Pay Dirt

Composting in Maryland
to Reduce Waste, Create Jobs, & Protect the Bay

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About the Institute for Local Self-Reliance

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The Institute for Local Self-Reliance (ILSR) is a national non-profit research and technical assistance organization that since 1974, has championed local self-reliance, a strategy that underscores the need for humanly scaled institutions and economies and the widest possible distribution of ownership. ILSR's Waste to Wealth program focuses on converting waste from liabilities to valuable assets. It is unique in promoting zero waste planning specifically aimed at maximizing the economic development potential for local communities. During the last three decades, ILSR has documented model composting initiatives, the job creation benefits of composting, and the link between expanding composting and climate protection. More recently it has researched states with model compost facility permitting regulations and other model policies to promote composting, and has led a peer-to-peer technical assistance program for farmers interested in composting in the Mid-Atlantic region. It currently chairs a metropolitan DC Organics Task Force as well as the US Composting Council's Legislative & Environmental Affairs Committee. In Maryland, ILSR worked with Delegate Heather Mizeur (District 20) to introduce HB817 *Environment – Composting*, which led to the creation of the Statewide Composting Workgroup and set in motion the revision of the State's composting permitting regulations.

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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 Maryland is a key sustainability strategy to create jobs, protect the Chesapeake Bay watershed, reduce climate impacts, improve soil vitality, and build resilient local economies.

Pay Dirt: Composting in Maryland to Reduce Waste, Create Jobs, and Protect the Bay summarizes the current composting infrastructure in the state, compares the number of jobs sustained through composting versus disposal facilities, outlines the benefits of expanding composting and compost use, underscores the importance of a diverse composting infrastructure that includes backyard and community composting, and suggests policies to overcome obstacles to expansion.

It does not analyze the costs to the public or private sectors of developing source-separated food scrap collection programs. Collection program costs will in part depend on the location and type of composting infrastructure developed. With local capacity available, communities and businesses will likely be better positioned to develop cost-effective collection programs. More research is needed to assess costs and how comprehensive composting could reduce the state's waste disposal needs and put it on a path to a zero waste economy. Additional research on the total jobs, economic output and wages that could be supported by expanding composting in the state is also warranted to corroborate the initial findings in this report.

Current Composting Infrastructure in Maryland

Most Maryland counties have a well-developed infrastructure for collecting and composting yard trimmings. In 2010, more than 780,000 tons of yard trimmings were composted, contributing to the state's reported 44.6% diversion level. Material composted represented more than a quarter of material recycled. However, many jurisdictions could capture more yard trimmings.

Several communities have or soon will pilot residential food scrap collection programs for composting, including Howard County, the Town of University Park, the City of Takoma Park, and Prince George's County. Howard County and Prince George's County are developing their own capacity to compost food scraps.

Many large food scrap generators such as the University of Maryland, supermarkets, and restaurants already have collection programs, but most of this material is transferred out of state to a large-scale state-of-the-art composting facility in Wilmington, Delaware. Few facilities accept food scraps for composting in the state. Chesapeake Compost Works, in Baltimore, is one new facility, but food scrap generators are still sending material out of state, despite the fact that this facility has excess capacity, charges competitive tipping rates and is open 7 days a week. However, even when the facility reaches capacity at 180 tons per week, it will only be able to handle a tiny fraction of the total tonnage of food scraps now disposed in the state.

One reason for the lack of more facilities accepting food scraps is an inadequate regulatory structure to facilitate the development of new operations. In our August 2012 survey of Maryland composters, regulations and permitting were the most frequently cited

challenges to facilities' financial viability and their opportunities for expansion. Another reason is the State's embrace of trash incineration and state policy that provides renewable energy credits to incineration, a technology that requires waste and wasting, and competes with the development of non-burn options such as composting, which are more environmentally benign.

Jobs: Composting Versus Disposal

Composting, mulching, and natural wood waste recycling operations in Maryland already sustain more total jobs than the state's three waste incinerators, which handle almost twice as much tonnage.

We identified 42 facilities that compost, mulch, or recycle natural wood waste. Half of these – 23 – participated in our survey in August 2012. These 23 operations process 358,230 tons and employ 147 full-time equivalent people, or 4.1 jobs per 10,000 tons per year.

Smaller facilities (under 5,000 tons per year) had a higher job-to-ton ratio than their medium sized (between 5,000 and 20,000 tons per year) and large sized (greater than 20,000 tons per year) counterparts. This indicates that the rollout of smaller facilities will create more jobs than the development of a handful of centralized facilities. A decentralized infrastructure will also reduce transportation costs, which are often the largest cost of any waste handling system.

In contrast to the state's organic material recycling operations, the state's three incinerators employ 160, while processing 1,329,530 tons per year (or 1.2 jobs per 10,000 tons per year).

The state has 22 landfills that accept municipal solid waste. Only six shared data on employment. These six employ 2.1 jobs per 10,000 tons per year landfilled.

Thus, on a per-ton basis, in Maryland composting (including mulching and natural wood waste recyclers) employs two times more workers than landfilling, and four times more workers than incineration.

Comparing the jobs sustained by composting operations to disposal facilities on a per capital dollar investment basis is even more striking. On a dollar-per-capital-investment basis, composting operations sustain three times more jobs than landfills and 17 times more jobs than incineration facilities in Maryland. But with data from only two landfills, more research is warranted. Regardless, composting sites do not pose the same bond and debt obligations for host communities.

In addition to direct jobs at composting sites (such as skilled equipment operators for windrow turners, front-end loaders, grinders, and screeners), further jobs are supported in the use of compost, which also tends to take place regionally.

Compost has many applications: agricultural and horticultural, landscape and nursery,

Benefits of Composting & Compost Use

- Reduces Waste
- Improves Soil
  - Creates a rich nutrient-filled material, humus
  - Increases the nutrient content in soils
  - Helps soils retain moisture
  - Reduces or eliminate the need for chemical fertilizers
  - Suppresses plant diseases and pests
  - Promotes higher yields of agricultural crops
  - Helps regenerate poor soils
  - Has the ability to cleanup (remediate) contaminated soil
- Reduces Stormwater Runoff & Soil Erosion
- Protects the Climate
  - Cuts landfill methane emissions
  - Stores carbon
  - Improves soil's ability to store carbon
  - Substitutes for energy-intensive fertilizers, pesticides, and fungicides
  - Improves plant growth, and thus carbon sequestration
  - Reduces energy use for irrigation
- Creates Jobs & Supports Local Economies
  - Composting can be small-scale and local
  - Jobs are local
  - Composting linked to urban farm production
  - Composting can diversify farm products and increase farm income
  - Compost products tend to be used locally
  - Use of compost products sustains additional businesses and green jobs

Source: Institute for Local Self-Reliance, 2013.

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. Jobs are sustained in each phase of the organics recovery cycle. 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, erosion and sediment control, and low-impact development. Growth in demand for compost can also be attributed to a strong green building movement helped along by the US Green Building Council and its LEED certification.

ILSR contacted 13 for-profit businesses that use compost for soil erosion control, stormwater management, and other green infrastructure to determine how many workers they employ and how much compost they use. Together these businesses, which span nine states from Maryland to California, employ 70 workers involved with compost use, while using approximately 38,000 tons per year of compost. That translates to 18 workers for every 10,000 tons per year of compost used.

If all Maryland's compost were used within the state for similar purposes, on a per-ton basis, composting and compost use would sustain 5 times more jobs than landfilling and 9 times more jobs than incineration. See Table ES-1 below.

If the estimated 1 million tons of organic materials now disposed in Maryland were instead composted at a mix of small, medium, and large facilities and the resulting compost used within the state, 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 the state's landfills and incinerators, this tonnage only supports 120 to 220 jobs. See Table ES-2.

Watershed Benefits of Compost Use

When added to soil, compost can help manage erosion, sedimentation, and stormwater runoff, which have devastating impacts on the Chesapeake Bay. Adding organic matter to soil via compost improves soil's ability to retain water. Because compost can hold up to 20 times its weight in water, when added to soil, it can

Table ES-1: Jobs, Composting Vs. Disposal in MD

Type of Operation	Jobs/ 10,000 TPY	FTE Jobs/$10 Million Invested
Composting Sites[a]	4.1	21.4
Compost Use	6.2	n/a
Total Composting & Compost Use	**10.3**	
Disposal Facilities		
Landfilling	2.2	8.4
Burning (with energy recovery)	1.2	1.6

[a] Includes mulching and natural wood waste recycling sites.

TPY = tons per year (of material composted)
FTE = full-time equivalent

Source: Institute for Local Self-Reliance, 2013. Incinerator data based on Eileen Berenyi, Governmental Advisory Assoc. Inc., *2012-2013 Municipal Waste to Energy in the United States Yearbook & Directory*. Westport, Connecticut. 2012.

Table ES-2: Potential New MD Jobs By Composting 1 Million Tons of Organics

Option	FTE Jobs
Burning	120
Landfilling	220
Composting	740
Compost Use	620
Total Composting	**1,360**

FTE = full-time equivalent

Composting jobs based on one-third tonnage composted at small facilities, one-third at medium-sized facilities, and one-third at large facilities. Compost use jobs based on data from 13 companies using compost for soil erosion control, stormwater management, and other green infrastructure applications.

Source: Institute for Local Self-Reliance, 2013.

prevent non-point source pollution, and help control erosion and sedimentation.

Compost can manage nutrient stormwater and agricultural runoff by serving as a filter and sponge. Its high porosity and permeability allow contaminated stormwater to infiltrate at much higher rates than most existing soils; especially those compacted via human development. Once in compost-amended soil, toxins and pollutants begin to break down. Compost immobilizes and degrades pollutants, improving water quality and has the ability to bind heavy metals, pesticides, herbicides, and other contaminants, reducing both their leachability and absorption by plants. When used as a filtering material, compost, reduces contamination of urban pollutants by an astounding 60 to 95%.

