COMPOSTING IN AMERICA

A Path to Eliminate Waste, Revitalize Soil and Tackle Global Warming

FRONTIER GROUP

Maryland PIRG Foundation

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WRITTEN BY:

ABIGAIL BRADFORD AND JONATHAN SUNDBY
FRONTIER GROUP

ALEXANDER TRUELOVE AND ADAIR ANDRE
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Cover Photo: Cover Photos: Top - Tossing a banana peel into an organics bin. Credit: MPCA Photos via Flickr, CC BY-NC 2.0. Bottom - Salad greens growing in a greenhouse. Credit: Ken Hawkins via Flickr, CC BY 2.0.

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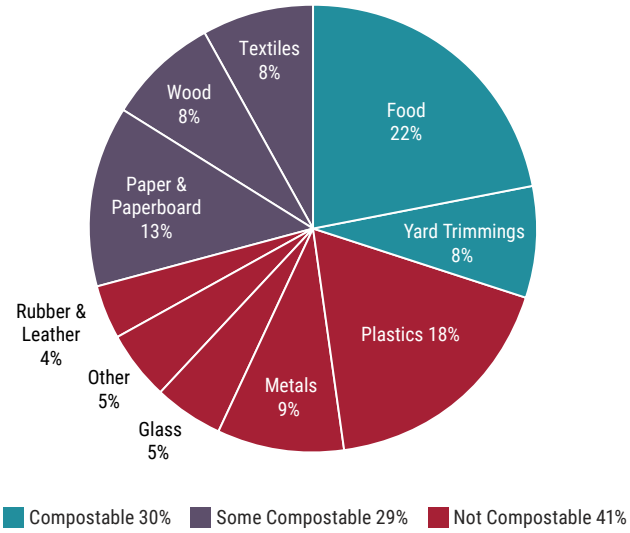
EXECUTIVE SUMMARY

AMERICA THROWS OUT immense amounts of trash, most of which is dumped into landfills or burned in trash incinerators. This is a costly system that damages the environment and harms our health. Luckily, communities across the country are turning toward a common-sense and beneficial solution: composting. Composting programs divert organic material – such as food scraps, leaves, branches, grass clippings and other biodegradable material – away from landfills and incinerators and turn it into a valuable product. Compost can replenish and stabilize soil, helping to boost and sustain food production in the future. It can also help pull carbon out of the atmosphere, helping to tackle global warming, and replace polluting chemical fertilizers, protecting public health.

Americans landfilled or incinerated over 50 million tons of compostable waste in 2015.[1] **That is enough to fill a line of fully-loaded 18-wheelers, stretching from New York City to Los Angeles ten times.[2]**

The system of collecting, landfilling and incinerating waste is a costly one that contributes to global warming and creates toxic air and water pollution. **Composting could reduce the amount of trash sent to landfills and incinerators in the U.S. by at least 30 percent.[3]**

FIGURE ES-1: MATERIALS LANDFILLED AND INCINERATED IN THE U.S. IN 2015 BY MATERIAL[176]



Thanks to strong composting and recycling programs, San Francisco has reduced the amount of trash it sends to landfills by 80 percent and composts 255,500 tons of organic material each year.[4] The state of Vermont passed a Universal Recycling Law in 2012 and is phasing in policies and programs until all of its recyclables, leaf and yard debris, food scraps and other organics will be banned from landfills in 2020.[5]

A growing number of cities, towns and states are recognizing the benefits of composting programs**. In just the last five years, the number of communities offering composting programs has grown by 65 percent.**[6] By following the best practices of programs around the country, American communities can launch successful composting programs that reduce waste, contribute to a sustainable food system, help tackle global warming, and reduce harmful air and water pollution.

Compost can help create a robust and sustainable agricultural system.

Topsoil, the nutrient-rich layer of soil vital for growing food, is being degraded and eroded at alarming rates, threatening our ability to grow enough food in the future.[7] According to the United Nations Food and Agriculture Organization, one-third of the world's topsoil is already degraded, and topsoil in the United States is eroding at more than nine times its natural rate of replacement.[8]

- Compost can replenish the nutrients in soil, restoring fertility in land that has been depleted.[9]

- Compost can help prevent topsoil erosion by allowing the soil to absorb more water during heavy rainfalls and by fostering robust plant growth.[10] **One study found that the application of compost helped to reduce soil loss by 86 percent.**[11]

Composting helps tackle global warming.

Organic waste does not decompose in the dark, low-oxygen conditions in landfills.[12] Instead, its degradation produces methane, a greenhouse gas about 56 times more potent than carbon dioxide over a 20-year period.[13] Landfills are the nation's third-largest source of methane emissions, emitting 108 million metric tons of carbon dioxide equivalent in 2017 – more than the total emissions of 34 individual states in 2016.[14] Composting organic material could significantly reduce methane emissions.

Unlike landfilling, composting organic material helps plants and microorganisms to grow and actually pulls carbon out of the atmosphere.[15] **One model found that applying compost to 50 percent of California's land used for grazing could sequester the amount of carbon currently emitted by California's homes and businesses.**[16]

Compost can replace synthetic chemical fertilizers, which can:

- Deplete soil in the long run,[17]

- Produce nitrous oxide – a greenhouse gas up to 310 times as potent as carbon dioxide over a 100-year period,[18]

- Produce nitrogen oxides, which can contribute to the formation of smog and cause respiratory problems and damage the lungs, and[19]

- Wash into waterways and fuel the growth of algal blooms that can kill or displace large numbers of fish and produce toxins that can sicken and kill animals and people who make contact with the water or consume contaminated shellfish and other organisms.[20]

To promote composting, cities and towns should adopt community-wide composting programs.

