

The logo features a green, semi-circular shape with stylized, curved lines inside, resembling a field or a bowl. The text "Community Food Systems Team" is centered over this graphic.

# Community Food Systems Team

UW-Cooperative Extension Just in Time Webinar Program

Wednesday, July 24th - 1:00-2:00 PM

## **Food Waste Management: A Primer, Part 1**

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# Food Waste/Waste Management A Primer - Part I

Jonathan Rivin  
UW Extension-SHWEC  
UWEX Community Food Systems Team



# Disappearing Food

- Food disappearance worldwide
- 4 billion metric tons/yr produced
- 30%-50% food lost before consumption
- 1.2-2 Billion metric tons/yr lost

# Disappearing Food

- Consumption waste
  - ~ 1/3 in developed countries
  - ~ 10X that in developing countries

# Disappearing Food

## ➤ Food (edible) loss

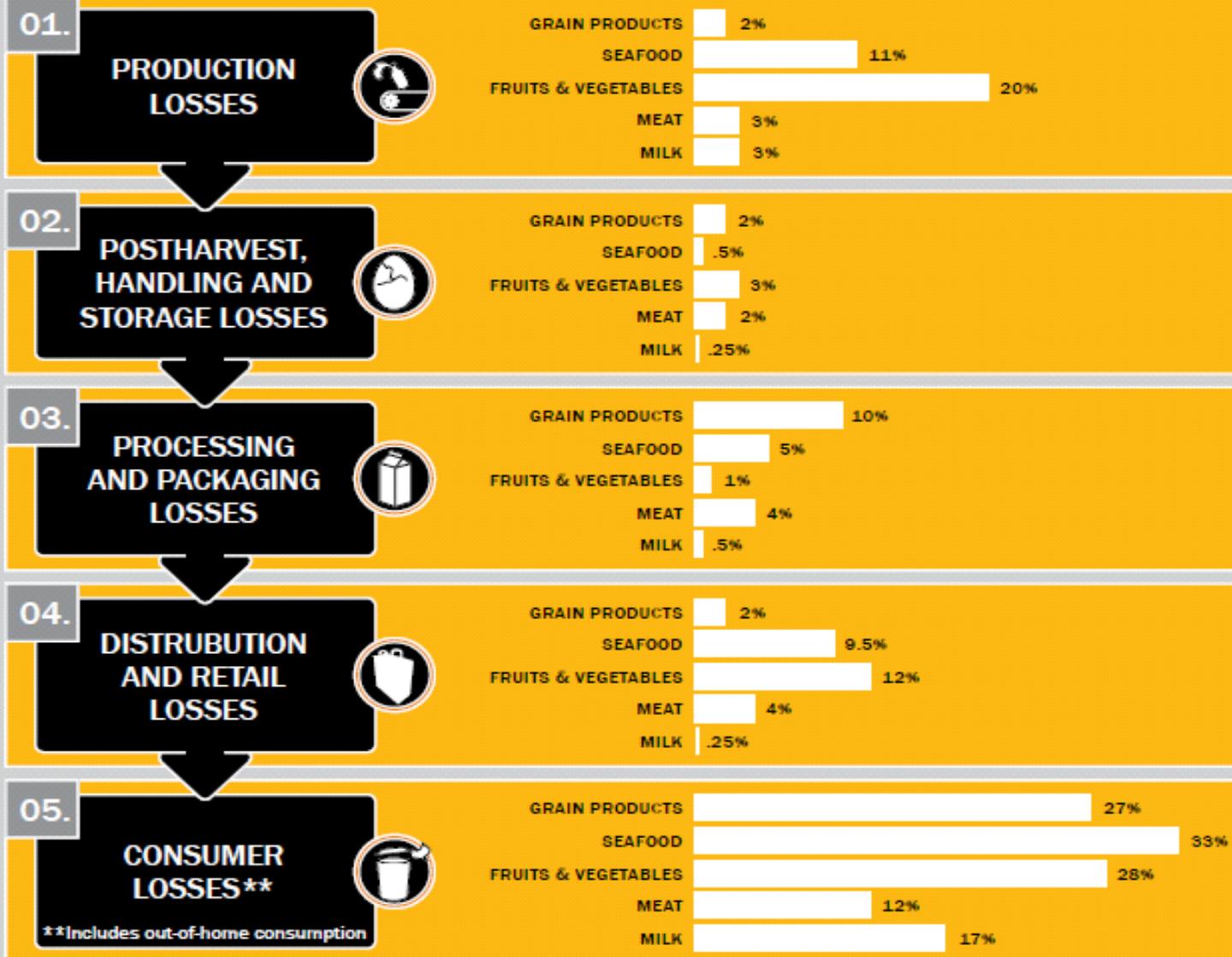
- Production, harvesting, handling, transportation, processing, storage (FAO)
- Any loss post harvest (USDA)

