US Composting Council

USCC Factsheet

Greenhouse Gases and the Role of Comp[illegible] A Primer for [illegible] Producer[illegible]

The biggest benefit of composting with respect to Global Climate Change comes from avoiding the production of methane.

Good composting practices minimize greenhouse gas emissions.

The use of compost provides numerous greenhouse gas benefits, both directly through carbon sequestration and indirectly through improved soil health, reduced soil loss, increased water infiltration and storage, and reduction in other inputs.

Anyone w[illegible] tended a compost pile, from a balcony worm bin [illegible] per day facility, is sure that what they are doing is [illegible] THE ENVIRONMENT. However, th[illegible] increased foc[illegible] Warming and Climate C[illegible] challenging this [illegible] nd forcing composters [illegible] new answers to ne[illegible] The goal of this factsheet is to provide composters w[illegible] definitions relating to Global Climate Change, [illegible] tand composting's role, and offer some directi[illegible] rces.

What is Global Climate Chang[illegible]

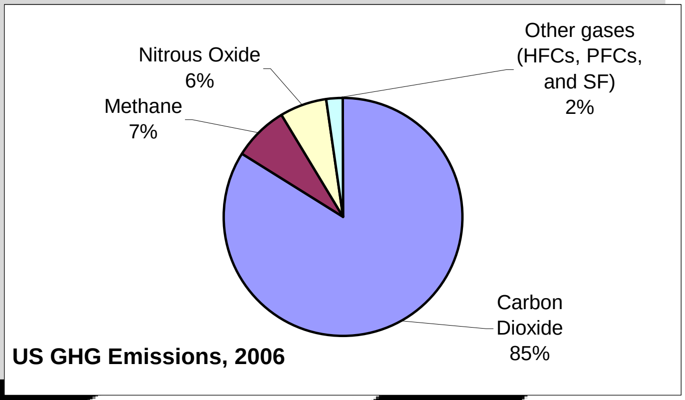
Global Climate Change is the result of increased average temperature of the Earth's oceans and atmosphere, with profound consequences for humanity and the world as a whole. Some of these consequences include rising sea level endangering coastal populations, more extreme weather, and threats to agricultural production. Human health will be jeopardized by all of these changes.”[2]

What is causing Global Climate Change?

The primary engine that drives the Earth's climate is the sun. A certain percentage of the solar energy that reaches our planet is trapped in the atmosphere by a process known as the “greenhouse effect,” first described by Joseph Fourier back in [illegible][3]. The primary gas responsible for this effect is carbon [illegible] hile CO_2 levels in the atmosphere have [illegible] of Earth's history, it has become clear [illegible] he industrial revolution has caused a dramat[illegible] s, as we have developed a fossil-fuel based [illegible] ease in CO_2 means that a greater fraction of the [illegible] apped rather than escaping each day, driving [illegible] tures up.

[illegible]hat are greenhouse gas[illegible]

Greenhouse gases (GHG) are gases in t[illegible] re that act to trap heat near the Earth's surface. Wh[illegible] ses and this effect are naturally occurring, human a[illegible] ve caused an increase in the levels of these gas[illegible] s an increase in t[illegible] ir effect. Because of the lag ti[illegible] n emission a[illegible] ct (up to 100 years) it is too [illegible] complet[illegible] ome climate change, but t[illegible] ch that c[illegible] ce emissions and thus [illegible] rate and[illegible] iving us more time to [illegible] nd [illegible]



Carbon dioxide (CO_2) is th[illegible] 2005, the US released 6,090 Tg (Te[illegible] ns of grams) of CO_2, which accounted [illegible] GHG emissions.[5] The burning [illegible] and transportation was [illegible] O_2 emitted. Since other gases, [illegible] and nitrous oxide (N_2O), are more [illegible] ng heat than CO_2, the amounts and effects of

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[1] Based on the article “Composting and Greenhouse Gas Emissions” by Sally Brown and Scott Subler, BioCycle, March, 2007, Vol. 48, No. 3, page 37-8.

[2] From “*Climate Change 101: Understanding and Responding to Global Climate Change*”, published by the Pew Center on Global Climate Change, www.pewclimate.org.

[3] Greenhouse effect. (2008, October 22). *New World Encyclopedia*..

[4] Technically, water vapor has a bigger impact than CO_2, but since it is not anthropogenic (of human origin) it is not regulated or considered a GHG by the International Panel on Climate Change

[5] Statistics on GHG emissions for the US are drawn from the USEPA website on climate change, http://epa.gov/climatechange/index.html

other gases are computed in terms of CO_2 equivalents (Table 1). In 2005, 539 Tg of CO_2 equivalents were released as CH_4, and 469 as N_2O.