Most town-wide or city-wide composting programs work just like trash and recycling services – residents and businesses put their organic waste in a separate bin by the curb each week and it is picked up by a truck and brought to a composting facility. These programs are typically run by municipali-

ties in conjunction with private haulers and composting facilities, but some communities allow private companies to operate in their town or city independently. In some communities, residents and businesses drop off their organic waste at a designated location, which requires fewer city resources but results in less collected organic material.[21]

Successful composting programs share several characteristics:

- **Convenience:** Residents and businesses contribute more organic material to composting programs if that material is picked up "curbside," as is most trash and recycling.[22] Some communities, such as San Francisco, have also encouraged residents to participate in composting programs by making the bins for organic waste larger and trash bins smaller.[23]

- **Affordability:** Municipalities can incentivize residents and businesses to participate in composting programs by making them more affordable than trash disposal. This can be achieved through systems like Save Money and Reduce Trash (SMART) in which residents pay less if they throw out less trash. Systems like this create a direct financial incentive for residents to toss their organic waste into the composting bin instead of the trash.[24]

- Local governments can also combine the cost of organic waste pickup with trash and recycling, so that participants do not pay an extra fee, which is a barrier to participation.[25]

- **Frequency:** Organic waste should be collected as regularly and frequently as trash. Portland, Oregon, picks up organic waste more frequently than trash, encouraging residents and businesses to put their organics into the compost bin for quicker service.[26]

- **Education:** If people throw out materials that do not belong in compost, the compost can become contaminated. Sorting contaminants out of organic waste is resource-intensive, so it is more efficient and effective for residents and businesses throw out the appropriate materials from the start. Education and outreach initiatives like public service announcements, media stories, community meetings and on-site training can inform residents and businesses about what to throw in the compost bin and can also encourage participation.[27]

In addition to taking the steps above to create successful community-wide composting programs, cities, towns and counties should also:

- **Require commercial producers of organic waste to divert it to composting facilities.** Requiring large, commercial producers of organic waste to compost can divert a large percentage of organic waste away from landfills and incinerators, and does not require resources from the city.[28] Some communities have also used such a requirement to help build up their composting capacity and infrastructure in order to gradually phase in a city-wide program.[29] New York became the sixth state to pass such a requirement in March, 2019.[30]

- **Require government projects to use compost:** Local governments should lead by example and require that all government-funded projects use local compost when beneficial.[31] This will both deliver the benefits of compost to the community – erosion control, carbon sequestration and pollution reduction – and also help create a consistent market to sustain local composting facilities.

- **Incentivize backyard and community composting.** Backyard and community composting programs are beneficial because they reduce or eliminate the need to transport organic material.[32]
    - Support community composting programs, for example at schools and community gardens, through grants, free advertising and support in picking-up and delivering organic waste.[33]
    - Educate residents and businesses about how and why to compost themselves.
    - Supply residents with free or discounted compost bins as Boston does.[34] These programs often pay for themselves, as cities save money on transporting and paying to dump waste.[35]

To support local composting programs, the federal government and state governments should:

- **Subsidize the creation of composting facilities and programs through grants, loans and other financial mechanisms.** Creating composting facilities is often a good environmental and financial investment for a community, but it can require a lot of upfront capital.[36] Federal and state governments can help encourage the creation of these facilities by providing grants, loans or issuing repayment guarantees to those local municipalities and private companies that lack the resources to begin a project.[37] Federal and state governments should provide similar financial assistance for local governments and businesses to launch curbside organics pickup programs and purchase necessary equipment, such as trucks and bins.
- **Fund programs to develop and test municipal composting programs.** The 2018 Farm Bill included a $25 million allotment for the USDA to develop and test municipal composting programs. However, the funding will only go toward programs in about 10 states, and is only authorized through 2023.[38] Congress should increase USDA funding to develop projects in more states over a longer period.

Introduction

IMAGINE, IN A LONG-AGO TIME, one of our ancestors picked an apple to eat.

They ate most of it as they walked along and tossed the core on the ground when they were finished. Within a couple of days, the remaining apple became soft and the skin wrinkled. Insects, fungi and microorganisms living in the soil ingested the apple's remains. Within weeks, the apple had decomposed, its nutrients spread throughout the soil.

Later, another ancestor dug a small hole in the ground to plant their crops, scooping up the rich topsoil. The nutrients provided by the apple helped new crops to grow, providing food for more humans, animals and organisms.

Today, after we eat an apple, we toss its core into a trash can. From there it is hauled off to a landfill, crushed among pizza boxes and plastic bags, away from soil, air and water. Or it is burned in a trash incinerator. In either case, it is not ingested by soil microbes, it does not help food to grow – its nutrients are lost from the natural system.

These stories of the fate of an apple illustrate that in the natural world, nutrients are continually cycled, replenishing soil and sustaining continual food growth. Today in America, we have replaced that cycle with a dead-end street that essentially pulls nutrients from the soil and dumps them into landfills or burns them in trash incinerators.

Composting programs are an elegant solution that enable our modern society to mirror the natural world. If all organic materials were composted, the U.S. could get nearly one-third of the way toward zero waste.[39]

Through composting programs, discarded organic materials – from raked leaves to apple cores – are picked up or dropped off at composting facilities. There, the materials decompose in much the same way as in the natural world. The resulting nutrient-rich compost can then be used in farms and gardens, helping to replenish and stabilize the soil.[40] This can help stop soil erosion and replace the need for synthetic chemical fertilizers that deplete the soil in the long run, create air and water pollution, and create nitrous oxide – an extremely potent greenhouse gas.[41]

Cities, towns and states across America are recognizing composting as a common-sense solution to our waste problem with other valuable benefits. Through smart policy and local composting programs, communities can take an important step to reduce waste, create a robust and sustainable agricultural system, tackle global warming, and reduce air and water pollution.