## ➤ Food (edible) waste

- Distribution (vendor), storage, handling, preparation, consumption → garbage

# Disappearing Food

## US/Canada/Australia/New Zealand



# Why Worry about Disappearing Food ?

## Nutrients

50 million people food insecure in US

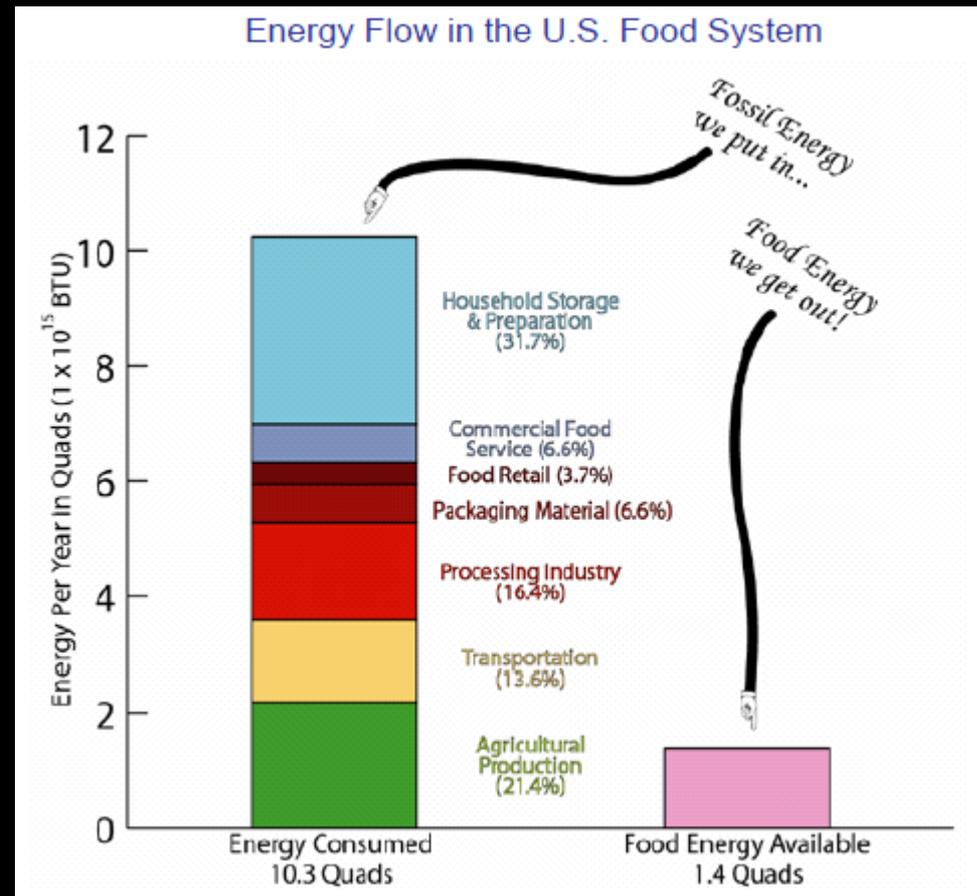
Reducing food waste 15% (US), feed 25 million



# Why Worry about Disappearing Food ?

## Resources

- 7.3 units of energy (primarily fossil) consumed for every unit of energy produced



# Why Worry about Disappearing Food ?



## Resources

50 glasses water = oranges for 1 glass orange juice

500 million hectars globally used to produce food  
not consumed [by humans] (2005)

# Why Worry about Disappearing Food ?



## Economy

133 b lbs of food waste (retail, restaurants, homes) = \$161 b

Cost (tipping fees) for disposing food waste in landfills => \$2 b

\$282 m of uneaten turkey tossed on Thanksgiving (2012)

Per capital food expenditures=\$4,229 (2011)

# Why Worry about Disappearing Food ?

## Environment

Reduces lifespan of landfills (NIMBY)

1.1 b lbs pesticides (US); 80% in agriculture (2007)

83% of average US household carbon footprint/yr for food  
consumption is agricultural production



# Global Food Demand



- Global population @ 9.1 billion in 2050
- Food production increase ~70% to meet demand
- Worldwide meat consumption: 40% increase by 2050

# Global Food Demand

- Meeting demand
  - 170 m more acres needed by 2050
  - 80% increase in crop yields in developing countries



# Global Food Demand

- Meeting demand
  - shifting food for animals to human consumption, food production increase about 50%
  - 1 ht rice/potatoes = 19-22 people/yr
  - 1 ht lamb/beef = 1-2 people/yr



# Global Food Demand

## Food or Fuel?

Syngenta .....[marketing their].....*Enogen*<sup>®</sup> corn

which features

the first biotech output trait designed for ethanol production.



