the non-recyclable bag
recovery rates where recyclables “break even” with non-recyclable coffee bag (environmental impacts)

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<th>Plastic Jar</th>
<th>Paper Can</th>
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<tr>
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<td>13%</td>
<td>&lt;0%</td>
<td>&lt;0%</td>
<td></td>
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<tr>
<td>Primary energy, nonrenewable (net cal. value)</td>
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<td>Acidification</td>
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<td>Global warming (excluding biogenic)</td>
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compostable packaging vs. non-compostable packaging
Oregon composters’ statement

A Message from
Composters Serving Oregon:

Why We Don’t Want Compostable Packaging and Serviceware

Every year, the Pacific Northwest’s compost industry turns hundreds of thousands of tons of yard and food wastes into nutrition-rich compost for agricultural, nurseries, landscaping businesses and home gardeners. The quality compost products that we create develop healthier and more resilient soil, reduce greenhouse gas emissions, recycle nutrients, conserve water, and may reduce the use of synthetic fertilizers, pesticides and herbicides.

“Compostable” packaging and serviceware items have been on the rise for the past decade and they are increasingly ending up in our facilities. These materials compromise our composting programs and limit many of the environmental benefits of successful composting.

Here are nine reasons why we don’t want “compostable” packaging or serviceware delivered to our facilities:

1. They don’t always compost. Not all “certified” compostable items will actually compost down as fully or quickly as we need them to. This is because certification standards for compostability vary on a case-by-case basis. Those conditions are not always replicated in the real world (our facilities) which means that some “compostable” material is not fully composted. The result is a finished compost that is contaminated with bits of partially degraded “compostable” material.

2. Contamination happens. As a consumer, you may not know it, but your neighbor might. When collection programs accept compostable products, non-compostable (look-alike) items inevitably end up in the mix. These materials then must be removed, either at the start (when we receive them) or at the end (as pieces of garbage mixed in with finished compost). Either way, the contamination increases our operating costs and degrades the quality of our product, which makes the compost industry less economically viable.

3. They harm quality. We don’t want to produce finished compost that is contaminated with fragments of packaging and serviceware, and our consumers won’t purchase contaminated material. Contamination lowers the value of our product, making it difficult and sometimes impossible to sell. When fewer people use compost, its environmental benefits aren’t realized.

4. We can’t tell to organic farmers: Farmers often use compost in the production of certified organic foods. National standards prohibit the use of any different-packaging materials when making compost used to grow extra-certifying Organic Foods. Accepting packaging and serviceware at our facilities hinders our ability to provide finished compost to organic farmers.

5. They may threaten human and environmental health. Packaging designed for water and grease resistance as well as other consumer packaging may contain chemicals that can transfer into finished compost. From the compost, these chemicals may then transfer to ground and surface waters, be taken up by plants, and lead to negative health impacts. While some chemicals of concern are being voluntarily phased out by some packaging producers, not all have been outlawed and alternatives are not always guaranteed to be safe. Separately, non-degraded fragments of plastic packaging can contaminate finished compost, introducing environmental health concerns when it is used by farmers. We want to keep our compost clean and safe for all.

6. It increases our costs and makes our job harder: Some of us have accepted compostable packaging in the past, and found that loads of compostable packaging require us to change our processes, adding water, using more energy and spending additional resources to produce finished compost. Some types of compostable packaging mostly degrade into carbon dioxide and water and leave behind little of value for all of the extra effort required.

7. Just because something is compostable doesn’t mean it’s better for the environment. Oregon DEQ has found that compostable serviceware often has a larger (life time) environmental footprint than non-compostable items. For example, compostable materials may require more fossil energy use, release more greenhouse gases, or result in more monogloaths than their non-compostable counterparts, mostly due to how they’re made. The research confirms what scientists already know: that what materials are made of, and how they’re made, may be more significant than whether they’re compostable, recyclable. “Composting” and “compostable” are not the same idea. Composting is a beneficial treatment option for organic wastes, but “compostable” is not a guarantee of low impact.

8. In some cases, the benefits of recycling surpass those of composting. Some items, like paper bags, can be either composted or recycled. Generally speaking, the recycling of manufactured materials (such as packaging) back into new products or packaging can provide greater overall environmental benefits than composting does.

9. Good intentions aren’t being realized. Compostable items often cost more – sometimes up to five times as much as non-compostable alternatives. That’s a lot of money spent on products that might not actually help the environment – money that could be spent in more productive and beneficial ways.

Not only do compostable products often cost more to purchase, they also add up the costs to operate our facilities and impede our ability to sell finished compost. Compostable packaging is promoted as a means of achieving “zero waste” goals but it burdens composters (and recyclers) with materials that harm our ability to efficiently process recovered materials. Reusable dishware is almost always a better choice for the environment. If you must use single-use items, please don’t put them in your compost bin.

We need to focus on recycling organic wastes, such as food and yard trimmings, into high-quality compost products that can be used with confidence to restore soils and conserve resources. Compostable packaging doesn’t help us to achieve these goals. We need clean feedstocks in order to produce quality compost.

Please help us protect the environment and create high quality compost products by keeping “compostable” packaging and serviceware out of the compost bin.

Thanks for your cooperation

See www.dirthugger.com/organics-recycling/
unsustainable circularity?
a modest proposal

1. Adopt better goals and metrics
   capture and recovery rates; generation rates; actual environmental impacts

2. Drop the “landfill” frame in public messaging

3. Align collection with markets
   focus on quality; treat recyclables as commodities; design collection as a supplier would; require industry involvement
packaging extended producer responsibility (EPR)
a modest proposal (continued)

4. Expand our toolbox

waste prevention; reuse; sustainable production and consumption

5. Design for environment

not only design for recycling and composting

6. Build internal capacity to understand environmental impacts

7. Maintain recycling and composting as a means to an end
“We cannot solve our problems with the same thinking we used when we created them.”

- Albert Einstein
materials management

conserving resources · protecting the environment · living well

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