An excavator moves over mounds of trash at the Anchorage Landfill. Credit: Brian Ferguson via U.S. Air Force, CC-BY-1.0.

The problem of organic waste in America

THE U.S. DISCARDS MILLIONS OF TONS of compostable material each year – primarily food scraps and yard waste. Most of this material is either burned in trash incinerators or dumped into landfills – where it emits methane, a potent greenhouse gas. Worse yet, in this system, the nutrients in organic materials are lost from the soil. This is a problem because topsoil – the vital, nutrient-rich top layer of soil – is currently being depleted at rates that are threatening our future ability to grow food. Composting can help solve these problems and can help reduce the use of synthetic chemical fertilizers that create toxic air and water pollution that harm our health.

America throws out immense amounts of compostable material

The U.S. wastes a huge amount of compostable material. Food waste and yard trimmings make up 28 percent of garbage thrown out by U.S. homes and businesses.[42] Wood, textiles and paper, some of which are compostable, make up another 38 percent.[43]

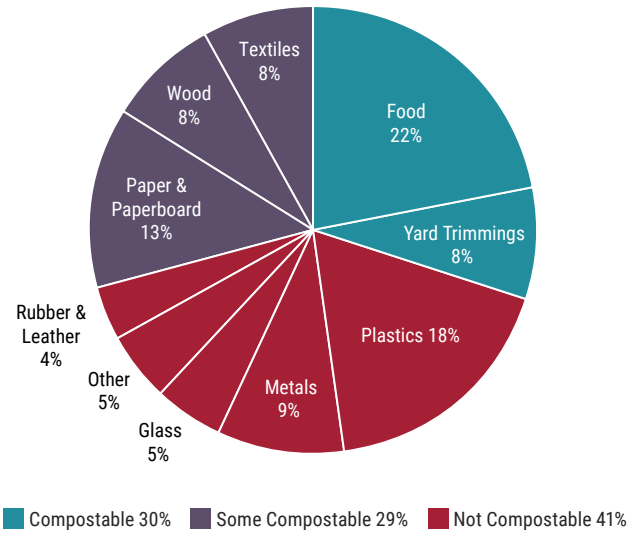
Americans landfilled or incinerated over 50 million tons of compostable waste in 2015.[44] That is enough to fill a line of fully-loaded 18-wheelers stretching from New York City to Los Angeles ten times.[45] In 2014, the Institute for Local Self-Reliance (ILSR) found that the U.S. has the potential to create 21 million additional tons of compost per year, which could cover up to 5.25 million acres of farmland.[46] This would be more than enough to cover all of the vegetable farms in the United States.[47]

All organic material can be composted, though not all composting programs accept all organic material. "Organic," in this case, does not refer to food grown without pesticides. Organic material in composting refers to any material derived from plants or animals – including food scraps, branches and leaves, some paper products, wood and natural fiber textiles.

Most discarded organic material is landfilled or incinerated

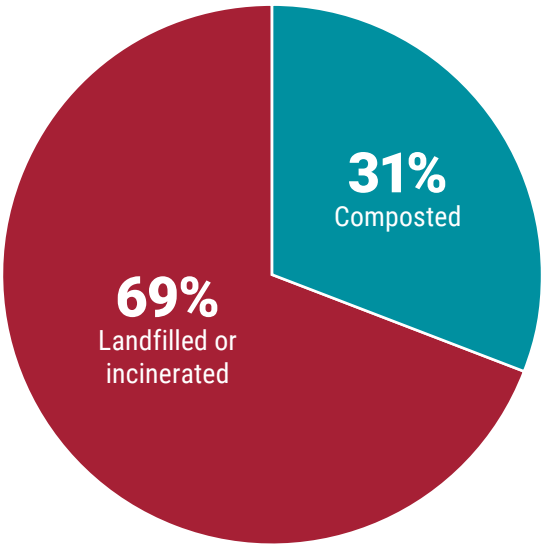
Food waste and yard trimmings make up 30 percent – nearly one-third – of the material that is landfilled or incinerated in the U.S.

FIGURE 1: MATERIALS LANDFILLED AND INCINERATED IN THE U.S. IN 2015 BY MATERIAL[177]



Less than one-third – 31 percent – of the food waste and yard trimmings that U.S. homes and businesses throw out is composted. The remaining 69 percent is burned in trash incinerators or dumped into landfills.[48]

FIGURE 2: U.S. ORGANIC WASTE HANDLING, 2015[49]



Composting programs for yard trimmings – grass, leaves, sticks, etc. – began in the 1970s and early 1980s.[50] These programs have since spread across the country, so 61 percent of yard trimmings are now turned into compost or mulch.[51]

The U.S., however, throws out more food waste than yard trimmings and almost none of that material is composted. Curbside pickup of food waste is available in less than 2 percent of American communities – only 326 towns and cities out of over 19,000 nationwide.[52] Since many Americans cannot or do not compost in their backyard, most of the country has no option but to throw their food waste into the trash. Because of this, nearly 95 percent of food waste is landfilled or incinerated, and only 5 percent is composted.[53]

Times are changing, though. The number of communities offering composting programs has grown by 65 percent in just the last five years.[54]