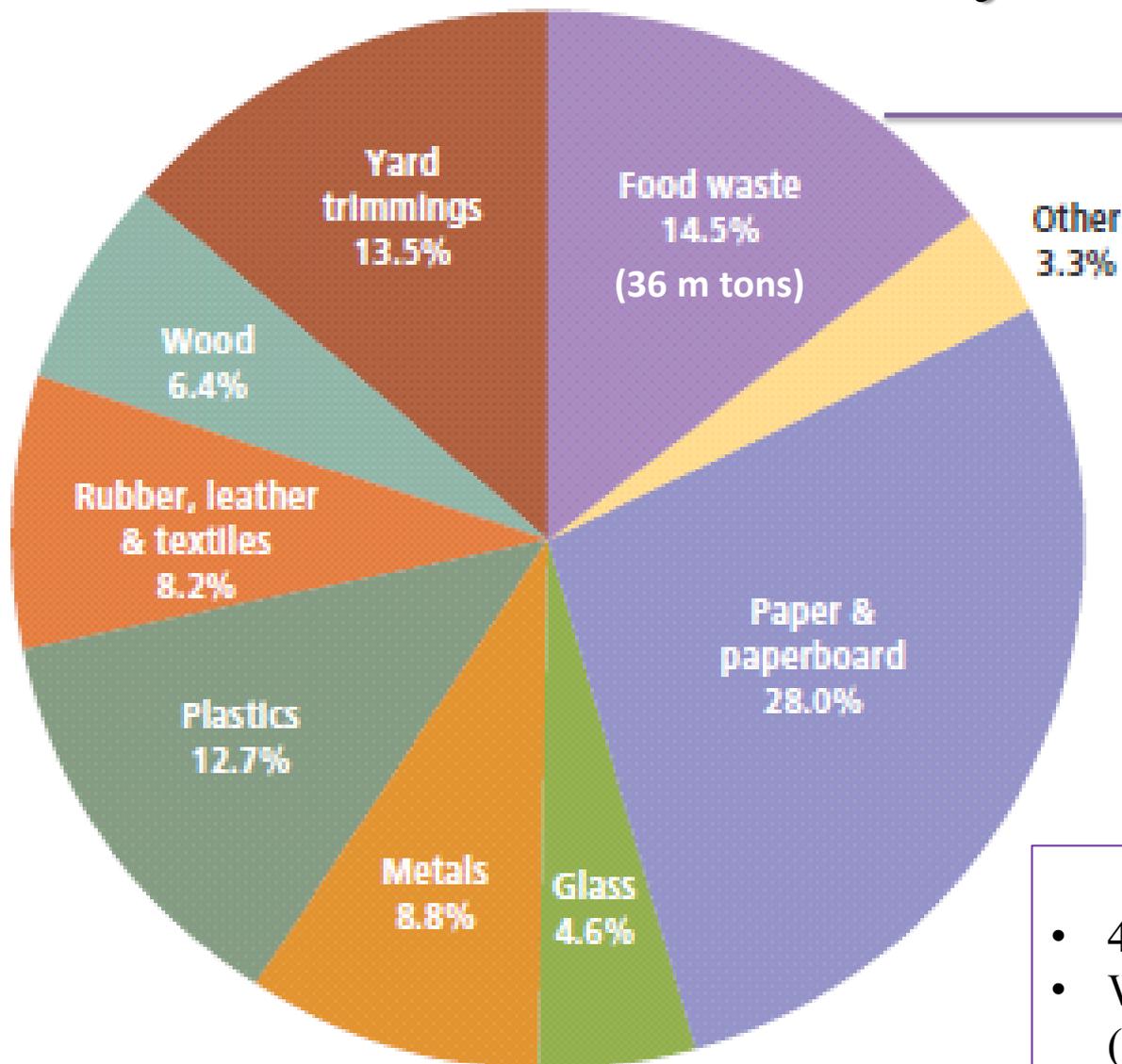
# Global Food Demand



**Estimates Do Not Assume  
Any Reductions in Food Wastage**

# 2011 MSW Generation

## > 250 million tons before recycling

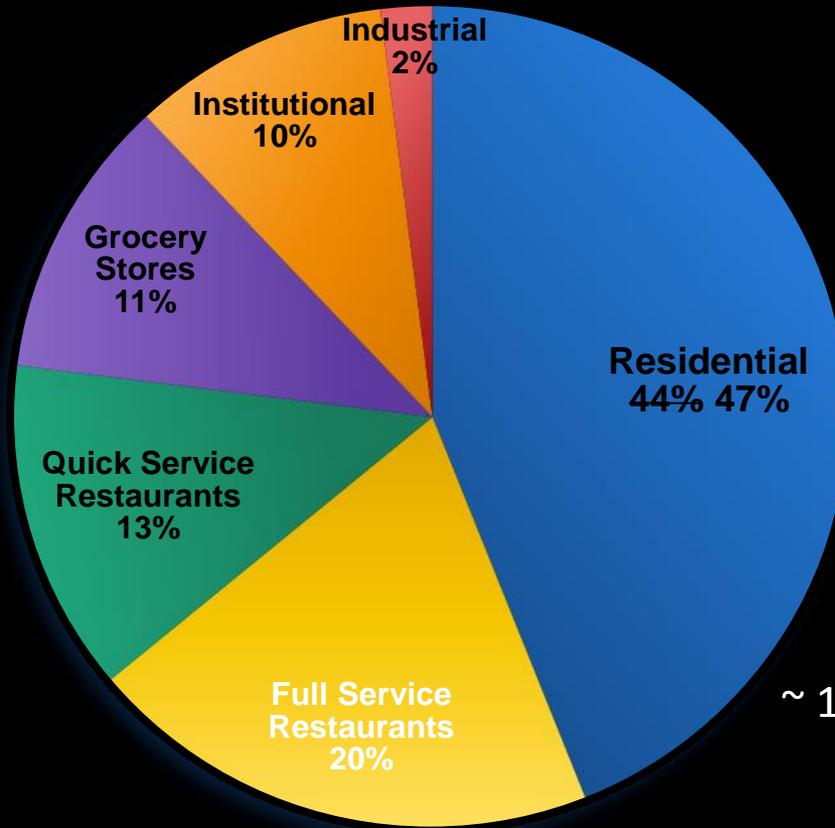


### Food Waste

- 4% recycling rate
- WI (2009): 455k t (11% MSW)