Table 1. Global warming equivalencies of primary GHGs

Gas	Global Warming Potential (GWP) [a]	Atmospheric Lifetime
Carbon Dioxide	1	50-200
Methane	21	12±3
Nitrous Oxide	310	120

[a] GWP of CH4 and N2O were changed to 23 and 296 respectively in the Third Assessment done by the IPCC. The equivalencies from the second assessment, shown above, are still used by the EPA so that updated inventories can be compared with former inventories and trends can be tracked.

How ar [illegible] ouse gase [illegible]

In orde [illegible] olicies aimed [illegible] bal Climate Chang [illegible] g an effect, w [illegible] e an inventory of GHG [illegible] ntory attempts [illegible] track the amount of GHG [illegible] released into t [illegible] re each year and how mu [illegible] s removed. In [illegible] n be done by cou [illegible] tes, industries a [illegible] dividuals. The United Na [illegible] ework Conventi [illegible] ate Change (UNFCCC), of [illegible] United States is [illegible] r, commits the country to [illegible] g an annual inver [illegible] HG sources and sinks. Th [illegible] ernmental Panel o [illegible] e Change (IPCC) pr [illegible] prot [illegible] ne. In doing th [illegible] , only a [illegible] nissions are co [illegible] sources”. [illegible] is naturally co [illegible] ing taken ou [illegible] through pho [illegible] s, that does no [illegible] oval. Only pro [illegible] store carbon for [illegible] ods of time, called sequ [illegible] are counted as “s [illegible] he US has [illegible] GHG [illegible] for the years 199 [illegible] ough 2007, r [illegible] source [illegible] by gas, by industr [illegible] and by sector.

How d [illegible] discards contribute to greenho [illegible] s?

By definition, a [illegible] ards contain carbon. [illegible] decompose natu [illegible] bic conditions the CO_2 they give off is part of th [illegible] term carbon cycle[6]. Since this is part of the natu [illegible] not considered in GHG computations. How [illegible] ganic discards are placed in an anaerobic envir [illegible] convert and release the carbon a [illegible] organic compounds which can contri [illegible] change. Organic discards that are high in [illegible] food scraps, manures and grass clippings, under wet [illegible] oxygen-limited conditions, can also produce N_2O during decomposition, roughly 300 times worse than carbon dioxide.

How does composting effect Global Climate Change?

To understand what effect composting has, we have to break the composting system into three components: the feedstocks, the composting process, and how the use compost product is used. Composting will have an impact based on what might have happened to the feedstocks if they were not composted, how the composting operation is run, and what happens to the compost. Positive impacts include emissions avoidance and [illegible] tration. Negative impacts result from emissions [illegible] ed processing equipment used to process [illegible] is determined by adding up the [illegible] component.

Part 1: Feedstock [illegible]

If material that would otherwise [illegible] cing methane or [illegible] us oxide is composted instead [illegible] in *avoided emissions.* Some common situations [illegible] might apply include food wastes that are going to l [illegible] manures that get stored in uncovered lagoons. F [illegible] every metric dry ton of food that goes to a landf [illegible] rate .25 metric tons of methane in the first 120 day [illegible] composting this food waste reduces emissio [illegible] equivalent [illegible] to 6 metric tons of CO_2. By t [illegible] ken, if grass cli [illegible] were going to a co [illegible] edirected to a [illegible] sult i [illegible] t 2 tons [illegible] quivalents for every ton [illegible] de [illegible] o [illegible] dfill [illegible]) [illegible] portati [illegible] also to be taken [illegible] ount. If the [illegible] in [illegible] s closer [illegible] l [illegible] the [illegible] us [illegible] o [illegible] giona [illegible] as furth [illegible] n less wi [illegible] ansporting the waste, an [illegible] t. On the [illegible] he food collection requir [illegible] cle trips [illegible] iles or use of less efficie [illegible] han would [illegible] otherwise, then that wou [illegible] creased [illegible] sions, reducing the total avo [illegible] ver, since methane is so much more dam [illegible] 2, the vehicle “costs” are usually far out [illegible] enefits of methane reduction. For exampl [illegible] ck can carry about 30 wet tons of mater [illegible] that is 6 dry tons of food waste. F [illegible] the truck will emit 327 kg of [illegible] of methane avoided by [illegible] 6,000 kg. That truck would have to [illegible] from LA to New York City seven times to [illegible] emissions outweighed the avoidance!