Vital topsoil is being lost at alarming rates

Topsoil is the layer of soil that contains the highest density of nutrients that plants and microorganisms need to grow. This layer of soil is vital for growing food and is currently being degraded and eroded at alarming rates. According to the United Nations Food and Agriculture Organization, one-third of the earth's topsoil is already degraded.[55] In the United States, 4.6 tons of cropland soil per acre are eroded annually, more than nine times the natural rate of replacement.[56] Topsoil is being eroded by deforestation, intensive industrial agriculture, global warming and sprawling urban development.[57] Topsoil loss is a serious threat to our society's ability to grow enough food in the future.[58]

Compost can help replenish topsoil and prevent future erosion.[59]

Landfilling organic waste contributes to global warming

Landfilling organic waste contributes to global warming. Organic material does not decompose in the dark, low-oxygen conditions of landfills. Instead, it degrades in a way that produces methane – a greenhouse gas around 56 times more potent than carbon dioxide over a 20-year period.[60] Landfills are the third-largest source of methane emissions in the U.S., responsible for 18 percent of total methane emissions. Globally, greenhouse gas emissions from waste have nearly doubled since 1970 and are now responsible for 3 percent of all human-made greenhouse gas emissions.[61] In 2017, landfills emitted methane equivalent to 108 million metric tons of carbon dioxide – more than the total emissions of 34 individual states in 2016.[62] Even if a landfill is equipped with methane capture technology, it still leaks significant amounts of methane into the atmosphere over time.[63]

When organic waste is composted, it helps plants and microorganisms to grow and pull carbon out of the atmosphere.[64]

Chemical fertilizers harm public health and the environment

Modern industrial agriculture relies heavily on synthetic chemical fertilizers to boost yield rates of certain crops. However, over time this practice depletes the soil of nutrients necessary to sustain food growth – such as organic carbon and nitrogen.[65]

When chemical fertilizers leak into waterways, they can produce algal blooms that suck the oxygen out of aquatic environments and create "dead zones," that can kill or drive away large numbers of fish and other organisms.[66] Harmful algal blooms, also known as red tides, blue-green algae or cyanobacteria, can produce toxins that can sicken or kill animals and people who make contact with the water or consume contaminated shellfish and other organisms.[67]

Inorganic nitrogen fertilizers also significantly contribute to air pollution by emitting ammonia and nitrogen oxides.[68] Ammonia emissions from fertilizer mix with other emissions, often from industrial sources, to produce fine particulate matter. These particles are small enough that when inhaled they often enter the bloodstream or become entrenched deep within the lungs. This can eventually lead to lung and heart disease.[69] Recent analyses estimate that fine particulate matter was responsible for 230,000 to 300,000 deaths in America in 2012, and 8.9 million deaths worldwide in 2015.[70] In the U.S., half of these emissions were due to nitrogen fertilizers and livestock.[71] Soils, particularly those fertilized with synthetic nitrogen, also produce 22 percent of global emissions of nitrogen oxides, which contribute to forming ground-level ozone or smog.[72] Both nitrogen oxides and smog can cause respiratory problems and damage the lungs.[73]

Compost can replace synthetic chemical fertilizers and reduce air and water pollution, and thus related health impacts.[74]

Composting programs have many benefits

COMPOSTING PROGRAMS MIRROR the natural world by allowing organic matter to decompose into nutrient-rich compost that is returned to the earth. This process has many valuable benefits. Composting programs can eliminate nearly one-third of the material sent to landfills and trash incinerators.[75] Through this shift, waste is swapped for valuable material that can help replenish and stabilize soils, helping to stop the loss of topsoil vital for growing food. Composting not only reduces greenhouse gas emissions, but it also helps sequester carbon dioxide. And lastly, compost can replace synthetic chemical fertilizers, helping to reduce toxic air and water pollution.

Composting can help eliminate landfills and trash incinerators

If all organic material was used or composted, the U.S. could get at least 30 percent of the way toward zero waste, helping to eliminate the use of landfills and trash incinerators.[76] This starts by reducing the amount of waste created – for example, 30 to 40 percent of the food grown for U.S. consumption each year never gets eaten.[77] There are steps that can be taken at each stage of America's food system – from when it's grown until someone purchases it – that can help eliminate food waste. Also, much of the yard trimmings thrown out – for instance, grass clippings – can be left on lawns and actually provide many benefits.[78] All of the organic waste that remains after such measures have been taken should be composted so that no organic material is wasted.

It is costly to build and operate trash incinerators as well as to contain the toxic waste produced by landfills. Conversely, composting produces a valuable product that can be sold. The average price to dump waste at landfills was $52 per ton in 2017 and is projected to rise substantially in the coming years due to increasing waste generation, a lack of haulers, and a recent Chinese ban on imported recyclables.[79] By comparison, the national average fee to dump organic waste at composting facilities is $35 per ton, about two-thirds the cost to dump at landfills.[80] Towns and cities are realizing the cost savings of diverting organic waste away from landfills and toward composting facilities.