The Importance of a Diverse Composting Infrastructure

One important benefit of composting is its ability to function effectively in a wide range of scales and sizes: small backyard bins, onsite systems at schools and hospitals, farm-based operations, and large low-tech and high-tech regional facilities.

What is needed is a highly decentralized and diverse organics recovery infrastructure 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. Communities embracing such an infrastructure will be more resilient and will better reap the economic and environmental benefits that organics recovery has to offer.

The benefits of onsite composting are avoided transportation costs and the ability to use finished compost onsite for landscaping and other uses. Onsite composting is truly closed loop recycling.

ECO City Farms, in Edmonston (Prince George's County), exemplifies the benefits of community-based composting. This urban farm takes residential food scraps and using different composting techniques, turns it into fertile soil to support the production of dozens of varieties of produce. The locally produced food is then marketed to the local community, which includes local restaurants. ECO City operates a commercial kitchen and teaching space to demonstrate low-tech and low-cost solutions for urban farmers, enable value-added and farm-to-school food entrepreneurial ventures, and shares information in an open source design. ECO City directly involves the community at its operations, which reinforces a culture of composting and the connection of compost to healthy soils and food production.

Home-composting and community-based efforts may not be enough to reach high diversion levels for organic materials. Larger centralized facilities will likely be needed too. By developing a diverse infrastructure, Maryland can become a model for other states to emulate.

Policies Needed

Local and state government policies are needed to overcome lack of infrastructure and other obstacles to diverting organic materials from disposal.

There are many strategies local government can embrace, such as:

- Adopting a highest and best use hierarchy that prioritizes source reduction, food rescue, home-based composting, and community-based and on-farm composting over large centralized facilities,
- Starting an edible food donation program,
- Training Master Composters,
- Targeting a wide range of yard debris materials for year-round collection,
- Banning yard trimmings from disposal facilities, and
- Piloting food scrap collection programs.

The State has a critical role in supporting and encouraging composting at the local level. It can provide technical assistance to local jurisdictions, for instance, on best management practices, but it also needs to take a leadership role in facilitating the development of an expanded compost infrastructure. New rules are needed to clarify environmental requirements, exempt small facilities, and ensure all facilities

protect public health and the environment by meeting performance standards.

In 2012, a Statewide Composting Workgroup convened (in response to HB 817 from the 2011 legislative session entitled *Environment – Composting*) to study composting in the State; make recommendations on how to promote composting in the State, including any necessary programmatic, legislative, or regulatory changes; and to report findings and recommendations to The Maryland General Assembly.

The *Composting Workgroup Final Report* highlighted 15 core recommendations, from new compost site permitting regulations and financial assistance to support for creating markets for finished compost. (See Appendix A.) The two top recommendations were for The General Assembly to authorize MD Department of the Environment (MDE) to issue regulations for the design and operation of composting facilities and to exempt these sites from being subject to the same regulations as refuse disposal sites.

In the 2013 legislative session, The MD General Assembly did just this by passing HB 1440: Recycling-Composting Facilities (introduced by Del. Heather Mizeur). This bill will advance composting by allowing MDE to establish a permit system for composting facilities and exclude source-separated materials from being regulated as a solid waste. The bill paves the way for MDE to address the regulatory hurdles facing MD composters and to create a clear regulatory pathway for composting facilities.

The MD General Assembly should address all 15 recommendations of the Composting Workgroup and consider the many additional policies identified in this report (e.g., pay-as-you-throw trash systems, encouragement of a decentralized composting infrastructure, a moratorium on building new trash burners, implementation of a per-ton surcharge on all disposal facilities to fund recycling and composting initiatives, establishment of a 75% recycling goal by 2030, and compost-amended soil requirements).

Key Findings

Composting can divert significant materials from disposal

- Composting yard trimmings already diverts more than 780,000 tons per year of Maryland's waste from disposal, representing more than a quarter of material recycled.
- Expanding composting for food scraps will be important for counties to meet higher recycling levels.
- Almost one-half of typical household garbage set out at the curb is compostable. A pilot food scrap collection and composting program in Howard County indicates that food scraps alone make up one-quarter of residential material.
- Communities elsewhere, such as San Francisco, that have comprehensive composting programs including food scrap recovery, have surpassed 75% recycling levels.
- In Maryland, the potential to expand composting is enormous; more than 1 million tons of yard trimming and food scraps are estimated disposed each year.

Composting and using compost create jobs

- Composting (including mulching and natural wood waste recycling) operations in Maryland already sustain more total jobs than the state's three trash incinerators, which handle almost twice as much tonnage.
- Jobs are sustained in each stage of the organics recovery cycle: manufacturing compost as well as using compost.
- On a per-ton basis, composting in Maryland employs two times more workers than landfilling, and four times more than the state's trash incinerators.
- On a per-dollar-capital investment basis, for every $10 million invested, composting facilities in Maryland support twice as many jobs as landfills and 17 more jobs than incinerators.

- Wages at composting facilities typically range from $16 to $20 per hour.
- 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 job 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 can help protect the Chesapeake Bay watershed

- Healthy soils are essential for protecting the Chesapeake Bay and other watersheds.
- Compost is the best way to add organic matter – which is vital to soil quality – to soils.
- When added to soil, compost:
    1. Reduces non-point source pollution by binding pollutants and absorbing water, reducing erosion and sedimentation.
    2. Improves the quality of soil, retaining moisture and reducing the need for fertilizers, pesticides, and fungicides.
- Compost helps reduce stormwater runoff because it can hold up to 20 times its weight in water.
- Compost helps manage nutrient-laden stormwater and agricultural runoff by serving as a filter and a sponge. Its high porosity and permeability allow contaminated stormwater to infiltrate at much higher rates than most existing soils, especially those compacted via human development. Once in compost-amended soil, toxins and pollutants begin to break down. Compost immobilizes and degrades pollutants, improving water quality. It has the ability to bind heavy metals, pesticides, herbicides, and other contaminants, reducing both their leachability and absorption by plants.
- Compost-based products are identified as best management practices for controlling erosion and sediment in construction activities and for post-construction stormwater management. Examples: compost socks to trap sediment and for slope stabilization, compost vegetated cover, compost engineered soil, compost vegetated filter strips, and compost bioswales.
- Compost-based products for erosion control and stormwater management have the ability to filter and remove up to 99% of bacteria, 73% of heavy metals, 92% of nutrients, and 99% of hydrocarbons from stormwater.
- Compost, when added to soil, can reduce contamination of urban pollutants by an astounding 60 to 95%.

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.

- Smaller composting facilities have a higher job-to-ton ratio. In Maryland, on a per-ton basis, small-scale composting facilities employ six times the number of jobs as landfills and eleven times more than incinerators.
- Several small-scale food scrap composting operations have opened in Maryland the last three years, demonstrating the viability of locally-based systems: ECO City Farms, an urban farm in Edmonston; Chesapeake Compost Works, a private enterprise in Curtis Bay, Baltimore; and a Howard County government site to process material from a residential pilot.
- 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.
- By developing a diverse infrastructure, Maryland can become a model for other states to emulate.

Policies are needed to expand composting and compost use in Maryland

- Local and state policies are needed to overcome lack of infrastructure and other obstacles to compost expansion, such as permitting restrictions. Permitting and regulations are top challenges to composting facilities' financial viability and their opportunities for expansion. Maryland composters also point to financing and lack of demand for compost as obstacles to expansion.
- An emerging industry of companies that use compost and compost-based products for erosion control and watershed protection is looking to expand in Maryland and the Mid-Atlantic region, and can benefit if policies that promote composting and compost use are implemented.
- The State has a critical role in supporting and encouraging composting at the local level. It can provide technical assistance to local jurisdictions, for instance, on best management practices, but it also needs to take a leadership role in facilitating the development of an expanded compost infrastructure. New rules are needed to clarify environmental requirements, exempt small facilities, and ensure all facilities protect public health and the environment by meeting performance standards.
- The MD General Assembly should address all 15 recommendations of a Statewide Composting Workgroup, convened in 2012 as a result of MD House Bill 817, and should consider many additional policies that would support expanding composting in Maryland (e.g., pay-as-you-throw trash systems, encouragement of a decentralized composting infrastructure, a moratorium on building new trash burners, implementation of a per-ton surcharge on all disposal facilities to fund recycling and composting initiatives, establishment of a 75% recycling goal by 2030, and compost-amended soil requirements).

Conclusion

Maryland is at a crossroads. Its recycling rate has stagnated at around 40% for more than a decade, and counties are only required to recycle 35% by 2015 (20% if they have populations under 150,000). 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 state in other important ways too.

At the same time Maryland struggles to increase its recycling levels, the Chesapeake Bay watershed continues to suffer from excessive nitrogen and phosphorus levels due to nutrient-laden runoff pollution, despite decades of attention. 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. Healthy soils are essential for protecting local watersheds. Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions: water infiltration; 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.

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 in Maryland. 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.

Maryland has numerous 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 the State continues to approve new waste incinerators and pass policies that encourage trash burning.

Legislation passed in 2012 provides subsidies for burning trash under the guise of renewable energy credits. And an unsuccessful bill proposed by the incinerator company Covanta during the 2013 legislative session would have driven more trash to incinerators by establishing landfill diversion goals and penalties for landfill disposal but not for burning (SB799). Covanta is already working to get it reintroduced in 2014. Large trash burners are planned in Frederick County (1,500 ton-per-day capacity) and in the City of Baltimore (4,000 ton-per-day capacity), two communities that have yet to develop comprehensive programs to recover source-separated organics. 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 introduction of comprehensive food scrap composting systems.