# Assessment: Total Food Waste DISPOSED by Sector

US Food Waste Disposal Data

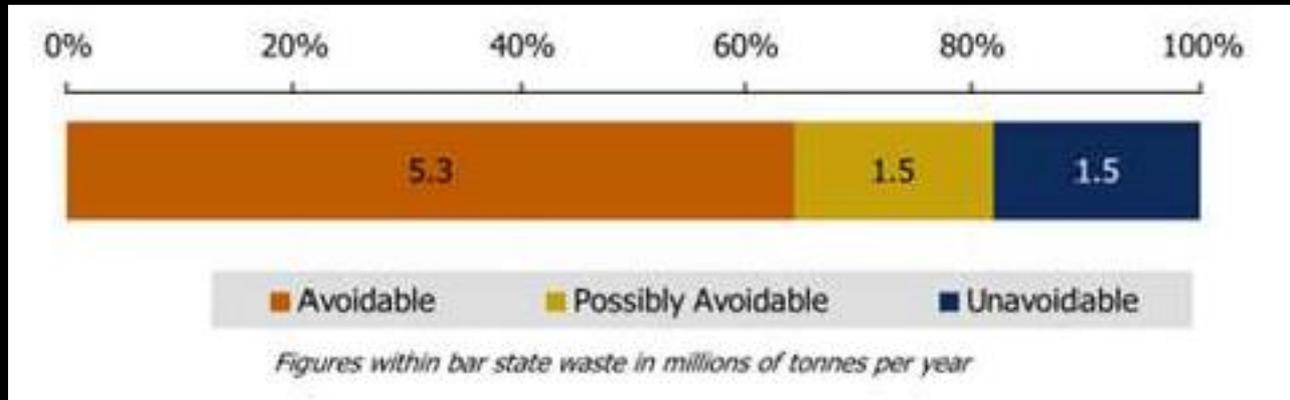


~ 1/3 food purchased, not eaten

# Consumer Food Waste

- North America/EU: 95-115 kg/person/yr (254 lb/p/yr)
- Households (US)
  - 2/3 spoilage
  - 1/3 cooking/serving too much