Compost can replenish soil and prevent erosion

Compost can help replenish nutrients in topsoil and prevent erosion – boosting food production today and protecting our ability to grow food in the future. Compost has been shown to increase crop yields over time thanks to these and other benefits, including fostering microbial communities in soil that break down nutrients so they can be used by plants.[81]

By slowly releasing nutrients into the soil, compost begins the process of making humus and a new layer of rich topsoil.[82] Compost has been shown to benefit soil quality by increasing organic carbon content, and by providing soil with nitrogen, phosphorus, potassium and essential micronutrients not found in mineral fertilizers.[83]

Compost can also help prevent erosion. An application of compost can increase water infiltration into the soil, aiding the soil's ability to absorb rainfall rather than be washed away by it. One study found that the application of compost helped to reduce soil loss by 86 percent.[84] Compost can also help plants to grow, which shelter the soil and hold it together with their root sys-

A compost pile in different stages of decomposition.
Credit: Joi Ito via Flickr, CC-BY-2.0.

tems, helping to prevent the soil from being swept away by wind and water flow.[85]

Compost has benefits beyond replenishing nutrients in soil and preventing erosion. Plants grown in compost have been shown to survive more extreme climate conditions compared to those grown solely with synthetic fertilizers.[86] Compost can also increase the number of earthworms and microbes in soil, which break down organic material into a form that plants can use. Numerous studies have shown that the robust microbial communities fostered by compost can also effectively suppress various plant diseases.[87]

Composting can help tackle global warming

Composting can help tackle global warming by diverting organic waste away from landfills where it produces methane; by helping plants and microorganisms, which pull carbon dioxide out of the atmosphere, to grow; and by replacing nitrogen fertilizers that produce nitrous oxide, an extremely potent greenhouse gas.

The methane organic waste produces in landfills is a potent greenhouse gas – around 56 times more powerful than carbon dioxide over a 20-year period.[88] By diverting this waste to composting facilities, the organic material can decompose naturally and greatly decrease methane emissions.[89] If all of the food waste and yard trimmings that were landfilled in 2015 had been composted instead, it would have resulted in net negative emissions of 14.8 million metric tons of carbon dioxide equivalent – equivalent to taking over 3 million cars off the road that year.[90]

In addition to preventing methane emissions, compost helps beneficial plants and microorganisms to grow, helping to sequester carbon already in the atmosphere.[91] One model found that applying compost to 50 percent of California's land used for grazing could sequester the amount of carbon currently emitted by California's homes and businesses.[92]

Lastly, compost can replace synthetic nitrogen fertilizers which contribute significantly to emissions of nitrous oxide, a greenhouse gas up to 310 times more potent than carbon dioxide over a 100-year period.[93]

Compost can reduce the use of chemical fertilizers

Compost can support naturally robust soil, where crops thrive without the use of chemical additives. As discussed above, synthetic chemical fertilizers deplete soil nutrients over time, create toxic air and water pollution, and contribute to global warming.[94] Studies have shown that compost can successfully replace synthetic chemical fertilizers and provide additional benefits such as increasing the organic content in soil, supporting microbes, and providing micronutrients not found in fertilizers.[95] There are some types of emissions, such as ammonia, that also occur in composting but proper care of a compost pile can reduce the production and leakage of ammonia.[96] Compost can also help retain fertilizer in soil, preventing runoff that can cause algal blooms.[97]

Composting programs

THERE ARE SUCCESSFUL composting programs in small towns and big cities alike in every region of the U.S. Cities and towns are turning toward composting as a common-sense and beneficial solution to significantly reduce their waste, greenhouse gas emissions and air and water pollution – all while supporting local agriculture.

Cities and towns are adopting community-wide organic waste collection programs similar to trash and recycling services. Other communities require large producers of organic waste – such as grocery stores – to divert it to composting facilities. And some cities and towns support community composting programs, such as those at community gardens and schools, and encourage residents to compost in their own backyards. All of these initiatives can work together to divert organic waste away from landfills and trash incinerators.

Community-wide composting programs

Most town or city-wide composting programs work just like trash and recycling services – residents and businesses put their organic waste in a separate bin by the curb each week and it is picked up by a truck and brought to a composting facility.

Some local governments run their own organics collection programs, but most are run in conjunction with private haulers and composting facilities.[98] For example, in 2015, Prince William county in Virginia wanted to expand the capacity and operations of its local composting facility. Since the 1990s, the county had been processing yard waste at its facility but wanted to upgrade its technology and add food waste to the program.[99] Instead of financing the project themselves, the county partnered with Freestate Farms which took over operations and installed new equipment.[100] Through the contract, Freestate Farms handles and finances the upgrades, while the county now pays a price per ton of organic material delivered to the facility – similar to how trash and recycling programs often work. The new fees are comparable to what it previously cost the county to operate the facility.[101] By 2020, the facility will be operating at double its original processing capacity, composting over 80,000 tons of organic waste per year.[102]

Cities and towns can also allow private composting companies to operate in their community independently. There are several private haulers and processors, like Compost Cab in Washington, D.C. and Bootstrap Compost in Boston, that charge participating residents and businesses a fee to haul away and compost their organic waste weekly.[103] Voluntary programs such as these are a great starting place but tend to have lower participation rates than municipally-run programs. This means they often have to charge a higher pickup fee to be financially stable because they are not able to achieve the same economies of scale as city-wide programs.

Once robust composting programs have been established, cities, towns and states can also require residents to separate their organics from their trash and ban organic materials from landfills and incinerators. For example, San Francisco and Seattle require that their residents and businesses separate their food and yard waste from the trash. In Seattle, non-compliance can result in a $50 fine for multi-family residences after warnings and a token $1 fine

for single-family homes.[104] San Francisco imposes more substantial fines of $100 for residents and small businesses, and up to $1,000 for multi-residence homes and large businesses.[105] However, a series of educational initiatives and warnings are applied before the city issues fines.[106] Both these mandates work because they are combined with robust and straightforward composting programs, which give residents and businesses a viable alternative.

Curbside organic pickup programs do not make sense in all communities, for example in rural communities where homes are very spread out. In these cases, residents and businesses can drop their organic waste off at designated locations such as recycling centers, farmers markets or other town facilities as they do with their trash and recycling.