The US sent 25 million tons of food waste to landfills in 2005. The GHG impact of composting this mass would be the equivalent of removing 7.8 million passenger cars from the road.

Part 2: Composting Process

The EPA recognizes that well-run composters emit little methane and N_2O from the biological process of composting, so have little impact in GHG. Of course, the compost process uses diesel fuelsto run grinders, turners, front-end loaders and the like. The burning of this fuel creates GHG emissions, as does electricity used to operate blowers, pumps, etc. If the

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[6] Carbon is constantly removed from the atmosphere by plant photosynthesis, moved among organisms through the foodweb and released by via decomposition.

energy comes from bio-based fuels, like biodiesel or methane-fired generators, or other renewable energy sources, those emissions would be reduced from a GHG accounting perspective (because the carbon emitted is coming from the short term carbon cycle and replacing the carbon from fossil fuels, which is coming out of long term storage).

This is not to say the composting itself can't have GHG emissions. Both methane and nitrous oxide have been observed coming from compost piles (Hao, 2001, Sommer and Moller, 2000, Lopez-Real and Baptista, 1996). Meth[illegible] forms under anaerobic conditions, often fou[illegible] piles. In the real world this probably [illegible] the methane is then oxidized as i[illegible] portions of the pile and befo[illegible] [illegible]rmation is less well understood, o[illegible] [illegible]e surface where oxygen is limited but [illegible] [illegible]ere nitrogen is in excess. The CO2 re[illegible] [illegible]mposting is considered biogenic, not anth[illegible] [illegible]s not considered in greenhouse gas[illegible] ***Good composting [illegible] balance the c[illegible] [illegible]n ratio and prov[illegible] aeration an[illegible] [illegible]ll minimize G[illegible]***

Part 3[illegible] [illegible]st Use

Comp[illegible] incorporated i[illegible] [illegible]ll continue to brea[illegible] [illegible]pending on th[illegible] [illegible]ement practices, tem[illegible] [illegible]ainfall and feed[illegible] [illegible]rtion of that co[illegible] [illegible]ganic matter m[illegible] part of the soil's long ter[illegible] pool (sequestrat[illegible]

In[illegible] there are a numb[illegible] [illegible]ect effects, such as, in[illegible] [illegible]il moisture holdin[illegible] [illegible]y and a reduction in the ne[illegible] [illegible]ilizers, herbicide o[illegible] [illegible]de. T[illegible] [illegible]d result in le[illegible] [illegible]n, wh[illegible] [illegible]d and av[illegible] associat[illegible] [illegible]e when co[illegible] results in r[illegible] [illegible]icide or fung[illegible] use[illegible]

In a[illegible] [illegible]fe cycle analysis [illegible] [illegible]w composting in Aust[illegible] [illegible]missions from the [illegible]ction of co[illegible] comp[illegible] [illegible]h were more than o[illegible]weighed by the [illegible] of the [illegible] [illegible]posted products. The emissions came from the use[illegible] [illegible]ter and electricity in compost production, transport[illegible] [illegible]ation. The benefits came from carbon sequestra[illegible] reduction in fertilizers, electricity, water and herbici[illegible] [illegible]eby reducing the emissions associat[illegible] with the prod[illegible] [illegible]e of these items). The [illegible] persisted even [illegible] [illegible]ted products were trans[illegible] 400 miles to the [illegible] [illegible] and the trucks returned empty (Sharma and [illegible] [illegible]3).[7]

Conclusion

The impact of composting on climate [illegible] three components of the compost system: th[illegible] process, and the end use.

- The biggest benefit for most composting projects comes from emission avoidance; primarily from keeping methane-generating organics out of landfills or lagoons. Landfills with methane capture systems result in less GHG benefits. (see USCC factsheet *Keep Organics Out of Landfills* for more details).
- The composting process has the potential to produces some GHG, though those can be minimized. Good composting practices that balance the carbon:nitrogen ratio and provide adequate aeration and moisture will minimize GHG emissions.
- The end use of the compost provides some GHG benefits, both directly through sequestration and indirectly through [illegible] [illegible]il health, reduced soil loss, increased water [illegible] [illegible]age, and reduction of other inputs.

The act[illegible] [illegible] facility or system will have to be determined o[illegible] [illegible]sis. For more info on carbon credits for co[illegible] [illegible]C factsheet Composting and Carbon Credits.

References:

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About the USCC: The United States Composting Council (USCC) is a national not-for-profit organization dedicated to the development, expansion and promotion of the composting industry. For more information visit www.compostingcouncil.org

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[7] The full report is available from the Recycled Organics Unit website, www.recycledorganics.com