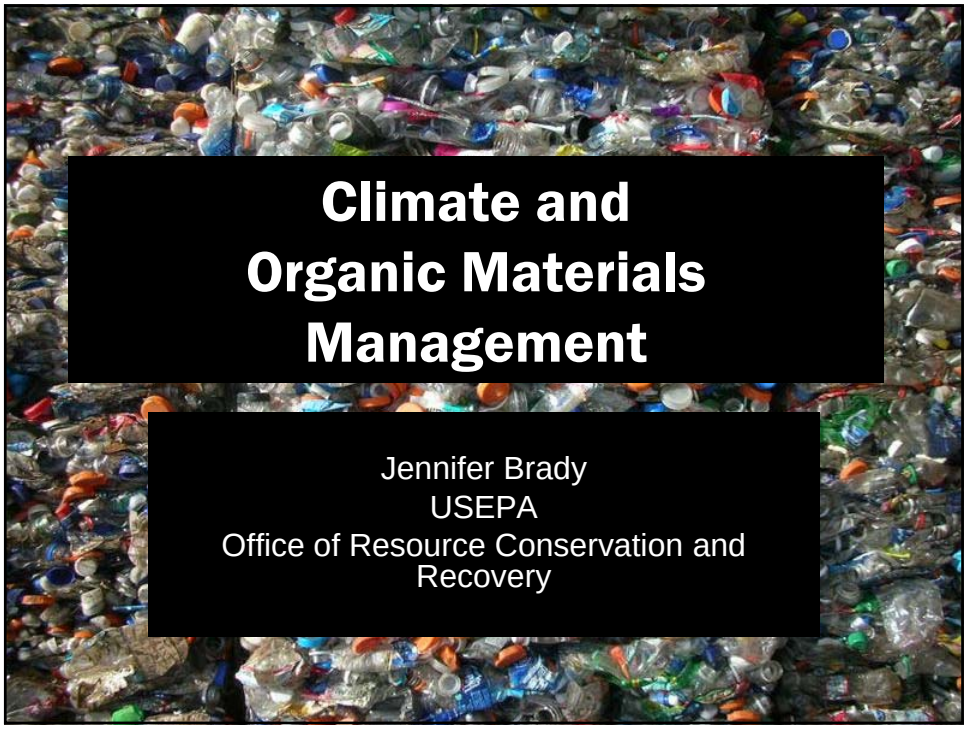

# Climate and Organic Materials Management

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## How are Waste and Climate Connected??

- What is the Life Cycle of a material?
- The simplified version:
  - Raw material extraction (bauxite mining, tree harvesting, oil pumped from underground, etc.)
  - Raw materials are processed into manufacturing inputs (trees made into paper, etc.)
  - Products are made from manufacturing inputs
  - Products are used
  - End-of-life products (and other discards) are managed as recyclables or waste

## Emissions from Organics Management

- Landfills
  - Transportation ($CO_2$)
  - Decomposition in landfill ($CH_4$)
  - Possible avoided energy generation ($CO_2$)
  - Landfill carbon sequestration (C)
- Composting
  - Transportation ($CO_2$)
  - Composting process (currently zero)
  - Soil carbon sequestration (C)