One major finding of this report is that the state's composting operations, on a per-ton and a per-dollar-capital-investment basis, sustain more jobs than its landfills or incinerators. For every 10,000 tons per year flowing to an incinerator, one job is sustained. Data from 6 of the state's 22 municipal solid waste landfills, indicate landfills sustain two jobs per 10,000 tons per year landfilled. In contrast, half of the state's 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.

Based on data gathered for this report, if the estimated 1 million tons of organic materials now disposed in Maryland were instead composted at a mix of small, medium, and large

facilities and the resulting compost used within the state, 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 the state's landfills and incinerators, this tonnage only supports 120 to 220 jobs.

By establishing a moratorium on building new trash incinerators while the State puts in place new regulations and support for composting, Maryland will be better positioned to reap the rewards of expanded composting and compost use: jobs, better soil quality, a healthier Chesapeake Bay, reduced greenhouse gas emissions, and more resilient communities.

ILSR recommends a comprehensive composting strategy for Maryland: 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. If implemented, such a strategy would make Maryland a national leader.

Introduction

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. Thus, advancing composting and compost use in Maryland is a key sustainability strategy to create jobs, protect the Chesapeake Bay watershed, reduce climate impacts, improve soil vitality, and build resilient local economies.

Pay Dirt summarizes the current composting infrastructure in the state, compares the number of jobs sustained through composting versus disposal facilities, outlines the benefits of expanding composting and compost use, underscores the importance of a diverse composting infrastructure that includes backyard community and on-farm composting, and suggests policies to overcome obstacles to expansion.

It does not analyze the costs to the public or private sectors of developing source-separated food scrap collection programs. Collection program costs will in part depend on the location and type of composting infrastructure developed. With local capacity available, communities and businesses will likely be better positioned to develop cost-effective collection programs. More research is needed to assess costs and how comprehensive composting could reduce the state's waste disposal needs and put it on a path to a zero waste economy.

What Is Composting and Compost?

Composting is the aerobic, or oxygen-requiring, decomposition of organic materials by microorganisms, under controlled conditions. During composting, the microorganisms consume oxygen. Active composting generates heat, carbon dioxide, and water vapor. Composting reduces the volume and mass of the raw materials while transforming them into a valuable soil conditioner – compost.[1]

One benefit of composting is its ability to function effectively in a wide range of scales and sizes: small backyard bins, onsite systems at schools and hospitals, farm-based operations, community and urban gardens, municipal sites, and large low-tech and high-tech regional facilities.

There are many types of composting systems, large and small, and everything in between. Regardless of size, all composting systems must have adequate microorganisms to digest organic materials, adequate oxygen, adequate moisture, adequate food for microorganisms (that is, a balanced carbon to nitrogen ratio), adequately sized food particles for microorganisms to digest, and an adequate volume of material.

Several basic types of composting configurations are widely in use.

Windrow composting: Elongated piles that are turned with front-end loaders, tractors, or specially designed windrow turners. This is the most common system used in Maryland for composting leaves, grass clippings, brush, and other garden trimmings.

Passive aerated windrow: Elongated piles with perforated pipes underneath to passively aerate.

Aerated static pile: Piles with perforated pipes underneath that are actively aerated with blowers to pull or push air through the pipes. This type of system is growing for use in food

scrap composting. Peninsula Compost, the state-of-the-art food scrap composting facility in Wilmington, Delaware, uses covered aerated static piles, as does the new pilot system recently opened in Howard County.

Bin systems: These are piles enclosed in some sort of bin that are manually turned for aeration. They can be covered or not. Bins are often used for on-farm composting, community gardens, and backyards.

Tumblers: A cylindrical bin that can be turned on its axis.

In-vessel: Enclosed systems in which oxygen, moisture, and temperature are frequently automatically controlled.

Vermicomposting or worm composting is another type of process that decomposes organic materials into a rich humus or soil amendment using special species of worm. *Eisenia fetida*, commonly called red wigglers, are the most popular.

Low-tech aerated static pile composting system at Eco City Farms, Edmonston, Maryland.

In-vessel Earth Tub compost system installed at the Breitenbush retreat center in Oregon.

Windrow composting at the Prince George's County Western Branch yard trimmings compost site, Upper Marlboro.

Three-bin composting unit used in the New York City Compost Project for community-based gardens.

Drivers to Expand Organic Materials Recovery

Key drivers for expanding composting and other forms of organic material recovery include:

Feeding the hungry: Much of what we set out at the curb is edible food that can be rescued.

Enriching and building healthy soil: Compost adds needed organic matter to soil, sequesters carbon in soil, improves plant growth, reduces agricultural water use by 10%, and reduces reliance on chemical pesticides and fertilizers.

Strengthening sustainable food production and completing the food cycle: Locally produced compost is a valuable soil amendment for local food production and cycles food scraps back to the soil.

Increasing demand for green infrastructure: Green building design is driving low-impact development (LID) management practices that combine native soil, compost, plants, and beneficial microorganisms to filter, retain, and infiltrate stormwater runoff from developed construction sites.

Creating green jobs and sustaining local manufacturing businesses: Composting sustains more jobs than disposal facilities on a per-ton basis. Compost facilities manufacture soil amendments. Many of the jobs have low barriers to entry.

Reducing solid waste management costs: Transportation costs to and tip fees at compost facilities are often lower than landfills and incinerators, saving the private and public sector money. Food scraps is one of the largest and heaviest portions of the waste stream making its recovery increasingly cost-effective compared to disposal.

Curbing landfill methane emissions: Landfills are a top source of methane, a greenhouse gas many times more potent than carbon dioxide. Biodegradable materials are a liability when landfilled but a valuable asset when composted.

Producing renewable energy via anaerobic digestion: Anaerobic digestion of segregated organics generates biogas, a renewable fuel. Unlike trash combustion technologies, anaerobic digestion is a microbiological process that the environmental community supports.

Increasing regulations at the local and state levels: The number of cities, counties, and states with goals and regulations impacting food waste is growing. Some cities have made participation in source-separated organics collection programs mandatory. Several states will soon require commercial food waste generators to divert organics from disposal. Dozens of cities have restricted the use of polystyrene in foodservice ware in favor of compostable products.

A Word about the Compatibility of Composting with Anaerobic Digestion Systems

One benefit of composting is that it is compatible with anaerobic digestion, another microbiological process that breaks down organics materials in the absence of oxygen to produce a biogas, with properties similar to natural gas. (Composting is an aerobic process.) The digestate – or solids – remaining after anaerobic digestion can be composted. Indeed, a number of North American cities are now pursuing hybrid composting and anaerobic digestion systems, including Toronto, San Jose, and San Francisco. These hybrid systems are widely implemented in Europe. Anaerobic digestion systems are enclosed or "in-vessel," which typically means that their capital costs are higher than most composting systems. As a result, digestion systems may not always make sense for every community but some sort of composting almost always will.

Current Composting Infrastructure in Maryland

More than one-third of the municipal waste stream consists of biodegradable materials that could be diverted from landfills and incinerators into a valuable soil amendment product via composting. Nationally, more than 57% of yard trimmings – leaves, grass clippings, brush, and other garden discards – are composted. However, only 2.8% of the 34.8 million tons of food scraps are recovered.[2] Maryland follows this national trend. The infrastructure to compost yard trimmings is well established in most counties. In 2010, more than 780,000 tons of yard trimmings were composted and mulched. Indeed in 9 of Maryland's 23 counties, yard trimmings represent the single largest type of material recovered, playing a critical role in helping the state achieve its 44.6% reported diversion level in 2010.[3] Material composted/mulched represented more than a quarter of material recycled. However, many jurisdictions could capture more yard trimmings and few facilities accept food scraps for composting in the state. An estimated 1 million tons of organic materials are disposed in the state each year.[4]

The Maryland Recycling Act (MRA) requires all Counties and Baltimore City to recycle 15% or 20% of the waste generated depending on population. In addition, in 2000, Maryland established a voluntary statewide waste diversion goal of 40% by 2005. The waste diversion goal is comprised of the recycling rate + source reduction credits (maximum 5%) that Maryland Counties and Baltimore City earn through activities designed to reduce the amount of waste going to the waste stream.

Table 1 summarizes the recycling rate by county for 2010 and shows the portion composting contributes.

The State does not maintain a single list of all facilities that accept yard trimmings for composting or mulching. Operations that accept natural wood waste are required to have a natural wood waste recycling permit. Many of the state's large yard trim composting facilities have such permits. Appendix B lists the 28 permitted natural wood waste recycling facilities.

Increasing the capacity to process food scraps was a major focus of a Statewide Composting Workgroup that met in 2012. Counties must meet recycling rates of 20 or 35% by December 31, 2015 (depending on population), and the Workgroup acknowledged that expanding composting for food scraps will be important for counties to meet these rates.

Businesses and institutions in the state have been driving the demand for food scrap recovery. Many restaurants, supermarkets, and hotels already separate their food scraps for collection for composting, as does the University of Maryland. However, due to the lack of in-state infrastructure, most of this material is transferred out of state to Peninsula Compost, a large state-of-the-art composting facility in Wilmington, Delaware.[*]

A decade ago, one obstacle to food scrap recovery was the lack of collection service providers. This is no longer true as many haulers now offer collection for source-separated organics including food scraps. The challenge today is finding close-in sites that can accept material. While few composting facilities accept food scraps for composting in the state, one new food scrap composting facility – Chesapeake Compost Works, which opened in Baltimore, December 2012 – still has excess some capacity. However, even when it reaches capacity it will only be able to accept 180 tons per week, a miniscule fraction of the total capacity needed in the state to handle the total tonnage of food scraps now disposed.

Howard County and the Town of University Park are the first local Maryland jurisdictions to pilot residential food scrap collection and composting programs. Other communities are following suit.

[*] The facility is considered state-of-the-art as it uses an enclosed composting system, the Gore Cover System, that automatically monitors temperatures and oxygen levels to optimize composting conditions. In addition, a biofilter manages odors as does the site's enclosed tipping building that has an air handling system built to exchange the air four times/hour.

