

Executive Summary

Compost is the dark, crumbly, earthy-smelling material produced by the natural decomposition of organic materials. It is a valuable soil conditioner. Compost adds needed organic matter to soil, sequesters carbon in soil, improves plant growth, conserves water, reduces reliance on chemical pesticides and fertilizers, and helps prevent nutrient runoff and soil erosion. But it also reduces the volume of and recycles materials that might otherwise be disposed in landfills or trash incinerators such as leaves, grass clippings, brush, garden trimmings, wood, manure, and food scraps. Furthermore, unlike recycling, composting is inherently local and part of the natural ecosystem. Recovered organics cannot be shipped abroad to be made into compost; this happens locally with myriad benefits to the local economy and environment. It is a place-based industry, which cannot be outsourced abroad. Thus, advancing composting and compost use in the US is a key sustainability strategy to create jobs, protect watersheds, reduce climate impacts, improve soil vitality, and build resilient local economies.

With all these benefits, why aren't we composting more? How can we generate and use more compost to sequester carbon in soil and improve soil structure and fertility? Where can the compost come from? What kinds of systems are the most effective? What types should be promoted? What are the threats to expanding composting? What are its limitations? What infrastructure and policies are needed to advance composting? How do we do implement these?

The State of Composting in the US: What, Why, Where & How seeks to address these questions. It explains what composting is and why it is important; summarizes model programs, technologies and systems; and provides a national and state-by-state snapshot of activities, infrastructure needed, and policy opportunities. It concludes with recommendations on how to grow composting in the US.

Section 1: What Is Composting and Compost

Composting is the controlled aerobic, or oxygen-requiring, decomposition of organic materials by microorganisms, under controlled conditions. It reduces the volume and mass of the raw materials while transforming them into a valuable soil conditioner – compost. Composting is a proven approach to recycling a wide variety of organic materials from household kitchen scraps and yard trimmings to crop residues, biosolids, animal manures, and soiled paper. Composting, at any scale, is a biological manufacturing process. The resulting compost product is valued for its organic matter content and is utilized to enhance the chemical, physical, and biological properties of soil. Compost is not typically considered a fertilizer, although it can reduce the amount of fertilizer needed.

Composting can take place at many levels – backyard, block, neighborhood, schoolyard, community, on-farm, and regional – and in urban, suburban, and rural areas. There are many methods and scales and ownership can be private or public or a combination of the two. Large-scale centralized facilities can serve wide geographic areas and divert significant quantities of organic materials from disposal facilities. Composting locally at the neighborhood or community-scale level yields many other benefits: improved local soils, more local jobs, greener spaces, enhanced food security and fewer food deserts, less truck traffic hauling garbage, increased composting know-how and skills within the local workforce and reinforced in the next generation. When composting is small-scale and locally based, community participation and education can flourish.

Composting Systems

There are many types of composting systems, large and small, and everything in between. Regardless of size, man-

aged composting systems have adequate microorganisms to digest organic materials, adequate oxygen, adequate moisture, adequate food for microorganisms (that is, a balanced carbon to nitrogen ratio), diversely sized particles that provide pore space for oxygen to travel, and an adequate volume of material to best allow the microbial population to grow and thrive (usually a cubic yard or more). Food scraps represent materials high in nitrogen; thus, any food scrap composting program must find adequate supplies of carbon-rich materials such as wood chips, straw, leaves, and brush. In addition, compost needs time and space to stabilize and mature after an initial phase, typically characterized by high temperatures, and frequent monitoring and management.

Composting is a relatively simple process that can be performed outdoors in most climates. Because of a desire to operate the process more efficiently, control odors, and minimize the effects of weather, some facilities operate under structures, in fully enclosed buildings, or in entirely mechanized facilities (and combinations thereto). There are many composting configurations in use today. All fall into one or more of these classifications: open vs. contained, passive vs. active, static vs. managed, and onsite vs. centralized. Several basic composting systems are available:

Static Systems: Static pile systems are passively aerated, relying on the “chimney effect” where the internal air heated by microbial decomposition rises and is replaced with cool air.