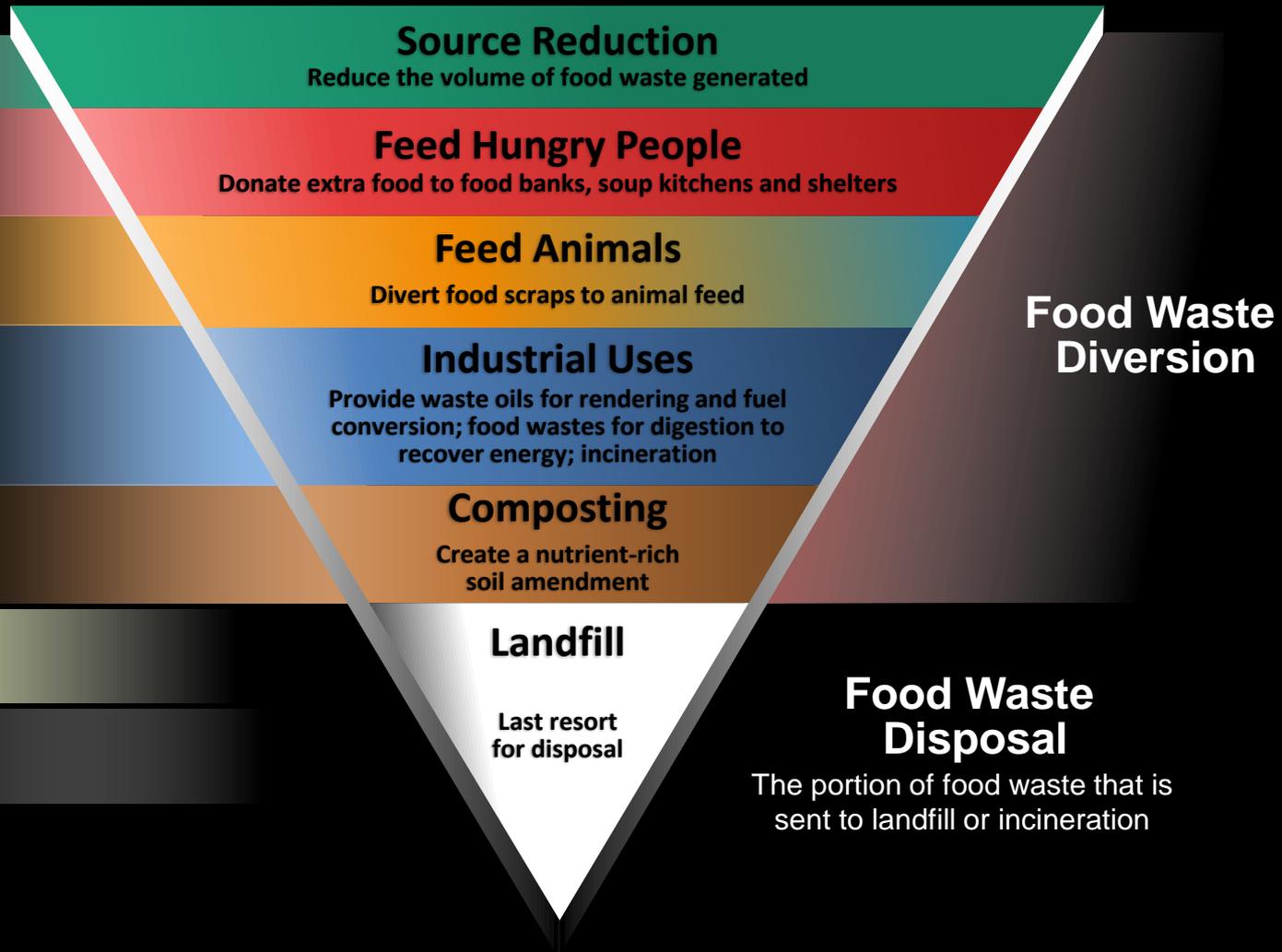
# Household Food Waste Generation



Edible food waste	
Avoidable food waste	Food that is thrown away that was, at some point prior to disposal, edible (e.g. slices of bread, apples, meat)
Possibly avoidable food waste	Food that some people eat and others do not (e.g. bread crusts, potato skins)
Inedible food waste	
Unavoidable food waste	Waste arising from food preparation that is not, and has not, been edible under normal circumstances (e.g. bones, egg shells, pineapple skins)

**Source: based on WRAP (2009) *Household Food and Drink Waste in the UK***

# Food Waste Recovery Hierarchy



**“The most important problem in the future will be to tackle increased demand for food, as it will outstrip supply. We can no longer afford to stand idly by, while perfectly edible food is being wasted. This is an ethical, but also an economic and social problem, with huge implications for the environment.”**

European Parliament (January 2012)



# \* Food Waste Resources

Sources, Collection & Traditional Disposal Options





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\*What do we think of when we say “waste”?