Table 1: Contribution of Composting Yard Trim to MD Recycling Rate, 2010

County	MRA Recycling Rate (%)[a]	Diversion Rate (%)[b]	Composted, tons	MRA Recycled, tons (including composted)	% Composted of MRA Recyclables	% Composted of MSW
Worcester	22.9%	22.9%	12,585	19,938	63.1%	14.4%
Wicomico	18.9%	18.9%	2,872	22,573	12.7%	2.4%
Washington	42.3%	43.3%	1,095	62,950	1.7%	0.7%
St. Mary's	36.6%	40.6%	7,478	32,041	23.3%	8.5%
Somerset	18.4%	18.4%	6	4,057	0.1%	0.0%
Prince George's	40.4%	45.4%	77,410	339,400	22.8%	9.2%
Montgomery	47.2%	52.2%	174,569	500,425	34.9%	16.5%
Mid-Shore[c]	50.3%	50.3%	12,061	107,051	11.3%	5.7%
Howard	45.9%	49.9%	79,602	216,947	36.7%	16.9%
Harford	56.8%	59.8%	58,542	155,780	37.6%	21.3%
Garrett	45.2%	46.2%	9,048	18,243	49.6%	22.4%
Frederick	44.3%	49.3%	27,194	107,443	25.3%	11.2%
Dorchester	19.0%	19.0%	1,126	9,001	12.5%	2.4%
Charles	39.0%	44.0%	29,842	52,575	56.8%	22.2%
Ceci	45.9%	49.9%	49,701	70,540	70.5%	32.3%
Carroll	41.2%	46.2%	37,359	73,095	51.1%	21.0%
Calvert	26.1%	26.1%	1,275	16,464	7.7%	2.0%
Baltimore County	41.0%	46.0%	97,825	433,207	22.6%	9.3%
Baltimore City	27.0%	27.0%	4,234	188,170	2.3%	0.6%
Anne Arundel	44.1%	47.1%	96,354	279,379	34.5%	15.2%
Allegany	25.2%	27.2%	6,061	21,922	27.6%	7.0%
Total			**786,239**	**2,731,201**	**28.8%**	**11.8%**

[a] MRA = Maryland Recycling Act
[b] Waste Diversion Rate = MRA Recycling Rate + Source Reduction Credit
[c] Mid-Shore Regional Recycling Program includes Caroline, Kent, Queen Anne's, and Talbot Counties

Source: Institute for Local Self-Reliance, 2013. Based on Maryland Department of Environment, *Maryland Solid Waste Management and Diversion Report – 2011 – (Calendar Year 2010 Data)*, Nov. 2011, p. 26.

Howard County's new pilot composting system is designed to compost yard trim with food scraps from the County's two pilot curbside collection areas servicing 10,000 households. It is the first facility of its kind in Maryland.

Howard County began its pilot program in August 2010 in Ellicott City. This initial pilot was well received by participating residents and indicated that a countywide food scrap collection program with carts would be a valuable service to Howard County residents. The pilot helped to reduce trash by 23% and increase recycling.[5] In April 2013, Howard County opened its own composting facility on a ¾ acre site at its Alpha Ridge Landfill. The goal of the project is to compost yard trim and food scraps locally, saving on processing and transportation costs. The composting system is an aerated static pile system manufactured and designed by Engineered Compost Systems, a system in wide use throughout the West Coast.

The Town of University Park's pilot program earned it an Outstanding Small Government Program Award by the Maryland Recycling Network in 2012. The Town partnered with Compost Cab, a local collection service provider, to provide weekly household pickup from 50 volunteer households. Response to the program was "overwhelmingly positive."[6] By using compostable bin liners, airtight collection buckets and weekly curbside pick-up, the pilot demonstrated that town-wide composting is possible without attracting pests or odors and with no inconvenience to participants. University Park is now conducting a larger and year-long pilot program with 150 households. Collected kitchen scraps are being composted at the US Department of Agriculture's compost demonstration site in Beltsville, Maryland.[7]

The City of Takoma Park started two pilot residential food scrap collection programs in February 2013. For one program, the City has partnered with growingSOUL to collect vegetable scraps and food contaminated paper products from 65 households. GrowingSOUL is delivering material to a farm in northern Montgomery County. The second pilot, with Compost Crew as the partner, is larger and includes 300 households. City collection crews collect material, which can include dairy and meat products, and deliver it to Chesapeake Compost Works. Both pilots will run 6 months.

Prince George's County has announced that it will pilot a food scrap composting program in 2013, and expects to have a full scale system in

place by December 31, 2015. It plans to replace its current windrow composting system at its Western Branch yard trim site in Upper Marlboro with a new aerated static pile composting system that can handle both yard trim and food scraps.

Despite this growing interest, there remains a current lack of capacity for processing food scraps in Maryland, and most material collected for composting is leaving the state for Delaware. One reason for the capacity shortage is an inadequate regulatory structure to facilitate the development of new operations. Another reason is the State's embrace of trash incineration and state policy that provides renewable energy credits to incineration, a technology that requires waste and wasting, and competes with the development of non-burn and more environmentally benign options such as composting.

Stakeholder members of the Statewide Composting Workgroup indicated that confusion surrounding regulatory requirements is a major barrier to increasing capacity for composting. Thus, the Workgroup identified as a priority the clarification of legal requirements and creation of a clear regulatory pathway for new operations.

In the Institute for Local Self-Reliance'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. Financing and lack of market demand for compost were also frequently mentioned. Despite these challenges, the rising interest in composting in the State is apparent; over 70% of survey respondents replied that they would like to expand their operations. When asked what kind of assistance would address the facilities' challenges, the most frequent response was assistance with, or improvements to the regulations and permitting process. Grants and funding were also mentioned frequently.

In the 2013 legislative session, The MD Assembly passed HB 1440: Recycling-Composting Facilities (introduced by Del. Heather Mizeur), a bill that will advance composting by allowing the MD Department of the Environment (MDE) to establish a permit system for composting facilities and exclude source-separated materials from being regulated as a solid waste. The bill paves the way for MDE to address the regulatory hurdles facing MD composters and create a clear regulatory pathway for composting facilities.

Clockwise from top left: 1. Finished compost at Recycled Green Industries in Woodbine. 2. Windrow turner at Montgomery's County's yard trim composting site in Dickerson. 3. Chesapeake Compost Works new food scrap composting site in Baltimore. 4. City of College Park's yard trim windrow turner at work.

Jobs: Composting Versus Disposal

Whether on a per-ton basis or on a per-dollar-capital investment basis, composting sustains more jobs than other handling options such as landfills and incinerators.

In order to document the contribution of composting and natural wood waste recovery to Maryland's job base, in 2012, the Institute for Local Self-Reliance (ILSR) identified and surveyed sites in the state that compost, mulch, or recycle organic materials such as yard debris, natural wood waste, and food scraps. The survey requested information in a wide variety of areas including types of materials processed, amount of material handled, number of employees, acreage of facility, obstacles to operation and expansion, and capital investments incurred. The "Compost/Mulch/Natural Wood Waste Survey," included as Appendix C, was sent to 42 operating facilities. About half participated: 11 public and 12 private operations.

Table 2 lists the name and location of the 23 participating facilities and the main products each produces. The amount of tonnage each handles per year significantly varies: from 16 to 75,000 tons. The number of employees likewise varies: from 1 to 26. Together, these sites sustain 147 full-time equivalent jobs, while processing an estimated 358,230 tons per year. For every 10,000 tons per year handled, 4.1 jobs are created.

In contrast, employment data from 6 of Maryland's 22 municipal solid waste landfills, indicate 2.2 full-time equivalent jobs are sustained per 10,000 tons per year landfilled. The state's three operating waste incinerators have an even lower job-to-ton ratio: 1.2 employees per 10,000 tons per year burned. See Table 3.

On a per-ton basis, composting in Maryland sustains twice the number of jobs as landfills and four times the number of jobs as incinerators.

But because composting facilities can be cost-effective at small scales as well as large scales, it is interesting to see how the job-to-ton ratio is impacted by size. Ten sites in our survey handle 5,000 tons per year or less. Seven sites handle between 5,000 and 20,000 tons per year. And six facilities handle 20,000 tons per year or more. Table 4 indicates that the smaller the facility, the higher the job-to-ton ratio. Small-scale facilities, for instance, employ six times the number of jobs on a per-ton basis than landfilling, and eleven times more than incineration.

Comparing the jobs sustained by composting operations to disposal facilities on a per capital dollar investment basis is even more striking. Composting systems – even the high-tech ones – do not require the same level of capital investment as landfills or incinerators. Table 5 compares the jobs per $10 million invested for each management option. But with data from only two landfills in the state and few state-of-the-art food scrap composting facilities, more research is warranted.

A Word about Survey Response and Data Available to ILSR

While close to 3 out of 4 public composting, mulch, or natural wood waste recycling facilities contacted were willing and able to respond, only about 1 out of 3 private facilities participated. Data from public facilities are, therefore, possibly overrepresented in comparison to their private counterparts. Despite this, the data and analysis are possibly bolstered by the fact that our total survey sample of 23 facilities is split evenly in terms of public and private operations. A facility was not any more or less likely to provide a particular type of information depending on its ownership. The small size of some private businesses may have affected their ability to devote time to even a brief survey or phone call. However, it is difficult to know the size (capacity or employees) of firms that did not respond to our survey or phone calls. Of the businesses that did respond, the 8 facilities that process 20,000 tons or more per year were predominantly public (5 out of 8). The remaining 15 sites, processing under 20,000 tons per year, are split fairly evenly (6 public, 9 private).