Turned Windrow Systems: Windrow composting involves forming material in long, narrow, low piles known as windrows that are about twice as wide as they are high. Windrow composting is the most common composting system used in the US today due to its suitability to a wide variety of materials and capacities and low capital and operating costs.

Passively Aerated Windrow Systems: Similar to static systems but where aeration is enhanced by using perforated pipes to allow air into the pile.

Actively Aerated Systems: These systems use fans and blowers to move air through the compost pile to maintain aerobic conditions in the piles. These are generally static systems with little or no turning during the 30-45 days of active composting. Appendix A explains the various aerated static pile (ASP) systems available and spotlights examples of operating facilities around the country.

Bioreactors: A bioreactor is an enclosed, rigid structure or vessel used to contain the material and is usually equipped with process control systems that monitor the operating performance of the composting process such as temperature and oxygen or carbon dioxide. Bioreactors can be classified by their configuration (horizontal, vertical with channels, with cells, with containers, with tunnels and with rotating drums), by operational mode (continuous or batch), and by movement of material within the reactor (static or dynamic). Appendix B provides more detail and examples of the wide range of bioreactor configurations available.

Vermicomposting: Vermicomposting – or worm composting – involves special species of worms decomposing or-

ganic materials into a rich humus. *Eisenia fetida*, commonly called red wigglers, is the most popular type of worm for vermicomposting. Vermicomposting systems are more suited to smaller-scale applications like backyard/individual, on-site, and on-farm than to the larger-scale applications. There are numerous sources of worm bins for small-scale applications. Larger-scale units are available from some technology providers.

Costs

Composting system costs vary and establishing a facility can be expensive (although as we note pales in comparison to building new landfills or trash burners). Fixed assets associated with composting facilities are land, site improvements, and the processing technology. Site improvements at larger-scale facilities can include security gating, grading, constructing roadways and materials handling impermeable surfaces, weigh scales and offices buildings, and storm water management facilities. Site improvements can be on the order of \$250,000/acre.

Smaller-scale, community-level composting facilities can be done for significantly less, in that many of them operate on municipally-donated or leased land or can be sited in repurposed commercial or industrial buildings, have limited site improvement needs and can use more affordable, small-scale processing technologies. One recent study estimated a capital cost of about \$220,000 for a network of four community-level composting facilities and one centralized curing/product management/equipment maintenance facility.

Costs for processing technologies vary widely and are considered proprietary information by most technology providers. Small-scale aerated static pile systems are usually below \$10,000-\$25,000 each; horizontal bioreactors and containerized ASPs can vary between \$100,000 and \$700,000 each; and larger-scale in-vessel systems and dry fermentation AD systems cost multiple millions of dollars. Technology providers generally sell the physical equipment, help oversee installation, provide operations and maintenance manuals, provide start-up training assistance, and, often, ongoing phone/internet support for a period of time along with a warranty.

Operating costs in organics recycling are similar to those in any bulk commodities industry: fuel for vehicles and equipment, labor costs, and vehicle/equipment maintenance.

A growing concern among many composters is the increasing cost of carbonaceous amendments needed to provide carbon and structural porosity for proper composting. In less than ten years, due in large part to demand created by the growth of the biomass industry, the price of wood chips has risen from near-nothing to over \$20 per ton. As the normal weight-to-weight ratio between wood chips and compostable solid waste is 1:1, this adds potentially crippling costs to a composting operation.

Despite the success of many composting enterprises, raising financing from traditional lending and equity institutions can be challenging. Banks and other financial institutions are

not familiar with these operations. As noted in Section 3, state grants and loan programs for composting have decreased over the last 10 to 15 years (see Table 3-7); these financing programs helped composters procure necessary equipment to get facilities started.

Material Feedstocks Available for Composting

There is enormous potential to increase composting and the production of compost in the US. At the same time, the need for compost is great, especially to restore soil structure, vitality and fertility.