Workers climbing over a compost pile. Credit: Ramiro Barreiro via Wikimedia, CC-BY-SA 3.0.

Commercial composting requirements

Some communities require large commercial producers of organic waste – such as food processing facilities – to divert their organic waste away from landfills and toward composting facilities. This is an impactful measure because these facilities can produce a significant portion of a community's organic waste.[107] Also, as it is up to the producers to contract with haulers to deliver their organic waste to composting facilities, it does not require resources from the city.

Requiring large producers of organic waste to divert it to composting facilities can spur the development of local organic waste hauling and composting businesses that can then expand to handle the waste of homes and smaller businesses, too. Because of this, some communities have used such a requirement as a first step toward developing community-wide composting programs.[108] The entire state of Vermont enacted its Universal Recycling law in 2015 that initially targeted the largest producers of food waste and will gradually expand until all food scraps are banned from its landfills in 2020.[109]

This program has also led to an unexpected benefit; large producers of food waste, like grocery stores, are pulling food off the shelves a bit earlier and donating it instead. The Vermont Foodbank reported that food donations increased 25 to30 percent in 2015 and another 40 percent in 2016. The quality of food donations has also dramatically improved to include far more fresh foods, like fruits, vegetables and meat.[110]

Community and backyard composting

Backyard composting and community composting programs, such as those at community gardens and schools, can further reduce the amount of organic waste sent to landfills and incinerators. These practices also have the added benefit of producing organic waste and compost in the same location or nearby, thus reducing or eliminating the need for transportation.

Many communities already have existing community composting programs and can help support these programs through grants, free advertising and support in picking-up and delivering organic waste.[111] Cities and towns are also encouraging residents to compost in their own backyards. This is a good initiative for rural areas where curbside pickup of any waste is difficult due to the distance between homes. Cities and towns can encourage residents to compost by providing educational resources and classes with hands-on training. Some cities, such as Boston, also provide residents with the tools to start their own compost pile, such as a composting bin, at a large discount.[112] These programs often pay for themselves, as cities save money on transporting organic waste and paying high fees to dump it.[113]

Best practices for composting programs

COMPOSTING PROGRAMS SHOULD BE tailored to the needs, resources and demographics of each community. To ensure success, towns and cities should make composting programs cheaper than trash disposal; educate residents and businesses on what to compost; use curbside pickup if appropriate; and require municipal agencies and other groups to use locally-produced compost to create a market for local composting facilities.

Make composting programs cheaper than trash disposal

Composting facilities make money by selling finished compost, but that is not enough to cover the costs of collection and processing. So, like most trash and recycling programs, composting programs can be funded by user fees charged to households and businesses.

Cities and towns can incentivize residents and businesses to participate in composting programs by making organics pickup cheaper than regular trash disposal. Most communities do this by combining composting with Save Money and Reduce Trash (SMART) or Pay-As-You-Throw (PAYT) systems.[114] In most towns, residents pay nothing at all to throw out their trash or pay the same amount regardless of how much they throw out.[115] SMART systems encourage waste reduction by charging consumers less if they throw out less trash. These systems create a direct financial incentive for residents and businesses to donate their organic waste for composting instead of throwing it in the trash – as long as the composting collection is cheaper than trash collection. A survey of the 50 largest municipalities in Massachusetts with curbside trash collection found that those that implemented SMART or PAYT systems reduced the amount of trash generated by 33 to 44 percent in the first year.[116]

Currently, most residential, curbside composting programs are voluntary and charge an additional monthly or weekly fee to have compost picked up, which can deter people from participating.[117] Fees are much lower in municipally-run organics collection programs than in ones run by private businesses, but all fees deter participation.[118] Communities should roll the cost of organics pickup into one fee with trash and recycling rates to remove this barrier.[119]

Educate residents and businesses

Educating residents and businesses about the benefits of composting can spur participation, and educating them on what to throw in the organics bin can prevent contamination.

Municipalities can increase participation in composting programs by educating residents and businesses about the benefits of composting food scraps.[120] This can be done through social marketing such as advertisements, public announcements and social media to help promote the concept of composting. Peer-to-peer education is another tool widely used by municipalities. In Linden Hills, Minnesota, "block captains" are appointed by a local non-profit to educate their neighbors about the mechanics and value of composting, and San Francisco educates many of its residents through volunteers who teach gardening and composting classes.[121]

If people include materials that do not belong in compost, the compost can become contaminated. Sorting contaminants out of organic waste is resource-intensive, so it is more efficient and effective for residents and businesses to throw out the appropriate materials from the start. Achieving this requires education.

There are many ways to educate residents and businesses about what to put in the organics bin. Educational and public outreach campaigns can and should be conducted through a variety of means. Before Seattle implemented its mandatory composting program, the city used public advertising, newsletters, community meetings and newspaper articles to help spread the word about the program.[122] Boulder and Portland, Oregon, post instructional videos on their websites, and the city of Denver recently released an online "quiz" that helped educate residents about proper source separation.[123] San Francisco employs specialists to knock on doors when the city updates its composting and waste policies, and other cities conduct onsite training by city employees or haulers on how to properly sort and handle compost.[124]

Use curbside pickup if appropriate

There are two main ways to collect organic material for composting: have it picked up by a regular curbside service, as is most trash, or require that residents drop it off at designated locations. There are benefits and drawbacks to both options, and the model a community adopts depends on a variety of factors – including its population density, budget and waste diversion goals. BioCycle identified 148 curbside and 67 drop-off organic waste programs around the nation that collected food scraps as of 2017.[125]