Table 2: Compost, Mulch, and Natural Wood Waste Recycling Facilities Participating in ILSR Survey

Facility	Location		Main Product(s)	Technology/Process Used
ACME Biomass Reduction Inc.	Brookville	Private	compost, wood chips	Chipping/Grinding
Allegany County Compost Site	Cumberland	Public	mulch	no information provided
Baker Rubble Landfil	Queenstown	Private	compost, wood chips	Static Piles (Non-Windrow)
Carroll County Government	Westminster	Public	mulch	no information provided
Chesapeake Compost Works	Baltimore	Private	compost	Aerated Static Piles
City of College Park Dep. of Public Works	College Park	Private	compost, wood chips	Windrows, Static Piles (Non-Windrow), Chipping/Grinding
Comer Construction	Aberdeen	Private	mulch, top soil	no information provided
Eco City Farms	Edmonston	Private	produce	Aerated Static Piles, Vermicomposting
Garrett County Solid Waste & Recycling	Oakland	Public	compost, wood chips	Windrows, Chipping/Grinding
Grant County Mulch	Burtonsville	Private	mulch	no information provided
Harford Waste Disposal Center's Mulch & Compost Facility	Street	Public	compost, wood chips	Windrows, Chipping/Grinding
Howard County Dep. of Public Works	Marriottsville	Public	compost, wood chips	Windrows, Aerated Static Piles, Chipping/Grinding
Kent County Nicholson Drop-Off Ctr.	Chestertown	Public	mulch	Chipping/Grinding
Montgomery County Compost Facility	Dickerson	Public	compost	Windrows
Prince George's County Government	Largo	Public	compost, wood chips	Windrows, Chipping/Grinding
Recycled Green Industries, LLC	Woodbine	Private	compost, wood chips, soil amendments, mulch	Windrows, Static Piles (Non-Windrow), Chipping/Grinding, Soil Screening/Blending
Sharp Lawn & Tree, Inc.	Chestertown	Private	mulch, wood chips	Static Piles (Non-Windrow)
Takoma Park Dep. of Public Works	Takoma Park	Public	mulch	Static Piles (Non-Windrow)
Topsoil Etc, Inc.	Baltimore	Private	compost	Windrows
Veteran Compost	Aberdeen	Private	compost, wood chips, soil amendments	Aerated Static Piles
Washington County Solid Waste Dep.	Hagerstown	Public	wood chips, soil amendments	Windrows
Wicomico County Government	Salisbury	Public	wood chips	Chipping/Grinding
Wirtz & Daughters	Joppa	Private	compost, wood chips, soil amendments	Chipping/Grinding

Source: Institute for Local Self-Reliance, 2013.

Table 3: Jobs Sustained: Composting Versus Disposal

	Compost, Mulch, Natural Wood Waste	Incineration, MSW[a]	Landfilling, MSW[b]
Number of Facilities	23	3	6
Range in Size, TPY	16 – 75,000	117,999 – 676,434	11,182 – 162,000
Range in FTE Jobs	1 – 26	43 – 68	5 – 46
Total TPY Processed	358,230	1,329,530	583,597
Total FTE Jobs	147	160	126
Jobs/10,000 TPY	4.1	1.2	2.2

FTE = full-time equivalent MSW = municipal solid waste

TPY = tons per year

[a] Jobs and tonnage data from Eileen Berenyi, Governmental Advisory Assoc. Inc., *2012-2013 Municipal Waste to Energy in the United States Yearbook & Directory*. Westport, Connecticut. 2012

[b] Based on personal communication with facility operators. Landfills surveyed are the publicly run facilities in Worcester, Harford, Cecil, Dorcester, and Washington Counties.

Source: Institute for Local Self-Reliance, 2013.

Table 4: Smaller Facilities Employ More Per Ton

	Small[a]	Medium[b]	Large[c]
Number of Facilities	10	7	6
Range in Size, TPY	16– 4,000	5,400 – 19,010	20,000 – 75,000
Range in FTE Jobs	1 – 8	2 – 10	5 – 26
Total TPY Processed	21,306	79,278	257,646
Total FTE Jobs	29	47	71
Jobs/10,000 TPY	13.6	5.9	2.8

FTE = full-time equivalent TPY = tons per year

[a] Less than or equal to 5,000 tons per year
[b] Between 5,000 and 20,000 tons per year
[c] 20,000 tons per year and more

Source: Institute for Local Self-Reliance, 2013.

Fifteen out of the 23 participating facilities provided information on their capital investments for their composting, mulching or natural wood waste recycling operations. The range in total capital investments (initial construction to present day) from these facilities varied from as low as $10,500 (in constant 2010$) to as high as $11.8 million (in constant 2010$). In total, the 15 facilities employ 101 full-time equivalent people for a total capital investment of $47 million (in constant 2010$), or 21 full-time jobs per $10 million invested.

We were only able to solicit capital investment data from two landfills in Maryland. One landfill, which employs 46, reported a capital investment cost of $58.64 million (in constant 2010$), or 8 FTE positions per $10 million invested. The second landfill reported total capital costs of $22 million (in constant 2010$) and employs 22 full-time people, or 10 full-time jobs per $10 million invested. In addition, the three Maryland incinerators have an aggregate capital investment of $998.9 million (in constant 2010$) and employ a total of 160 full-time persons. This equates to 1.6 jobs per $10 million invested.

On a dollar-per-capital-investment basis, the 15 composting, mulching, and natural wood waste recycling operations sustain 2 times more jobs than the two landfills and 17 times more jobs than Maryland's three incineration facilities.

The nature of jobs at composting sites varies widely as do the wages paid. Table 6 shows the ranges in hourly wages and the average hourly wage paid to employees reported by 12 facilities. Whereas the highest wage rate was paid at a public facility, so was the lowest hourly rate. Typical wages are in the $16 to $20 per hour range.

In addition to direct jobs at composting sites (such as skilled equipment operators for windrow turners, front-end loaders, grinders, and screeners), further jobs are supported in the use of compost, which also tends to take place regionally.

Types of Jobs at Compost Sites

Vehicle Drivers
Other Equipment Operators
Supervisors, Management, Administration, Dispatch
Business Development
Product Marketing and Development
Communications, Public Relations
Accounting

Table 5: Jobs Per Capital Investment

	Total Capital Investment, million $	Capital Investment/ 1 FTE Job	FTE Jobs/$10 Million Invested
Landfills (2)	$80.7	$1,190,000	8.4
Incinerators (3)	$998.9	$6,243,000	1.6
Composting[a] (15)	$47.1	$466,000	21.4

Note: All dollars converted to constant 2010$

[a] Includes mulching and natural wood waste recycling sites.

Source: Institute for Local Self-Reliance, 2013. Incinerator data based on Eileen Berenyi, Governmental Advisory Assoc. Inc., *2012-2013 Municipal Waste to Energy in the United States Yearbook & Directory*. Westport, Connecticut. 2012.

Table 6: Wages Paid at Composting Sites

	Range in Hourly Wages (min-max)	Average Hourly Wage
private	$13 - $20	$16.50
private	$12 - $17	
private	$11 - $28	$20
private	$8 - $20	$16
public	$12.88	$12.88
public	$7.39 - $23.55	$11.44
public	$13 - $26	$19.20
public	$10.75 - $22.76	
public	$13.65 - $19.00	$18.50
public	$17.95 - $44.10	$29.75
public	$15 - $25	$20
public	$22	$22

The Benefits of Compost Use: Jobs, Enterprise Development, Enhanced Landscapes, Reduced Chemical Use

Composting and compost use have numerous benefits in addition to green job creation and reducing the amount of waste destined for landfills or incinerators. At the same time we throw away tons of food scraps and yard trimmings, our soils are eroding and losing nutrients. Excess fertilizers from farms and suburban lawns, and sediment from construction projects wash off the land and into our waterways every time it rains. About 60% of soil that is washed away ends up in rivers, streams and lakes, contaminating waterways with fertilizers and pesticides. Soil erosion also reduces the ability of soil to store water and support plant growth. Nationally, soil is being swept and washed away 10 to 40 times faster than it is being replenished, destroying acres of cropland, despite the fact that the need for food and other agricultural products continues to grow.[8] The economic impact of soil erosion is enormous.

The good news is that many of these problems can be mitigated by expanding the use of compost. Compost – a rich humus and soil amendment – adds needed organic matter to soil, sequesters carbon in soil, improves plant growth, reduces water use by 10%, avoids landfill methane and waste incinerator emissions,

reduces reliance on chemical pesticides and fertilizers, and helps prevent nutrient-runoff and soil erosion.

Compost itself has many applications: 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. Jobs are sustained in each phase of the organics recovery cycle. 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, erosion and sediment control, and low-impact development. Growth in demand for compost can also be attributed to a strong green building movement helped along by the US Green Building Council and its LEED certification.[9]

Jobs and Enterprise Development

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.

Compost products can be used in sediment control, inlet protection, dam checking, concrete wash-outs, slope protection, temporary seeding during construction, bank stabilization and more.

One company that has been an industry leader in compost-based products for erosion control and stormwater management is Filtrexx. Filtrexx has dozens of patents for numerous products such as compost blankets, compost filter socks, and other mesh-containment systems. Its products have the ability to filter and remove up to 99% of bacteria, 73% heavy metals, 92% of nutrients, and 99% of hydrocarbons from stormwater. It has spent over $25 million on market development, research, and design since its inception in the year 2000. Today, Filtrexx and its trained installers use approximately 2 million cubic yards of recovered organics annually. Spread across one hundred Filtrexx certified installers, this is approximately 20,000 cubic yards (or 10,000 tons) per installer per year. Thus, 10,000 tons of compost can sustain one new business.[10]

Table 7 presents employment data for 13 companies, spanning Maryland to California, that specialize in using compost for green infrastructure. These 13 companies together employ 70 workers involved with using approximately 38,000 tons per year of compost (84,000 cubic yards of material). In other words, they sustain ~18 positions per 10,000 tons of compost they use each year (or 6 positions per 10,000 tons original materials composted).