From the municipal waste stream alone (material discarded by households, businesses, and institutions), approximately 35 millions tons of food scraps, 14 millions of yard trimmings, 13 millions tons of soiled paper, and 13 millions tons of wood waste are landfilled or burned each year. Assuming only half of this wood waste and the paper is suitable for composting, 62 millions tons of municipal organics now disposed in the US could instead be captured for composting, producing an estimated 21 million tons of additional compost.

Livestock manure and municipal biosolids are also suitable compost feedstocks. Dairy cows generate about 146 millions tons of manure each year. Beef cattle produce an estimated 280 million tons, swine 287 million tons, and poultry livestock 230 million wet tons. On a dry ton basis, this equates to 136 million tons of manure each year. Municipal biosolids are the residual semi solid material from wastewater treatment. Each person produces about 30-50 dry pounds of biosolids per year. With a US population of 316 million in 2013, this translates to 5 to 8 million dry tons of biosolids per year. Manures and biosolids are high in nitrogen, and thus require mixing with high carbon feedstocks such as leaves, wood waste, or agricultural crop residues (e.g., corn stalks, corn silage, or wheat straw) in order to properly compost.

Millions of tons of agricultural crop residues are potentially available for composting, but it should be noted that excessive harvesting of agricultural residuals could have long-term impacts on soil quality, especially if the land from which they are harvested is not replenished with the compost or other organic matter. No-till farming is increasingly recognized for its ability to retain organic matter and cycle nutrients in the soil. It is a method of farming in which crop residues are left on the field and there is minimal soil disturbance. One potential avenue for using some agricultural residues high in carbon such as wheat straw, rice straw, barley straw and stalks from sorghum, would be to first use the material as animal bedding. The advantages of this approach include providing two uses for the material and the likely proximity of animal operations to fields used to produce animal feed.

Challenges and Impacts

Composting has many benefits but it is also not without its drawbacks and challenges. These include odors, pathogens, contaminants, and concerns about nutrient run-off. Composting inherently involves dealing with putrescible materials, which means odors need to be actively managed to avoid becoming a

nuisance. Pathogens also need to be reduced, which is why time, temperature, and mixing are important. High-quality compost has to be free of harmful and physical contaminants. Physical contaminants – most notably plastics – are increasingly a problem, particularly for facilities accepting post-consumer food scraps. Persistent herbicides are another challenge, as they can find their way into composting facilities and even in very minute concentrations cause crop damage when the compost is used. However, failure to control and manage odors is the single biggest cause of adverse publicity, regulatory pressures and facility closures in the organics recycling industry. Appendix D discusses managing odors at compost sites.

Markets and Applications for Compost

There are many markets and applications for compost, both existing and emerging: agricultural and horticultural, landscape and nursery, vegetable and flower gardens, sod production and roadside projects, wetlands creation, soil remediation and land reclamation, sports fields and golf courses, and sediment and erosion control. Moreover, markets for quality compost are growing thanks to the expansion of sustainable practices associated with green infrastructure such as stormwater management, green roofs, rain gardens, and other forms of low-impact development (LID). Another emerging market is use of compost to sequester carbon.

Highest and Best Use

Composting is an age-old and important technique for cycling organic materials into soil, but it is not considered the highest and best use for all organic materials. Avoiding the generation of waste in the first place – source reduction – and rescuing food to feed people, for instance, are considered higher priorities than composting for food scraps. The US EPA has developed a hierarchy that represents EPA's perceived best management activities for food scraps. Reducing wasted food and feeding the hungry are considered the most beneficial, followed by industrial uses and composting. Landfill and incineration are identified as the least attractive.

ILSR endorses a more nuanced hierarchy of highest and best use, one that takes into account scale, ownership, and the level of community engagement. In general, we believe locally based systems should be prioritized over centralized systems. Locally based composting is important to support local food production and keep our backyards and streetscapes rich in organic matter. (Training programs are needed to ensure small-scale decentralized sites are well operated.)

The concept of highest and best use can apply to the finished compost in addition to how the raw organics materials are managed. Compost used for daily landfill cover, for instance, is a high-volume but low-value end market. In order to recycle organic materials into high-value compost, composters have to produce high-quality compost suitable for the desired end market. Buyers may be concerned with weed seed content, soluble salts, pathogens, pH, nutrient value, and level of organic matter. Compost quality requirements can differ significantly depending on the end use. The US Compost-

ing Council has a compost testing, labeling and information disclosure program – the Seal of Testing Assurance program – that provides reliable information on the quality of compost. The program supports production of consistently high-quality compost for high-value end uses.