\*Yuk factor

\*Worthless factor

\*Missed opportunity factor

\*Waste?



\*What do we think of when we say the word “resource”?

\*Wow factor

\*Value factor

\*Opportunity factor

\*Framing a Change  
With The Right Words



- \* Farm fields
- \* Transportation
- \* Wholesale & retail
- \* Manufacturing
- \* Commercial
  - \* Restaurants, cafeterias, events, institutions
- \* Households

## \* Sources of Food Waste Resources



## \* Today in Wisconsin

### \* Retail, Commercial & Institutional

- \* Both pre-consumer & post-consumer go to either dumpster (mixed with other waste) or drain garbage disposal
- \* Some are diverting some fruit/vegetable materials to compost, farms (feed hogs) & digesters
  - \* Orchard Ridge Landfill food waste composting project
    - \* Milwaukee-area grocers send fruit/vegetable waste for composting
  - \* Wal-Mart
    - \* Strategic goal to divert organics (including food waste resources) to food donation, composting or waste-to-energy

# \* Collecting Food Waste Resources



- \* Households

- \* Two or three bins for refuse-none for food waste collection

- \* Madison & Fitchburg

- \* 2012/2013 pilot

- \* Backyard composting



# \* Collecting Food Waste Resources



\* Today's most common disposal option (in the U.S.)

\* Sanitary Landfills

\* Resource Conservation & Recovery Act Subtitle D (1976)

- \* Locational criteria
- \* Clay liners
- \* Plastic (geo-membranes) liner
- \* Leachate collection system
- \* Active gas collection system
- \* Closure requirements
- \* Financial responsibility requirements
- \* Environmental monitoring requirements



\* Disposal

- Buffer Area -

- Buffer Area -

### Leachate (Arrows)

Leachate is a by-product of landfills, formed by the decomposition of solid waste mixed with water. Leachate will percolate through the layers of a landfill toward the Collection System.

### Creating A Cell

Each day trash is piled, compacted and covered with a compacted layer of soil. This pocket of waste is called a cell.

### Old Cells

By compacting and covering waste in one-day cells, the formation of methane gas and leachate is reduced.

### Impacted Groundwater Leachate Disposal

The collected impacted groundwater leachate is either treated on-site, off-site or used for on-site dust control.

### Landfill Gas Disposal

The collected gas is disposed either by thermal destruction in flares and/or converted to electricity in a gas-to-electric facility.

### Landfill Gas Condensate Disposal

The collected gas condensate is collected in storage tanks and hauled offsite for treatment or routed to the flare and vaporized.

### Plastic Liner

The polyethylene liner is designed to prevent leachate from draining into the groundwater.

### Liner Seams

Sections of the plastic landfill liner are bonded together by heat welding. Seams are tested while the landfill is in use for strength and impermeability.

### Landfill Slopes

The slopes of a landfill may be lined with a geotextile nonwoven fabric mat and polyethylene liner. The mat and a liner are anchored inside the earthen embankment.

### Site Analysis

A study must be made of an area before it can be approved as a landfill site. This analysis examines the wildlife living in the area, as well as the condition of the underlying soil and bedrock. It must also be determined if the site has historical or archaeological value.

### Compacted Clay

Compacted clay separates a landfill from groundwater. If soil does not meet permeability standards, bentonite may be added to the soil to create this dense layer of clay.

### Leachate Collection Pipe

Leachate drains into pipes where it is pumped into holding ponds or tanks.

### Geotextile Mat

A nonwoven fabric mat protects the plastic landfill liner from the gravel in the washed rock layer.

### Soil Layer

A 30-inch layer of soil separates the first cell and the granular drainage layer.