The Texas Department of Transportation's use of compost exemplifies the economic benefits of developing a compost utilization program. In the late 1990s, TxDOT partnered with the Texas Commission on Environmental Quality (TCEQ) to use compost for roadway projects. The project was fueled by the EPA, which offered a rebate for purchasing compost in an effort to

24 Compost-Based Best Management Practices

Erosion & Sediment Control – Construction Activities

- Compost socks for sediment control
- Compost socks for inlet protection
- Compost socks for check dams
- Compost socks for concrete washouts
- Compost socks for slope interruption
- Compost socks for runoff diversion
- Compost vegetated cover
- Compost erosion control blanket
- Compost socks for sediment trap
- Compost socks for riser pipe filter

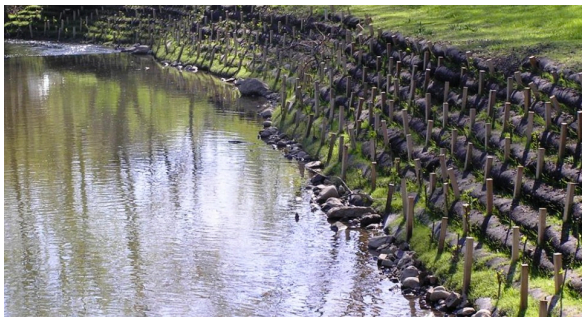
Stormwater Management – Post-Construction

- Compost stormwater blankets
- Compost vegetated filter strip
- Compost engineered soil
- Compost socks for channel protection
- Compost socks for bank stabilization
- Compost sock biofiltration system
- Rain gardens
- Green roof system
- Compost socks for slope stabilization
- Compost for vegetated retaining walls
- Compost grout
- Compost socks for level spreaders
- Compost socks for vegetated gabions
- Compost bioswale

Source: Rodney W. Tyler, Alexander Marks, Dr. Britt Faucette, *The Sustainable Site* (Santa Barbara: Forester Press, 2010).

mitigate watershed problems (e.g. nutrient leaching) caused by over application of dairy farm manure.[11] TxDOT's use of compost for roadway projects quickly leaped from using 500 cubic yards statewide each year before the program started, to 400,000 cubic yards purchased in 2003.[12] Today, after a cumulative total of 3 million cubic yards used to date, the TxDOT compost utilization program has become the nation's largest market for compost.[13] Because it is not cost-effective to transport compost far distances, it is an entirely in-state market, keeping dollars within the Texas economy.

What's more, using compost for highway maintenance projects created a whole new industry of subcontractors in Texas who can blow the compost onto varying slopes using truck-mounted pneumatic pumps. While these jobs did not exist at the outset of the program, 12 new contractors emerged within several years.[14] Though this method is quite effective for steep slopes, TxDOT utilized other means as well, such as blade (or disk) application, and biodegradable erosion control logs akin to the Filtrexx system.[15] The various techniques and products offer opportunities for contractors throughout the country to learn a new trade, enhance their skills, and establish niche markets.[16] Companies like Landscape Contracting and Irrigation Inc., Wims Environmental Construction LTD, and USA Erosion Inc. all found new work through the TxDOT program. Bert Lary, President of Landscape Contracting and Irrigation averages 2,000 to 3,000 cubic yards of compost use per year. He has two full-time equivalent (FTE) employees but requires up to six to eight employees on any given compost job.[17] Wims Environmental in Balch Springs, Texas, regularly employs 25-30 staffers and provides special trade services such as silt fence erosion control applications. The TxDOT program fostered opportunities to use innovative compost-based systems, as the company's compost use more than doubled in the past decade. Today, Wims uses 7,500 cubic yards annually, and dedicates a quarter of its employees to compost-use operations.[18] In Royse City, Texas, USA Erosion Inc. employs



MCS Inc. streambed restoration project using compost. www.mcsnjinc.com

MCS Inc. worker installing growing media made from compost on green roof. www.mcsnjinc.com

30 to 35 FTE employees, four of whom work on compost projects.[19]

Driving the industry, Filtrexx is now extending its certification courses beyond installers to include designers in the field of engineering, architecture, landscape architecture and land planning. As more municipalities realize the benefits of using compost for land applications, demand for trainers themselves will likely grow. According to Rod Tyler, Filtrexx Founder and CEO, each company certified under his program requires an educator, which is often a Filtrexx representative, but could mean a new position on the installer's team. In addition to Filtrexx's 15 staff members, 15 additional employees work at its factory, manufacturing the company's compost-based filter "Soxx." "All new jobs," says Tyler (and American manufacturing jobs at that).[20]

In the Mid-Atlantic, Filtrexx installers, other businesses, and government agencies using compost are contributing to the region's

economy and demonstrating the potential for industry growth through innovation. Envirotech Environmental Consulting, Inc. and Blessings Blends are two companies doing this on the Delmarva Peninsula. As a Filtrexx certified installer, Envirotech has 17 employees working on projects in Delaware and Maryland's Eastern Shore. Since the company began using Filtrexx products in 2009, this new aspect of its business has produced a $70,000-100,000 increase in annual revenue, says Wes Allen, Director of Operations.[21] Just down the road from Envirotech in Milford, Delaware, is Blessing Greenhouses and Compost Facility, producer of Blessings Blends premium compost. While Blessings is a composting facility, its contribution to the region's economy and environment are noteworthy. The facility is the largest organic waste handler on Delmarva, solely committed to turning poultry manure waste into a marketable value-added product.[22] Using a proprietary in-vessel system with an "enviro-cover," Blessings converts the poultry litter into a more stable, finished compost, that is less likely to lose nutrients through leaching and runoff, and can be returned to the same farmers that produced the litter. As a result, owner Bruce Blessing has created 12 green jobs that benefit

Table 7: Jobs Sustained by Select Companies Specializing in Compost Use for Green Infrastructure

Company		FTE Involved with Compost Use	CY Compost Used/YR		Compost Used TPY[a]	Est. TPY of Feedstock Material Composted[b]	FTE/10,000 TPY Composted
			Range	Avg.			
Filtrexx of Silicon Valley	CA	1.5		2,000	900	2,700	5.6
Sustainable Environmental Consult.	KS	5		17,778	8,000	24,000	2.1
Gold Leaf Group	MD	6		2,146	966	2,897	20.7
Oreg	MD	1	300 – 400	350	158	473	21.2
Eco-Constructors	MO	7		5,000	2,250	6,750	10.4
Eco-Fx	NC	9		10,000	4,500	13,500	6.7
Filtrexx Northeast Systems	NH	6	4,000 – 5,000	4,500	2,025	6,075	9.9
MCS Inc.	NJ	4	5,000 – 7,000	6,000	2,700	8,100	4.9
River Valley Organics	PA	10	10,000 – 15,000	12,500	5,625	16,875	5.9
Landscape Contracting and Irrigation Inc.	TX	2	2,000 – 3,000	2,500	1,125	3,375	5.9
Soil Express LTD	TX	8	2,760 – 6,455	4,139	1,863	5,588	14.3
USA Erosion Inc.	TX	4		10,000	4,500	13,500	3.0
Wims Environmental Construction LTD	TX	7		7,500	3,375	10,125	6.8
Total		**70**		**84,413**	**37,986**	**113,958**	**6.2**

CY = cubic yards FTE = full-time equivalent jobs TPY = tons per year

[a] Based on average compost density of 900 lbs/cubic yard. Personal communication, Craig Coker, Coker Composting & Consulting. Also, see USCC Field Guide to Compost Use (2001), p. 68. http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/1330/Field_Guide_to_Compost_Use.pdf

[b] On average, feedstock materials are one-third their original volume when composted.

Source: Institute for Local Self-Reliance, 2013. Based on personal communication with company representatives.

The Montgomery County, MD RainScapes Rewards Rebate program requires 3 inches of compost for its conservation landscape projects, incorporated to create a 6-12 inch improved soil layer. *Photo: Montgomery County Department of Environmental Protection*

local agriculture in a closed-loop system, while supporting many more jobs in various industries including horticulture and turf projects.[23] Envirotech is just one company that has previously used Blessings Blends for its projects, which demonstrates how recovered organics can support business and extend the life span of resources, rather than reaching a final resting place at a landfill or incinerator.[24]

Indeed, composting operations are manufacturing businesses, whereas landfills and incinerators are disposal facilities.

Furthermore, some companies using compost state that they have experienced success in a fairly short period of time and continue to grow. Filtrexx-certified MCS Inc. in Williamstown, New Jersey, is one of them. In its third year of existence, MCS sells between 5,000-7,000 cubic yards of compost per year and employs four FTE employees. Erosion control and the Filtrexx system are the backbone of its company as both an installer and manufacturer of the products. Projects have spanned from homeowner lawn bioremediation, green roofs, and bioretention basins to highway slope stabilization with Delaware's Department of Transportation. Most MCS business is done at the manufacturing facility in New Jersey and in the Greater Philadelphia Area (Pennsylvania is the world leader in filter sock production) but opportunities are increasing elsewhere, such as working on Total Maximum Daily Loads (TMDLs) education projects with the Department of the Environment in Washington, DC (DDOE). The company would like to expand its educational efforts to other agencies and engineers, which can provide valuable information to the public sector while equipping professionals with tools for an increasingly green job market. According to MCS' Jason Dorney, the company is also piloting a partnership with a construction company in Maryland that will act as a "master distributor," providing products to other distributors throughout the region.[25]