Section 2: Why Compost?

Unsustainable patterns of wasting drive climate change, resource depletion, habitat destruction, and a range of other environmental crises. At the same time we throw away valuable organic materials, our soils suffer from topsoil loss and erosion, which in turn leads to severe watershed problems and threatens our ability to sustain life on earth. Shifting toward a decentralized recycling infrastructure addresses these environmental threats and forms the basis for strong local economies that operate in harmony with nature. Advancing composting and compost use is a key sustainability strategy to create jobs, protect watersheds, reduce climate impacts, improve soil vitality, and build resilient local economies.

Compost to Improve Soil & Protect Watersheds

One-third of the world's arable land has been lost to soil erosion and continues to be lost at an alarming rate. In the US, 99 million acres (28% of all cropland) are eroding above soil tolerance rates, meaning the long-term productivity of the soil cannot be maintained and new soil is not adequately replacing lost soil. Erosion reduces the ability of soil to store water and support plant growth. Much of the soil that is washed away ends up in rivers, streams and lakes, contaminating waterways with fertilizers and pesticides. Amending soil with compost has the following benefits:

- Improved soil quality and structure
- Erosion and sedimentation control
- Improved water retention
- Reduced chemical needs
- Cutting non-point source pollution

Compost to Protect the Climate

When landfilled, biodegradable organic materials are a liability as they break down and produce methane, a greenhouse gas 72 times more potent than carbon dioxide in its global warming strength (over a 20 year time horizon). Compost protects the climate in two main ways: it sequesters carbon in soil and it reduces methane emissions from landfills by cutting the amount of biodegradable materials disposed. There is a significant and growing body of evidence that demonstrates the effectiveness of compost to store carbon in soil for a wide range of soil types and land uses.

Compost to Reduce Waste

The potential to expand composting is enormous. The US disposes of 164 millions tons of garbage per year. Almost half the materials Americans discard – food scraps, yard trimmings, and soiled paper – is compostable. Food scraps alone represent one-fifth. While 58% of yard trimmings are recov-

ered for composting, the recovery level for food scraps remains low at only 4.8%. Many communities (such as San Francisco) have proven the ability of convenient composting programs to achieve high diversion levels.

Compost to Create Jobs

Jobs are sustained in each phase of the organics recovery cycle. In addition to the direct jobs at composting facilities, the use of compost supports new green enterprises and additional jobs. Most of the end markets for compost tend to be regional, if not local. Each recycling step a community takes locally means more jobs, more business expenditures on supplies and services, and more money circulating in the local economy through spending and tax payments.

- On a per-ton basis, composting sustains four times the number of jobs as landfill or incinerator disposal.
- In addition to manufacturing compost, using compost in “green infrastructure” and for stormwater and sediment control creates even more jobs. Green infrastructure represents low-impact development such as rain gardens, green roofs, bioswales, vegetated retaining walls, and compost blankets on steep highway embankments to control soil erosion.
- An entire new industry of contractors who use compost and compost-based products for green infrastructure has emerged, presenting an opportunity to establish a new made-in-America industrial sector.
- Utilizing 10,000 tons of finished compost annually in green infrastructure can sustain one new business. For every 10,000 tons of compost used annually by these businesses, 18 full-time equivalent jobs can be sustained.
- For every 1 million tons of organic material composted, followed by local use of the resulting compost in green infrastructure, almost 1,400 new full-time equivalent jobs could potentially be supported. These 1,400 jobs could pay wages from \$23 million to \$57 million each year.
- Composting and compost use represent place-based industries that cannot be outsourced abroad.

Compost to Build Community

When composting is small scale and locally based, it has the potential to build and engage the community. Locally based composting circulates dollars in the community, promotes social inclusion and empowerment, greens neighborhoods, builds healthy soils, supports local food production and food security, embeds a culture of composting know-how in the community, sustains local jobs, and strengthens the skills of the local workforce.