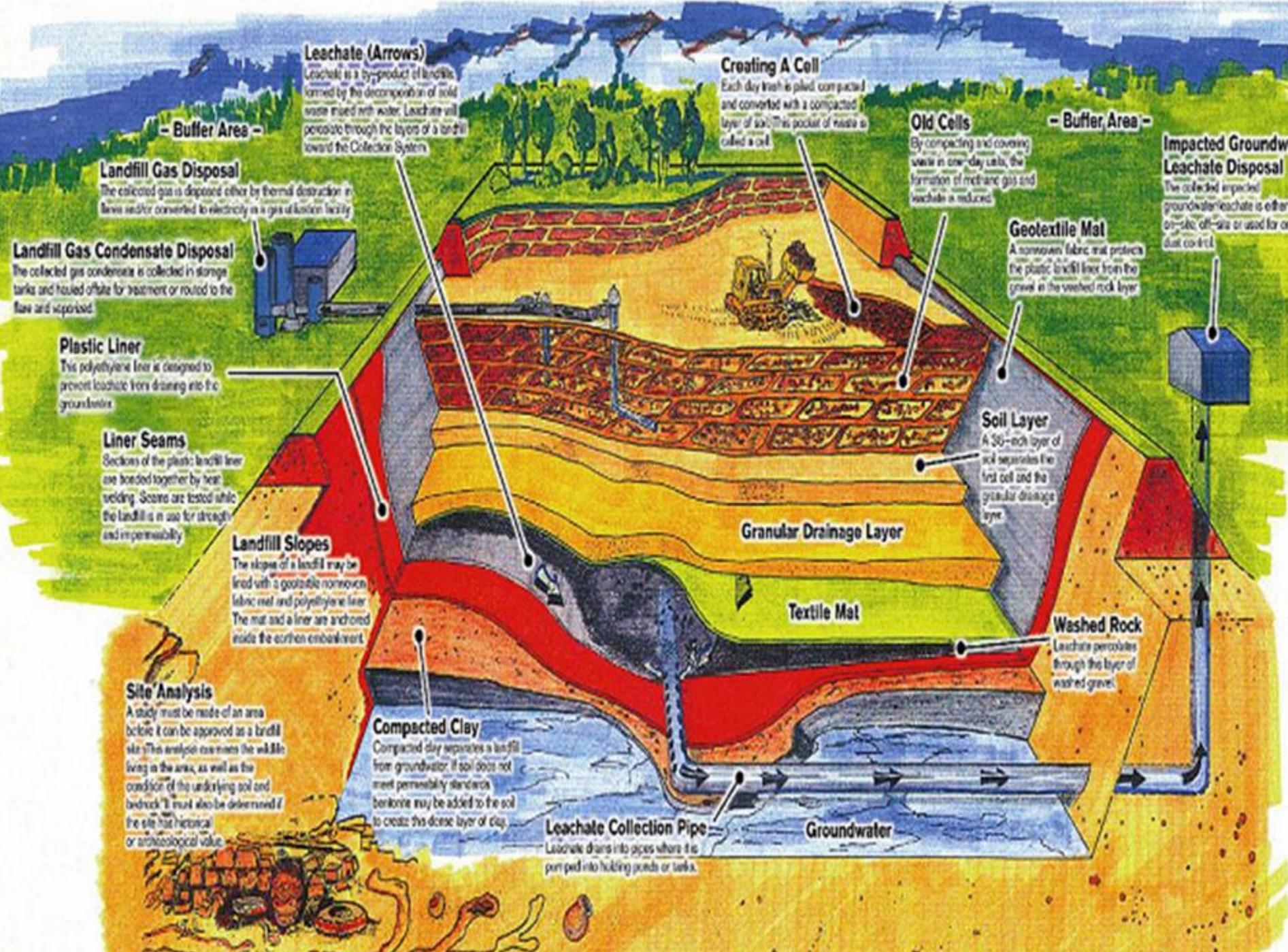
### Granular Drainage Layer

### Textile Mat

### Washed Rock

Leachate percolates through this layer of washed gravel.

### Groundwater

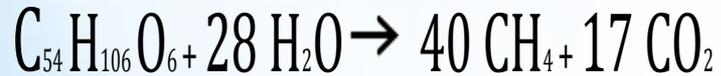
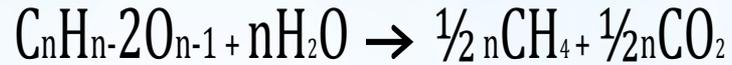


- \* 455,259 ton of food waste entering WI landfills
- \* Approximately 11% of overall tonnage
- \* Not a large portion of the waste stream, but is responsible for most of the issues at landfills
  - \* Leachate management
  - \* Gas system management
  - \* Environmental monitoring