Curbside pickup is similar to most municipalities' trash and recycling programs – a truck makes the rounds and collects every building's organics on a regular schedule. A survey of 180 food scrap collection programs found that the vast majority of these programs have curbside service.[126] A curbside program is a familiar model to most residents and the convenience is likely one reason why these programs experience higher waste diversion rates than programs where participants have to drop off their organics at a collection facility.[127] The same survey found that households with curbside organics collection diverted an estimated 25 to 30 pounds of waste per week from the trash, about 49 to 59 percent of their total waste.[128] Curbside pickup is more resource-intensive than drop-off programs, but has been shown to be more successful in keeping organic waste out of landfills.[129]

Some communities go even further to make composting more convenient than trash pickup. San Francisco has encouraged residents to participate in composting programs by making the bins for organic waste larger and trash bins smaller.[130] Portland, Oregon, picks up organic waste more frequently than trash, encouraging residents and businesses to put their organics into the compost bin for quicker service.[131]

Many municipalities have incorporated food waste into their longstanding curbside programs for yard waste.[132] Residents and businesses that are already used to separating their yard waste can now include their food scraps, helping to speed the adoption of food waste programs and divert more of our waste away from landfills and incinerators.[133]

A green compost bin accompanies a blue recycling bin on pickup day. Credit: Becky Striepe via Flickr, CC-BY-SA 2.0.

Including both food waste and yard trimmings can even help create better compost.[134]

Currently, some cities provide curbside composting only to customers who live in single-family units. This precludes a large portion of the population from composting and can hinder a city from meeting its waste diversion goals. Beyond simply allowing multi-family residents to participate in composting, some cities have realized that their participation is crucial to the success of a composting program. In Toronto, the city government commissioned targeted advertising to apartment dwellers, a specialized hotline for questions and a task force whose goal is to help multi-unit residences meet their waste diversion targets.[135] The city also extended PAYT pricing to multi-family residences, which provides a financial incentive for building owners to both adopt and encourage composting amongst their tenants.[136]

Drop-off programs require residents to drop off their organic waste at specific locations, such as recycling centers, farmers markets or other town facilities. Drop-off centers are a common approach to collecting yard debris from households as well as recycling, particularly in rural areas. These programs usually lead to lower participation rates but are often cheaper than curbside collection and have been shown to work well in urban settings.[137] The average drop-off program received 3 to 4 pounds of food scraps for each household per week – that is about one-eighth as much material as curbside programs collect.[138] However, New York City and several cities in Minnesota, Massachusetts, Colorado and Vermont have been able to establish successful drop-off programs with multiple sites that are staffed by volunteers or city officials.[139] Although drop-off programs are less convenient, they can be a good, low-cost starting point for municipalities looking to implement a food-waste program.

Compost the organic material

Once organic material is collected, it must be brought to a composting facility. There, microorganisms and fungi feed off the nutrients in the organic material and break it down into compost. This process typically takes 60 to 90 days before the compost is ready to be used on soil.[140]

Composting requires air, water and the right mix of materials and heat to reduce the presence of pathogens and to produce compost with the right composition. There are multiple methods that composters use to create these conditions. Different uses also call for compost with varied nutrient make-ups which are produced using different ratios of materials.[141]

The most common method for large-scale composting is called "windrow" composting, where piles are placed outdoors and turned periodically by heavy machinery or are constructed to allow air to flow through the piles. The turning of the piles inserts oxygen into the process, which helps the material decompose properly.[142] This composting technique is often used at industrial composting facilities, as they can handle large amounts of diversified organic waste streams and subsequently produce significant amounts of compost.[143] Because windrow composting can process large amounts of organic waste, this method is well-suited for many municipalities.[144]

Conversely, "in-vessel" composting contains compost within a silo, drum or concrete-lined trench.[145] This eliminates the manual work required to turn piles in windrow composting and helps control the odor and leachate that can accompany compost piles.[146] While there are many areas in which an in-vessel system is superior to the traditional methods, they also are more expensive and may require experienced and technical oversight.[147] Additionally, there

are some concerns as to whether compost produced through in-vessel systems is equal in quality to compost produced through more traditional methods.[148] Municipalities that are considering an in-vessel system should evaluate their human and monetary resources and decide whether they have the capacity and need for the technology.

Feeding an in-vessel composting machine on Homestead Air Reserve Base. Credit: Lou Burton via U.S. Air Force, CC-BY 1.0.

Another option is to pair composting operations with anaerobic digesters.[149] Anaerobic digesters break down organic material in a facility without oxygen, or "anaerobically." This process produces biogas, primarily composed of carbon dioxide and methane, which is captured to produce electricity or renewable natural gas.[150] In addition to harvesting the energy, a facility can later compost the partially decomposed by-product.[151] While they also produce methane, anaerobic digesters are quite different from landfills because all the gas is captured in a controlled environment, which means that digesters are not contributing to global warming like landfills.

Composting facilities also differ in the types of organic material they use. All plant matter – including food waste and yard trimmings – can be composted, and some facilities use processes and conditions to compost animal by-products, such as meat and dairy, and consumer products, such as plastic-like compostable bags (which, despite their name, do not always break down easily). According to a BioCycle survey of American composting programs that process food waste, over 90 percent of programs allow meat and dairy into their food scrap stream, 68 percent accept paper bags, and fewer than half allow compostable plastic products, such as bags.[152]

Create markets for compost

Composting facilities can sell their compost directly to stores, farms and other businesses, but cities and towns should also buy back locally-produced compost for use in public projects or to distribute to residents, community gardens or other local projects.[153] To achieve this, some municipalities require agencies to use local compost in their public works projects.[154] This helps create steady demand for the compost produced at local composting facilities and also helps ensure governments and their contractors use environmentally friendly practices.