Composting done in conjunction with community and school gardens provides a full soil-to-soil loop that few students would experience otherwise. Young composters grow into old composters, and students are instrumental in spreading compost awareness and experience throughout the entire community. Investment in training and education of today's youth will have a long-term payback for composting efforts in the future.

Section 3: Where Is Composting Happening – National Snapshot and Models to Replicate

Municipal and county government, and private food scrap generators increasingly recognize the importance of diverting yard trimmings and food scraps from disposal to reach recycling goals and manage solid waste handling costs. Yard trimmings composting programs are fairly well developed in the US. Of the 4,914 composting operations identified in the US for this study, about 71% compost only yard trimmings (based on 44 states reporting.) Food scrap recovery is slowly growing. More than 180 communities have now instituted residential food scrap collection programs, up from only a handful a decade ago. Countless supermarkets, schools, restaurants, and other businesses and institutions are also source separating their food scraps for composting. But the current infrastructure remains inadequate.

State organics recycling officials contacted as part of this project were asked to tally the number of composting facilities in their state by volume of material processed. For the states that provided total tonnage diverted and the number of facilities, the average diverted per facility per year was 5,155 tons. This is far too small. To achieve higher levels of composting in the US, more processing capacity will be needed.

Model Policies

At the state level, policies have been enacted to encourage or require diversion of source separated organics. Over 20 states enacted bans on disposal of yard trimmings in landfills many years ago. More recently, a handful of states have established food waste disposal bans. Connecticut's and Massachusetts' laws cover commercial food waste streams. Vermont's law covers both residential and commercial, phased in over the years 2014 to 2020. Commercial generators are required to comply first; residential organics diversion is required by 2020.

But disposal bans are certainly not the only mechanism for driving composting. Of the top five states in terms of diversion of organics to composting, only Iowa has a ban on disposal of yard trimmings in landfills. While California does not have a disposal ban on organics, it passed a waste diversion law in 1999 — AB939 — that required jurisdictions to divert 50% of the waste stream by 2000 or be subject to fines. The waste diversion goal has been effective at establishing local organics diversion programs — for both yard trimmings and food scraps.

Of the 39 states that responded to the question on programs in place to support composting, only 14 reported having a grant program, and even fewer, 7, have a loan program. This lack of funding via grants and loans to establish or expand composting infrastructure is discouraging in light of the critical need for more organics processing capacity in the US. In addition, many states have cut the number of full-time employees dedicated to composting, i.e., state organics recycling specialists often are given other programs to manage that are unrelated to composting and organics management. The

Ohio Environmental Protection Agency and the California Department of Resources Recycling and Recovery (CalRecycle) stand out as two exceptions to this trend. Massachusetts, which is getting ready to enforce its commercial organics disposal ban in fall 2014, has contracted much of its technical assistance for composting to a nonprofit organization, so has not added staff at the agency level.

One reason for the lack of more facilities accepting food scraps is an inadequate regulatory structure to facilitate the development of new operations. In ILSR's August 2012 survey of Maryland composters, regulations and permitting were the most frequently cited challenges to facilities' financial viability and their opportunities for expansion. This is beginning to change. States are starting to modify their regulations to facilitate composting of source separated organics. Massachusetts, Ohio, Oregon and Washington are examples of several states that recently revised composting rules to create distinct categories for source separated organics including food waste. The permitting and site approval process in this tier is designed to be more streamlined and less costly.

Demand for compost will help drive the supply and development of new infrastructure. Compost purchasing incentives and specifications are needed. At the state level, a number of Departments of Transportation (DOT) have specifications for compost-based products for erosion and sediment control and storm water management. In almost all cases, the specifications require that the compost be certified under the US Composting Council's Seal of Testing Assurance (STA).

At the local level, municipalities — as part of their compliance with the federal Clean Water Act storm water rules — are utilizing green infrastructure tools such as green roofs and bioretention swales to manage storm water. In July 2013, Washington, DC's Department of Environment finalized new storm water regulations that rely in part on storm water retention. In its best management practices (BMP) guide for achieving water retention, compost is an element of several of the BMP groups, including green roof growing media, bioretention media, and compost-amended trees.