Presently, there are only two Filtrexx installers located in Maryland: Oreg located in Silver Spring and Gold Leaf Group Inc. in Brookeville.[26] Representatives from both companies contend that their contribution to Maryland's economy and potential business growth could benefit by much needed regulatory action. Of Oreg's five FTE employees, currently one job position is dedicated to its compost use, which is approximately 300-400 cubic yards per year. Acknowledging the need for compost-based watershed protection products in the marketplace, Oreg's Matt Owings says the company would like to expand its compost-related business. Unfortunately, Oreg has shifted its focus away from erosion control until state policies and programs become more installer-friendly. "There is no avenue to get new products approved," says Owings, who worked for five years to get the Filtrexx system approved in Maryland (an effort that took over a decade). Potential water quality fines and penalties that fall solely on the installing contractor (as opposed to potential polluters for instance) have been a cost-prohibitive risk and obstacle for the company, Owings adds.[27]

Similarly, Jeff Opel of the Gold Leaf Group insists that a private and public sector relationship that is more conducive to innovative technologies would be advantageous for the industry. Since Maryland accepted the compost filter sock system as an erosion and sediment control best management practice (BMP), Opel says there has been rapid industry growth in the state, which is benefiting Gold Leaf Group – the company consists of 16 FTE positions, 6 of which exist due to compost use. Nevertheless, Opel says there is an apprehension "to step

outside state manuals to use new techniques." He adds, "There is a whole new world of options." Having reviewed thousands of manuals during his 20 year tenure as head of one of Anne Arundel County's Soil Conservation Management Districts, Opel believes that state codes serve as a basis, suggesting that new, equivalent or superior methods should be permitted so long as they are founded on sound engineering principals. The alternative "stifles innovation that will lead to real improvement in our watersheds," Opel adds.[28]

On the other hand, there are certain compost-use policies and programs in Maryland that have benefited both business and citizens alike according to many involved in the industry. In Montgomery County, the RainScapes Rewards program offers a rebate to property owners for installing low impact development (LID) strategies such as rain gardens, green roofs, or conservation landscapes.[29] Compost is part of the RainScapes best management practice strategy for reducing runoff and improving water quality, and requirement for all conservation landscapes.[30] Property owners receive up to $1,200 per property, and are a new pool of clientele for local installers.[31] Small businesses are realizing economic gains and creating job opportunities from this new arena of sustainable development. According to Toni Bailey, the program helps support her company Gracefully Green, as well as a sister company, and her subcontractor. Each year Bailey does a dozen projects ranging from design, audits, and educational events. Every one of her projects uses compost and if it's not in the spec or existing environment, Bailey figures out how to incorporate it.[32] Backyard Bounty is another certified RainScapes installer and a slightly larger example. The company has two full-time employees and several subcontractors that are employed full time during the planting season. Three-quarters of Backyard Bounty's projects use compost, approximately 50 per year.[33]

However, the RainScapes program has the potential to benefit more than just small businesses. Mid-size and large companies like John Shorb Landscaping and the Brickman Group have become certified installers as well.[34] John Shorb employs approximately 80 FTE workers and says business opportunities have steadily grown thanks to local LID projects. His company serves the Maryland and DC area, using a variety of recovered organics from compost to shredded leaves.[35] As one of the largest landscapers in the U.S., Brickman Group has sent its Montgomery County and Central Maryland branches through the RainScapes education program. Yet with 23 locations across Maryland and Virginia and over 160 throughout the country, Brickman represents the vast potential to educate an entire industry of landscapers about compost-based LID systems and products through initiatives like RainScapes.[36] These types of programs allow landscapers to bring new services to the marketplace and provide new opportunities to work on income-generating green infrastructure projects. What's more, such government programs offer composters or home and garden retail stores like Lowes, Home Depot or Johnson's Nursery an opportunity to benefit the local economy and themselves by selling compost to contractors that are required to use it.

Table 8 compares the job creation benefits of both *composting* and *compost use* compared to disposal options in Maryland. When taking in account the potential jobs that could be sustained by utilizing compost in-state for green infrastructure, on a per-ton basis, composting and compost use would sustain 5 times more jobs than landfilling and 9 times more jobs than incineration.

If the estimated 1 million tons of organic materials now disposed in Maryland were instead composted at a mix of small, medium, and large facilities and the resulting compost used within the state, 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 the state's landfills and incinerators, this tonnage only supports 120 to 220 jobs. See Table 9.

Compost Use Enhances Landscapes and Reduces Chemical Use

Washington State's "Soils for Salmon" initiative uses compost for economic advantage, and could serve as a model for Maryland. By amending soils with compost and implementing LID tactics to protect the Pudget Sound watershed,

the Soils for Salmon project cost-effectively improves stormwater management. The added value of compost to soil systems reduces: irrigation needs (by up to 50%), urban stormwater pollutants (by 60-95%), the need to replace dying plants, and thus, the associated costs of water consumption, water treatment, and additional landscaping labor and materials. This equates to cheaper and easier landscape maintenance, healthier and more attractive landscapes, and "happier customers, which sells the next job."[37]

The improved health and appearance of compost-amended soils is clearly evident in the City of Greeley, Colorado, which has required the use of compost as a sustainable development practice for years. According to Ruth Quade, the City's Water Conservation Coordinator, "you can drive through a new development (in March/April) and tell just from appearance in the lawns that were amended and the ones that weren't."[38] In Maryland, the RainScapes program notes that it is "these unique landscaping enhancements that can ultimately add value to the property" (while also reducing energy consumption which is a cost-bearing environmental consideration).[39] With formidable regulations and incentives, perhaps RainScapes can make an impact of comparable magnitude as projects like Soils for Salmon; the Washington project has been so successful that its best management practices have been incorporated into the Sustainable Sites Initiative, a project similar to US Green Building Council's LEED program. The Sustainable Sites Initiative is developing the first national rating system for sustainable sites.[40] So far, the RainScapes initiative has prompted Maryland's City of Rockville and the City of Gaithersburg to partner and create their own programs modeled after Montgomery County's.[41]

One key economic and environmental benefit that can be produced from amending soils with compost is a reduced need for chemicals like fertilizers, pesticides, and herbicides. Among many other benefits, compost and its organic matter can improve soil fertility and protect plants against diseases.[42] As opposed to fertilizer, compost also improves soil structure and releases these nutrients in a slow, controlled, manner.[43]

Table 8: Jobs, Composting Vs. Disposal in MD

Type of Operation	Jobs/ 10,000 TPY	FTE Jobs/$10 Million Invested
Composting Sites[a]	4.1	21.4
Compost Use	6.2	n/a
Total Composting & Compost Use	**10.3**	
Disposal Facilities		
Landfilling	2.2	8.4
Burning (with energy recovery)	1.2	1.6

[a] Includes mulching and natural wood waste recycling sites.

TPY = tons per year (of material composted)
FTE = full-time equivalent

Source: Institute for Local Self-Reliance, 2013. Incinerator data based on Eileen Berenyi, Governmental Advisory Assoc. Inc., *2012-2013 Municipal Waste to Energy in the United States Yearbook & Directory*. Westport, Connecticut. 2012. Jobs through compost use are based on the data from the 13 businesses listed in Table 7.

Table 9: Potential New MD Jobs By Composting 1 Million Tons of Organics

Option	FTE Jobs
Burning	120
Landfilling	220
Composting	740
Compost Use	620
Total Composting	**1,360**

FTE = full-time equivalent

Composting jobs based on one-third tonnage composted at small facilities, one-third at medium-sized facilities, and one-third at large facilities. Compost use jobs based on data from 13 companies using compost for soil erosion control, stormwater management, and other green infrastructure applications.

Source: Institute for Local Self-Reliance, 2013.

Billie Gibson of Blessing Greenhouses and Compost Facility was transitioning toward organic growing when she began working for the company. By using Blessings Premium Compost, Gibson reduced her chemical use, which cut her input costs in half, while producing a noticeable improvement in the quality of her vegetables. She currently consults with other organic growers using Blessings Blends.[44] Filtrexx certified MCS in New Jersey says that, from highways to homeowners, its projects have often diverted the need for fertilizers through compost applications. Most notably, MCS owner Chris Sztenderowicz was able to reduce his chemical use after doing a bioremediation of his home lawn (scraping the yard to bare soil then incorporating compost to rebuild the soil structure). A seasonal top dressing of compost now acts as his fertilizer. As in the case of an MCS Pennsylvania turnpike project, Jason Dorney says most clients avoid additional need for chemicals, if using sustainable landscape strategies such as allowing biomass to accumulate, die, and nourish existing soil (e.g. grasscycling).[45] This can provide a number of benefits to state agencies (e.g. departments of transportation) including avoiding the costs and time to remove beneficial organic matter while reducing the waste stream by diverting this natural debris from landfills and incinerators.

What's more, using compost to limit the need for harmful chemical-based products can keep dollars in the local or state economy while helping to minimize the dependency on an unpredictable oil market. Throughout the past decade, high oil-based fertilizer costs have stressed the budgets of local farmers as imports of foreign fertilizer continue to rise. In 2011, the U.S. imported 10.79 million tons of nitrogen, 0.63 million tons of phosphate, and 7.23 million tons of potash – all record high fertilizer imports.[46]

Conversely, composting is inherently local with myriad benefits to the local economy and environment. Unlike recycling, recovered organics cannot be shipped abroad to be made into compost.[47] It is also generally cost-prohibitive to ship finished compost far distances, so money remains in-state or within the region.

Benefits of Composting & Compost Use

- Reduces Waste
- Improves Soil
  - Creates a rich nutrient-filled material, humus
  - Increases the nutrient content in soils
  - Helps soils retain moisture
  - Reduces or eliminate the need for chemical fertilizers
  - Suppresses plant diseases and pests
  - Promotes higher yields of agricultural crops
  - Helps regenerate poor soils
  - Has the ability to cleanup (remediate) contaminated soil
- Reduces Stormwater Runoff & Soil Erosion
- Protects the Climate
  - Cuts landfill methane emissions
  - Stores carbon
  - Improves soil's ability to store carbon
  - Substitutes for energy-intensive fertilizers, pesticides, and fungicides
  - Improves plant growth, and thus carbon sequestration
  - Reduces energy use for irrigation
- Creates Jobs & Supports Local Economies
  - Composting can be small-scale and local
  - Jobs are local
  - Composting linked to urban farm production
  - Composting can diversify farm products and increase farm income
  - Compost products tend to be used locally
  - Use of compost products sustains additional businesses and green jobs

Source: Institute for Local Self-Reliance, 2013.