## Landfill Carbon Storage

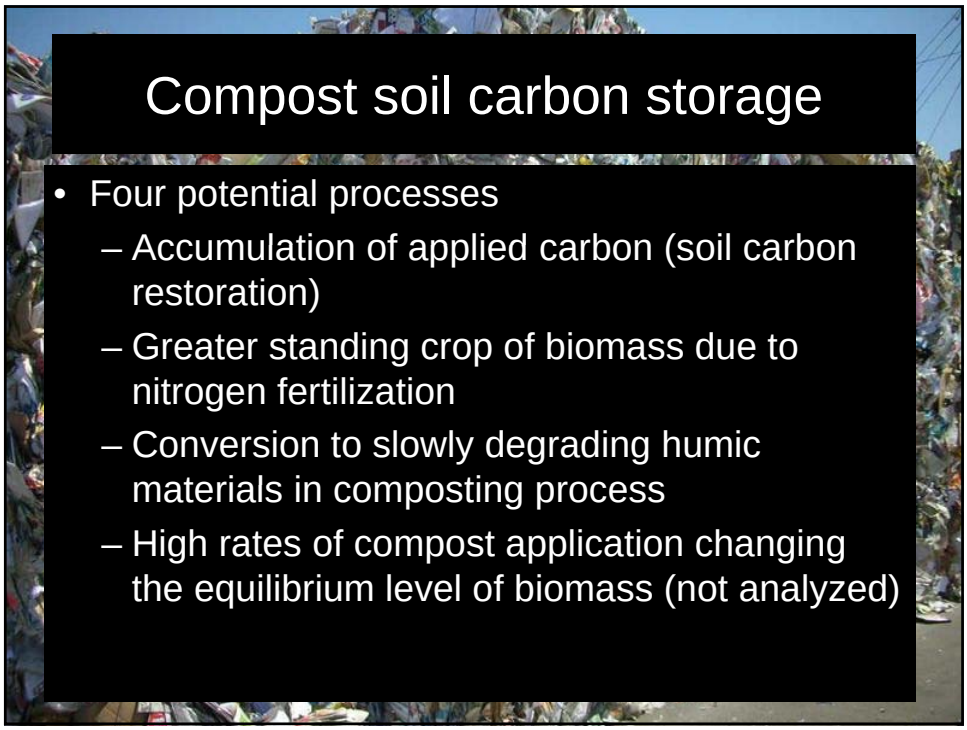
**Landfill carbon storage**

- **Some materials are not completely decomposed by anaerobic bacteria, so some of the carbon in these materials is stored in the landfill**
- **Counted as an anthropogenic sink since this carbon storage would not normally occur under natural conditions**
- **Included in factors for corrugated cardboard, magazines/third-class mail, newspaper, office paper, phonebooks, textbooks, lumber, fiberboard, food scraps, grass, leaves, branches**

## Landfill Carbon Storage (cont.)

**Biogenic vs. Anthropogenic Emissions**

- **IPCC – and therefore EPA – does not count biogenic carbon as a greenhouse gas if it would otherwise have been released as part of the natural carbon cycle. Thus, carbon dioxide from organic materials in a landfill are not considered a greenhouse gas.**
- **However, if the gas is converted to methane in a landfill it would be counted as a greenhouse gas because it would not have occurred naturally.**
- **This is also true of organic materials burned for combustion**



## Compost soil carbon storage

- Four potential processes
  - Accumulation of applied carbon (soil carbon restoration)
  - Greater standing crop of biomass due to nitrogen fertilization
  - Conversion to slowly degrading humic materials in composting process
  - High rates of compost application changing the equilibrium level of biomass (not analyzed)

## New research

- Integration of decay rates, rather than lifetime methane yield
- Recognition that even the best landfill capture systems take time before they are at optimal performance
- In the near future – different types of composting??

## Proposed change

- Decay rates and landfill capture systems
- Old method:
  - Total methane released over life of material X capture rate
- New method:
  - (Methane released in time $t_0$ x capture rate in time $t_0$) + (Methane released in time $t_1$ x capture rate in time $t_1$) + . . .
    - For 100 year timeframe

## Reduction of Fertilizer Use with Compost

- Add an additional upstream factor to compost analysis.
  - How much fertilizer does compost replace?
  - How does transportation use change?
  - What are the emissions from producing fertilizer?
    - Majority of life-cycle data available focuses on Nitrogen-heavy fertilizers

## Tools to measure the environmental and monetary cost of organics management

- Waste Reduction Model (WARM)
  - www.epa.gov/warm
  - Climate and energy benefits
- Food waste management cost calculator
  - www.epa.gov/foodscraps
- Jeffrey Morris's work
  - See Biocycle October 2008

## Food waste management cost calculator

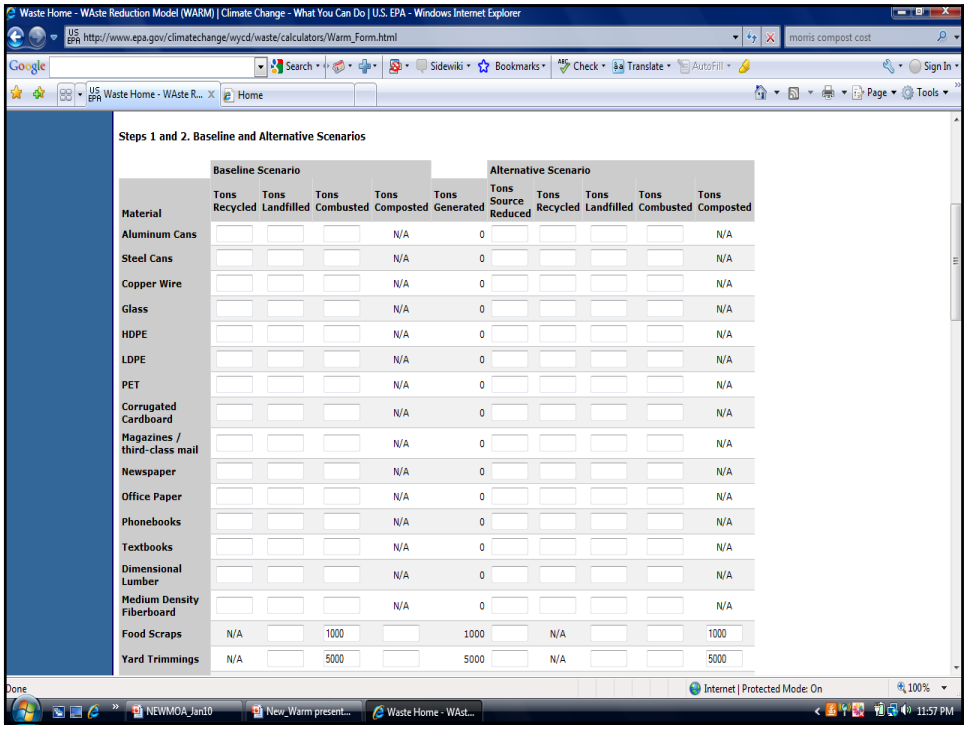
- Estimates the cost competitiveness of alternatives to food waste disposal
  - source reduction
  - donation
  - composting
  - recycling of yellow grease
- Compares cost estimates for a disposal versus an alternative scenario.