In Washington State, the Washington State Department of Ecology (DOE) *Stormwater Management Manual for Western Washington* includes a BMP for "Post Construction Soil Quality and Depth," which requires preserving site topsoil and vegetation where possible, reducing soil compaction, and amending disturbed soils with compost to restore healthy soil functions. The BMP calls for planting beds to have a topsoil layer with a minimum organic matter of 10% dry weight, which equates to 30-40% compost by volume. Turf areas should have 5% minimum organic matter (15-25% compost amendment by volume). King County, Washington, is one jurisdiction that has adopted this guideline as policy in its County code.

A small number of cities are requiring new lawns to incorporate compost as a water-saving measure (Leander, Texas, and Greeley and Denver, Colorado). Montgomery County, Maryland's RainScapes Program incentivizes the use of com-

post in raingardens and new landscapes. These innovative programs and policies could easily be adopted across the country.

Model Programs

Examples of successful composting facilities are plentiful. And feedstocks composted range from the typical municipal solid waste and wastewater organics (leaves, brush, grass clippings, food scraps, soiled and nonrecyclable paper, biosolids) to the “exotic” (road kill, whales, pizza dough). In short, source separation of organics, provides tangible rewards for changing behavior. Households and businesses can witness their trash shrinking by downsizing to smaller carts or less frequent set-out in the case of households, and downsizing from compactors to small dumpsters that are serviced less frequently in the case of businesses and institutions. When households become involved in composting, either at home or in the community, they reap the further reward of the finished compost.

ILSR has been documenting model composting programs for more almost 30 years and the archives of *BioCycle* are filled with how-to information on establishing and managing source separation and composting programs for residential, commercial and institutional organics. In addition, a number of toolkits are in the public domain.

In general, the most successful programs have the following elements:

- Convenience for participants (such as bins provided, frequent collection)
- Education and outreach (participants need to understand the benefits, what materials are accepted and how to sort properly)
- Targeting a wide range of materials (year-round yard trimmings, all types of food scraps, food-soiled paper)
- Elimination of sources of contaminants (such as banning polystyrene foodservice ware and requiring reusable, recyclable, or compostable ware)
- Pay-as-you-throw trash fees (which provide an economic incentive to reduce and recycle as much as possible and participate in recycling and composting programs)

Section 4: How to Advance Composting

There are many strategies to advance composting in the US. Solid scientific research is needed to demonstrate composting’s benefits. The US Composting Council’s Research and Education Foundation, for instance, is actively seeking support to compile and improve data related to storm water discharge from composting facilities, propose standards and specifications for compost use in green roof media, and demonstrate water savings with compost use across different soil/climate/crop scenarios. An accurate estimate of the number of composting and digestion facilities in the US and evaluation of both the direct and indirect economic benefit from the existence of these organics recycling facilities is needed to support economic development efforts to expand the industry. Further research to document the actual impacts (social,

environmental, economic) of small-scale community composting facilities is also warranted.

New rules and policies are very effective means for growing composting. There are numerous local and state policies that could be implemented to accelerate composting and compost production. Also needed is financial modeling to provide valid data for investors and other interested parties. Training is critical to the success of composting, regardless of the size. The development of professional compost science, engineering and usage programs at state land-grant colleges in the US could be funded to both raise the professionalism of the industry and to create a cadre of graduates that can help run and expand composting facilities.

A diverse and local composting infrastructure is needed. Composting can take place effectively in a wide range of scale and sizes: small backyard bins, community gardens, onsite systems at schools and hospitals, rural and urban farm-based operations, and large low-tech and high-tech regional facilities. Communities embracing a decentralized and diverse organics recovery infrastructure – one that first prioritizes food rescue, backyard composting, onsite institutional systems, community composting, and urban and rural on-farm composting before the development of centralized regional facilities – will be more resilient and will better reap the economic and environmental benefits that organics recovery has to offer. ILSR’s October 2013 survey of community composters identified a number of needs including training and staffing, technical assistance and grants, policies and standards, access to land, and help with public education and marketing. (Appendix F summarizes the survey results.)