Cities can also require residents and businesses to use compost in landscaping renovations or large projects. This is done by more than 10 Colorado communities as a way to promote water conservation, but also has the additional benefit of stimulating compost demand.[155]

Some composting programs provide participants with free compost to encourage participation.[156] Some composting facilities also give away excess compost to participants or residents to help educate them about the benefits of compost and encourage participation. Although this type of program can be a workable solution for facilities with too much product, it may also undermine the value of the compost in the market.

Policy recommendations: A path toward universal composting

IF ALL ORGANIC MATERIAL were used or composted, America could eliminate at least 30 percent of the waste sent to landfills and trash incinerators each year.[157] The amount of organic waste, such as uneaten food, that is produced should be reduced as much as possible and all remaining waste should be composted. Compost helps replenish and stabilize vital topsoil, tackle global warming, and protect public health by reducing toxic air and water pollution.

Communities across the country are recognizing these benefits and are using smart policies to expand composting. At all levels of government, elected officials can implement reforms to divert waste away from landfills and trash incinerators and toward composting and recycling facilities. Through robust composting and recycling programs and clear, goal-oriented legislation, San Francisco is able to divert 80 percent of its waste from landfills and compost 255,500 tons of organic material each year.[158]

Municipal and county governments should:

Create community-wide organics collection programs. By following the best practices outlined above, local governments can implement their own composting programs to significantly reduce the amount of waste they send to landfills and their greenhouse gas emissions, while supporting local agriculture.[159] Local governments should design compost programs that work for their communities while aiming to implement curbside programs whenever feasible as these have been shown to be the most effective at diverting organic waste from landfills.[160] Many communities have successfully expanded their curbside yard trim pickup programs to include food waste.[161]

Make organics collection cheaper than trash disposal. Programs such as Save Money and Reduce Trash (SMART) charge residents and businesses less if they throw out less trash. This creates a direct financial incentive to throw organic material into the composting bin instead of the trash. This has been shown to increase composting participation. Another approach is to embed the cost of organics collection into the overall cost of trash and recycling services to remove the disincentive of paying an additional fee.

Require commercial producers of organic waste to divert organic waste to composting facilities. Large commercial producers of organic waste, such as food processing facilities and grocery stores, can produce a significant portion of a community's organic waste.[162] Requiring such facilities to divert their organic waste to composting facilities can greatly reduce the organic waste a community sends to landfills and trash incinerators. Also, as it is up to the organic waste producers to contract with haulers to deliver their organic waste to composting facilities, it does not require resources from the city. Such requirements can spur the development of local organic waste hauling and composting businesses that can then expand to handle the waste of homes and smaller businesses, too. Because of this, some communities have used commercial diversion requirements as a first step toward developing community-wide composting programs.[163] New York became the sixth state to pass such a requirement in March, 2019.[164]

Use locally-produced compost in public projects and spaces. Cities and towns should buy back locally-produced compost for use in public projects or to distribute to residents, community gardens or other local projects.[165] To achieve this, some municipalities require agencies to use local compost in their public works projects.[166] This helps create steady demand for the compost produced at local composting facilities, and also helps governments and their contractors use environmentally friendly practices. Cities can also require residents and businesses to use compost in landscaping renovations or large projects. This is done by more than 10 Colorado communities as a way to promote water conservation while also stimulating compost demand.[167]

Support backyard and community composting. Community and backyard composting have the added benefit of reducing or eliminating the need to transport organic waste and compost.[168] Towns and cities should support community composting programs, for example at schools and community gardens, through grants, free advertising and support in picking up and delivering organic waste.[169] Communities should also educate residents and businesses about how to compost themselves and supply residents with free or discounted compost bins. These programs often pay for themselves by reducing the amount of waste cities have to haul and pay to dump at landfills or incinerators.[170]

Ban organic material from landfills. Once a robust composting program is in place, municipalities can ban residents from throwing their organic waste in the trash. After implementing universal and accessible composting programs, both San Francisco and Seattle have now made it illegal for organic waste to end up in a landfill.[171] For over 20 years, 20 states have banned yard debris from landfills and five states now ban food waste to help drive composting development.[172] Cities can first address non-compliance with warnings and education, and later with fines.

Encourage local composting economies. Transporting organic materials for long distances reduces the climate benefits of composting. Strategically placing composting facilities in areas that don't require extensive transport can help maximize the environmental benefits of composting. Establishing smaller-scale, community-level composting facilities can also give residents access to high-quality compost which helps improve local soils.

To support local composting efforts, federal and state governments should:

Subsidize the creation of composting facilities and programs through grants, loans and other financial mechanisms. Creating composting facilities is often a good environmental and financial investment for a community, but it can require a lot of upfront capital.[173] Federal and state governments can help encourage the creation of these facilities by providing grants, loans or issuing repayment guarantees to those local municipalities and private companies that lack the resources to begin a project.[174] Federal and state governments should provide similar financial assistance for local governments and businesses to launch curbside organics pickup programs and purchase necessary equipment, such as trucks and bins.

Fund programs to develop and test municipal composting programs. The 2018 Farm Bill included a $25 million allotment for the USDA to develop and test municipal composting programs. However, the funding will only go towards programs in about 10 states, and is only authorized through 2023.[175] Congress should increase USDA funding to develop projects in more states over a longer period.

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