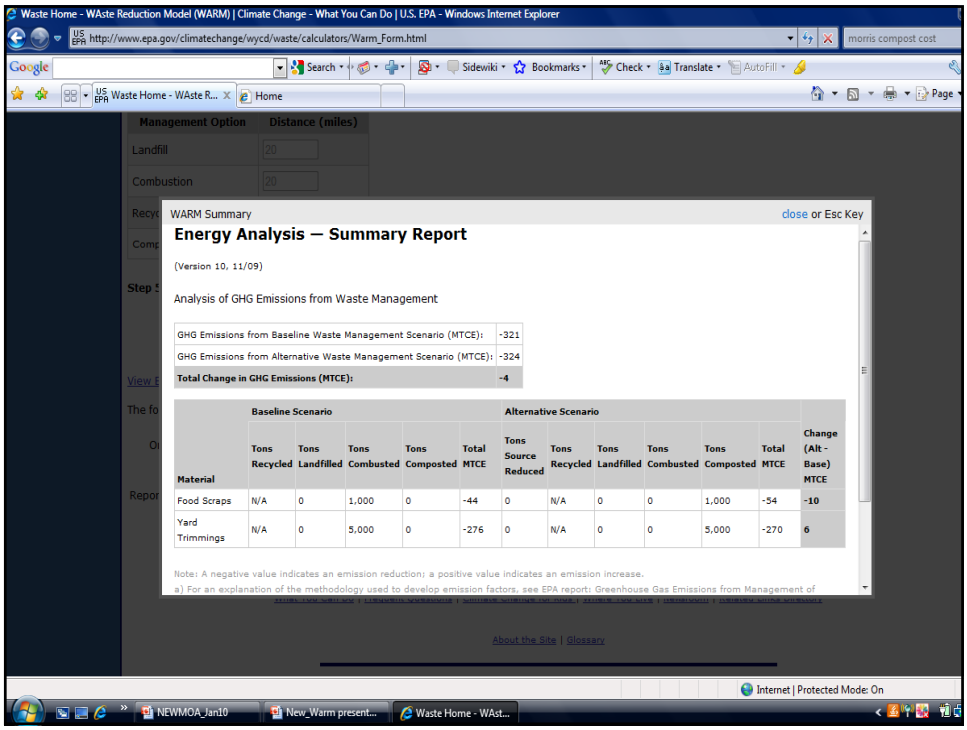
## WARM Emission factors

Food Scraps, Leaves, Grass, Branches, Yard Trimmings, Mixed Organics (Food Scraps 48%, Yard Trimmings 52%)

- Source reduction (NEW!)
- Composting
- Combustion
- Landfilling

– 26 material types and 6 categories of mixed materials


Waste Home - WAste Reduction Model (WARM) | Climate Change - What You Can Do | U.S. EPA - Windows Internet Explorer
http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html
Steps 1 and 2. Baseline and Alternative Scenarios
Baseline Scenario
Alternative Scenario
Material
Tons Recycled
Tons Landfilled
Tons Combusted
Tons Composted
Tons Generated
Tons Source Reduced
Aluminum Cans
Steel Cans
Copper Wire
Glass
HDPE
LDPE
PET
Corrugated Cardboard
Magazines / third-class mail
Newspaper
Office Paper
Phonebooks
Textbooks
Dimensional Lumber
Medium Density Fiberboard
Food Scraps
Yard Trimmings


Waste Home - WAste Reduction Model (WARM) | Climate Change - What You Can Do | U.S. EPA - Windows Internet Explorer
Management Option
Distance (miles)
Landfill
Combustion
WARM Summary
close or Esc Key
Energy Analysis — Summary Report
(Version 10, 11/09)
Analysis of GHG Emissions from Waste Management
GHG Emissions from Baseline Waste Management Scenario (MTCE): -321
GHG Emissions from Alternative Waste Management Scenario (MTCE): -324
Total Change in GHG Emissions (MTCE): -4
Baseline Scenario
Alternative Scenario
Material
Tons Recycled
Tons Landfilled
Tons Combusted
Tons Composted
Total MTCE
Tons Source Reduced
Change (Alt - Base) MTCE
Food Scraps N/A 0 1,000 0 -44 0 N/A 0 0 1,000 -54 -10
Yard Trimmings N/A 0 5,000 0 -276 0 N/A 0 0 5,000 -270 6
Note: A negative value indicates an emission reduction; a positive value indicates an emission increase.
About the Site | Glossary

## Future versions of WARM

- Will have categories for different landfill conditions, most likely
  - Average
  - Wet
  - Dry
  - Bioreactor

## Contact Information

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**EPA's Waste Reduction Model** http://www.epa.gov/warm