Conclusion

America is at a crossroads. Our recycling rate has stagnated at around 40% for more than a decade. With compostable material making up one-third to one-half of municipal solid waste, there is an enormous opportunity to achieve higher recycling levels with comprehensive composting. In addition to yard debris and food scraps, soiled paper such as pizza boxes and paper towels can be composted. Switching to compostable foodservice ware and packaging would further help divert materials from disposal facilities. Increasing composting and compost use would benefit the US in other important ways too.

At the same time many states struggle to increase their recycling levels, local watersheds continue to suffer from excessive nitrogen and phosphorus levels due to nutrient-laden runoff pollution. Excess fertilizers from farms and suburban lawns, sewage from septic systems, and sediment from construction projects wash off the land and into our waterways every time it rains. When added to soil, compost can help manage these erosion, sedimentation, and stormwater runoff problems, while providing other benefits such as carbon sequestration. Healthy soils are essential for protecting local watersheds. Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions: water infil-

tration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition. These functions are largely lost when development strips away native soil and vegetation and replaces them with minimal topsoil and sod. Organic matter is vital to soil quality and amending soil with compost is the best way to increase the organic matter in soil, which improves soil's ability to retain water as well as sequester carbon.

Expanding the use of compost for stormwater and erosion control and in green infrastructure such as green roofs and rain gardens will create a new business sector throughout the US. For every 10,000 tons of compost used per year, about 18 jobs are sustained. This is in addition to the jobs that could be created by expanding the manufacturing of compost at composting sites.

There are countless farmers who could potentially start composting if they were trained and could navigate zoning and other regulations. Expansion of backyard composting would reduce municipal government costs to collect and handle material and retain valuable organic matter in our neighborhood soils. The creation of a comprehensive food recovery strategy would ensure that edible organics are diverted to those who need them most.

However, despite best intentions, composting and compost use will ultimately be limited if disposal fees remain cheap, new trash incinerators are built (under the false guise of providing renewable energy), persistent herbicides remain on the market, and policies are not passed to support the development of adequate infrastructure.

Incinerators need waste to make good on bond obligations. While incinerators are presented as green, renewable, economical solutions to waste problems, in reality, these facilities drain financial resources, pollute, undermine waste reduction and economic development efforts, and compete with the in-

roduction of comprehensive food scrap composting systems.

Composting operations, on a per-ton and a per-dollar-capital-investment basis, sustain more jobs than landfills or incinerators. For every 10,000 tons per year flowing to an incinerator, one job is sustained. A 2013 ILSR study, *Pay Dirt*, focused on Maryland, indicates that landfills sustain two jobs per 10,000 tons per year landfilled. In contrast, composting operations sustain four jobs for every 10,000 tons per year they handle.

Hundreds of new jobs could be created if organic material was diverted from landfills and incinerators to composting facilities. The potential job creation would increase if a diverse composting infrastructure was developed, that included many small- and medium-sized operations. The study found that if every 1 million tons of organic materials now disposed were instead composted at a mix of small, medium, and large facilities and the resulting compost used in green infrastructure, almost 1,400 new full-time equivalent jobs could potentially be supported, paying wages ranging from \$23 million to \$57 million. In contrast, when disposed in landfills and incinerators, this tonnage only supports 120 to 220 jobs.

ILSR recommends a comprehensive composting strategy: one that promotes home composting and small-scale farm and community sites as a priority, followed by onsite institutional systems and then development of commercial capacity for remaining organics.

It is time to adopt a national soils strategy that institutionalizes the role of healthy soils — achieved by adding organic matter such as compost — as a tool to manage the harsh effects of climate change as well as sequester carbon. The US has millions of acres of marginalized land starving for organic matter. Just applying 1/2 inch of compost per year to the 99 million acres of cropland eroding above soil tolerance levels would require about 3 billion tons of compost. There is not enough compost to meet this need. No organic scrap should be wasted. □