# \* 2009 WI State-Wide Waste Characterization Study





# \* Anaerobic Decomposition



- \* All liquid (including precipitation) coming in contact with waste must be treated as leachate
  - \* As liquid percolates through waste mass, picks up volatile organic compounds, toxins & metals
    - \* Lead, mercury, benzene, trichloroethylene, pharmaceuticals, etc.
    - \* Not all compounds are removed in WW treatment systems
  - \* Leachate sent to wastewater treatment plants
    - \* Transport is expensive
    - \* Treatment is expensive
      - \* Penalties for excessive suspended solids (SS)
      - \* Penalties for excessive biological oxygen demand (BOD)
    - \* Some WWTP will not take leachate
      - \* One WI landfill shipped leachate nearly 125 miles

# \* Leachate management



- \* Gas system efficiencies
  - \* Estimates range from 60%-80% efficient at capturing landfill gasses
    - \* 2012 gas production at MCSW landfills = 413,855,759.41 SCFM @ 51% methane
  - \* Fugitive emissions
  - \* Cover materials
- \* EPA Air permit requirements

## \* Gas system management



- \* Real costs related to managing landfill gas system
  - \* Staff
    - \* MCSWD - 1 FTE dedicated to gas system management
  - \* Gas & condensate system infrastructure
    - \* Installation of 1 gas well = \$8,000-\$10,000
    - \* Hundreds of thousands in connecting piping (header pipes)
  - \* Host community compensation
    - \* Odors are generally a dis-amenity for which landfills neighbors are compensated
  - \* Air permit
    - \* \$5,000-\$20,000 every 5 years
    - \* Non-compliance costs = \$20,000+ per day

# \* Gas system management



- \* Environmental monitoring occurs during active phase of landfill and for 40 years after closure
  - \* Groundwater monitoring
  - \* Potable well monitoring
  - \* Gas migration monitoring
  - \* Air quality monitoring
  - \* Compliance costs related to exceedances

# \* Environmental Monitoring



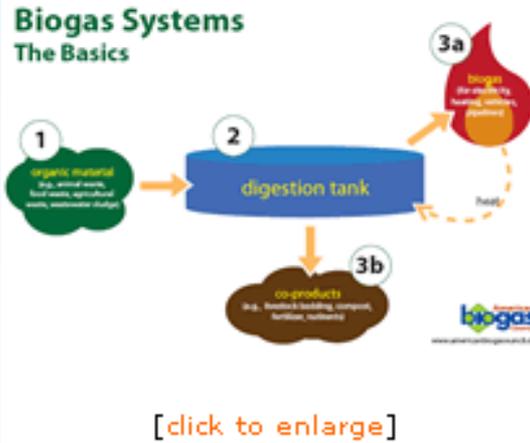
- \* Any new or expanded landfill after 2005-required to have organic stability plan
  - \* Must bring landfill into a stable state...
    - \* A point at which there is no need for engineering/maintenance to manage environmental impacts caused by decomposing organic materials
    - \* Most plans include leachate recirculation
      - \* Obtain maximum saturation level for waste to ensure rapid decomposition
      - \* Use biologics in leachate to enhance decomposition
      - \* Many operational issues
      - \* Extra costs
  - \* To a lesser degree -organics diversions
    - \* Could play a bigger role in the future

## \* NR 514.07 Organic Stability Plans



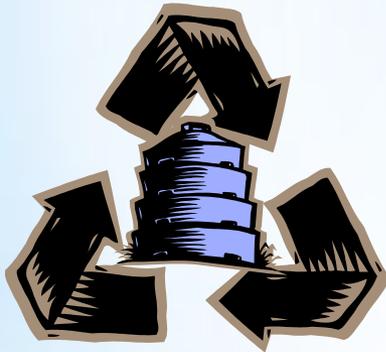
- \* Competition for the organic fraction of the waste stream
  - \* Despite problems caused by food in landfills, landfill-gas-to-energy (electricity, heat & biogas) require organics in landfills
  - \* Compost operations
  - \* Anaerobic digesters
  - \* Feedlots

\* But.....



**Source  
Reduction**

\*What is the “best”  
means of managing  
food waste resources?



## **Additional Resources**

UWEX Community Food Systems Team blog-<http://fyi.uwex.edu/cfsi/>

An archive of this presentation can be found on the blog listed above with the following supplemental documents:

\*Gunders, D. 2012. Wasted: How America is Losing up to 40% of its Food, from Farm to Fork to Landfill. Natural Resources Defense Council.

\*Gustavsson et al., 2011. Global Food Losses and Food Waste. FAO.

(UWEX Colleagues) Just in Time Webinar Program registration can be found on the CFS Team blog.



# THANK YOU!