According to Barrie Cogburn, this is why Maryland and the Mid-Atlantic region are especially conducive to a compost utilization program similar to the award winning one she began in Texas. Cogburn believes this geographic area would be a particularly good target because of its high density – the towns and facilities where compost is (and could be) produced and used are much closer to each other, which drastically reduces the price to transport, compared to a state like Texas. Shipping freight is sometimes half of total costs, so best to use a local product; "otherwise it starts eating into your profit margin," says Cogburn. Although, DC and Maryland have many differences from a state like Texas, they can learn from model metropolitan areas like Houston, Dallas, and Ft. Worth where the bulk

of the TxDOT program occurred. In addition to urban areas, Cogburn says, "this can happen anywhere!" "Everyone has issues with depleted soils, and compost works remarkably to restore these soils," she adds. The fact that compost can be made from such a wide array of materials (from seaweed on the coasts to manure on land-locked farms) makes the production and usage all the more feasible. No matter the geographic location, "the feedstock is different, but the erosion issue is the same" says Cogburn. "If you can use this value added product that was once trash, all the better."[48]

Watershed Benefits of Compost Use

Healthy soils are essential for protecting local watersheds.[49] Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions: water infiltration; 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.[50] 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.[51]

By improving soil ecosystems, compost can help states meet total maximum daily load (TMDL) limits.[52] In an effort to restore impaired water bodies throughout the country, the federal Clean Water Act requires states to develop TMDLs (i.e. the maximum amount of a pollutant that a water body can receive and still meet state water quality standards) as part of their Watershed Implementation Plans (WIPs).[53] In 2010 the US Environmental Protection Agency established the Chesapeake TMDL, a historic and comprehensive "pollution diet" and largest TMDL ever established.[54] Many of the region's primary waterways, such as the Anacostia and Potomac River in the Washington DC Metropolitan Area, have become unfishable due to elevated levels of toxic pollution.[55] Because most of the Bay and its tidal waters are impaired due to excess nutrient pollution and sedimentation, the Chesapeake TMDL is designed to achieve significant reductions in nitrogen, phosphorous, and sediment. Specifically, the Chesapeake TMDL mandates a 25% reduction in nitrogen, a 24% reduction in phosphorous, and a 20% reduction in sediment by the year 2025. Restoring the Bay watershed to meet these targets requires effective non-point source pollution control. Runoff from agricultural, urban and suburban lands carry nutrients, sediment and other pollutants to local waterways, causing eutrophication and harming aquatic life.[56] Integrating compost and compost-based products into the region's soils is an effective way to protect the watershed, while providing a number of additional benefits such as promoting higher crop yields, reducing greenhouse gases through carbon sequestration, diverting discarded biodegradable material from the waste stream, and creating "green" jobs.

There are six major watershed benefits of compost-amended soils.

Benefit 1: Non-Point Source Pollution Prevention (Agricultural Runoff & Urban/Suburban Stormwater) – One of compost's greatest benefits is its ability to treat non-point source pollution. Compost can manage nutrient stormwater and agricultural

Above, a tubular check dam made from compost intercepts stormwater to slow the flow velocity, while filtering sediment and pollutants. The water below the check dam is noticeably clearer and cleaner.

Photo: Filtrexx International LLC

runoff by serving as a filter and sponge. Its high porosity and permeability allow contaminated stormwater to infiltrate at much higher rates than most existing soils; especially those compacted via human development.[57] Once in compost-amended soil, toxins and pollutants begin to break down. Compost immobilizes and degrades pollutants, improving water quality and has the ability to bind heavy metals, pesticides, herbicides, and other contaminants, reducing both their leachability and absorption by plants.[58] Biofiltration media like compost reduces contamination of urban pollutants by an astounding 60 to 95%.[59]

Benefit 2: Erosion & Sedimentation Control – Using compost as a soil amendment significantly reduces erosion and sedimentation. This is in large part attributed to a material in compost called humus. Humus functions as a glue that keeps soil particles stuck together and resilient to eroding forces. Thus, adding compost to existing soil changes its properties, improving its binding ability.[60] As the soil properties are altered, the surface structure becomes stabilized and "less prone to crusting and erosion."[61] Best management practices recommend amending landscape beds with a minimum organic matter content of 10% dry weight (or 30-40% by volume of compost), and turf grasses with a minimum organic matter content of 5% dry weight (equivalent to 15-25% by volume of compost).[62] Mixing in the proper amount of compost into native soils provides resistance to erosion and minimizes sediment-carrying runoff by as much as 50%. In addition to soil stabilization, the improved soil structure enables greater infiltration, capturing water runoff and sediment.[63]

The above bioswale is a shallow landscape depression or channel used to convey, slow, and filter stormwater. Bioswale installation uses organic matter and vegetation to create low impact developments (LID) that can serve as pre-treatment or post-treatment for stormwater containment systems while reducing runoff volume and peak flows.
Photo: Filtrexx International LLC

Benefit 3: Improved Water Retention – The high organic matter content in compost (40-60%) increases water infiltration rates and the soil's ability to retain water.[64] Microbial organisms in the soil create pore spaces for air and water, increasing permeability and storage capacity. Furthermore, the same binding properties in humus that reduce erosion retain water as well. Compost can hold up to 20 times its weight in water.[65] It can also "increase water storage by 16 thousand gallons per acre foot for each 1 percent of organic matter."[66] This allows rainwater that would normally be lost through evaporation or runoff to remain in and replenish ecosystems. Thus, integrating compost into existing or rebuilt landscapes lowers irrigation requirements (by up to 50% in the summer) and runoff rates, which are typically higher in developed zones.[67] Compared to other soil amendments, research also indicates that compost has a higher absorption and storage rate than raw manure, anhydrous ammonia, and commercial fertilizer.[68]

Benefit 4: Reduced Chemical Needs (Fertilizers, Pesticides, Fungicides) – Because the type and amount of organic matter present in the soil impacts plant health, compost can reduce the need to use fertilizers and pesticides.[69] First, the improved cation exchange capacity (CEC) of compost makes nutrients available to plants over a much broader range of pH than soils without compost.[70] Amending soil with compost creates a controlled, slow-release of phosphorous, potassium, sulfur and various other "micronutrients" that are critical to plant survival. These nutrients are also less likely to be lost through leaching as the stable organic matter in compost steadily allows plants to take what they need.[71] This offers low-maintenance attractive landscapes for home and property owners while reducing polluted runoff. In sum, an active sub-soil food web and reduced soil compaction create an overall healthy ecosystem, resulting in fewer required chemicals.[72]

Benefit 5: Improved Soil Quality and Structure – Compost's organic matter is the catalyst for the overall health of the entire soil ecosystem. Organic matter can be considered the soil's fuel source, as billions of microorganisms feed on it. This microbial process produces room for stormwater infiltration, drainage, and moisture-holding capacity and a strong, stable soil structure.[73] These passageways and a higher bulk density also allow plant roots to establish and expand.[74] This is particularly important for disturbed and compacted soils where compost amendment rejuvenates degraded soils to native-like conditions, providing food and shelter for these beneficial organisms, and "restarting the soil ecosystem."[75] Because soil organic matter consists of 10 to 1,000 times more water and nutrients than soil minerals, the many microbes and organisms can thrive.[76] In addition, compost makes the soil more fertile for plant growth by controlling pH levels, increasing buffering capacity against pH change. Research also shows that the type of organisms found in compost can curtail soil-borne diseases and plant pathogens like pythium and fusarium as well as nematodes.[77]

Benefit 6: Reduced Costs – Amending soils with compost, and implementing compost-based green infrastructure practices produces significant cost savings. A recent study indicated that under a 3-inch/24-hour period storm, a typical 10-acre development with a compost blanket (i.e. a layer of loosely applied compost) would reduce runoff volume as compared to an impervious site and avoid $181,428 per year in water treatment costs. If the runoff was treated on-site with a stormwater management pond, the compost blanket application equates to a cost reduction of $697,800, avoiding the need for a larger pond to accommodate an increased volume of water. These savings are attributed to the significantly lower curve number (CN) of the compost blanket. A curve number is a value attributed to a given watershed surface based on the percentage of runoff volume generated from rain falling on that surface. Impervious surfaces produce a high volume of runoff and therefore have high CNs (CN 98) as compared to the compost blanket which helps mimic a natural surface, thus producing a much lower runoff volume and curve number (CN 55) while reducing pollutant load as well. This can also produce more "fiscally sound municipal governments realizing tax collection gains from increased land values and lower water treatment costs."[78] Many other compost products can reduce the cost of erosion and overburdened stormwater management systems – a cost totaling $44 billion each year in America.[79]

A Word About Nitrogen and Phosphorus Issues

Compost Can Reduce N & P Runoff
Agricultural runoff, raw sewage, and stormwater and other sources transport nutrients, namely nitrogen (N) and phosphorous (P), which devastate aquatic ecosystems. In the Chesapeake Bay watershed, agricultural runoff accounts for 40% of the N and 50% of the P entering the Bay due to farmland applications like raw manure and fertilizer.[80] Although compost itself contains some N and P, it can mitigate nutrient problems by preventing soil erosion and runoff in the first place, and by converting N into a more stable and less mobile form and P into a less soluble form. Compost's pollution reduction qualities led EPA to include compost-based strategies on its National Pollution Discharge Elimination System menu of stormwater best management practices.[81]

Water Solubility: A Key Consideration
The water soluble percentage of N and P in soils is important. The higher the solubility of nutrients, the higher the ability of plants and crops to uptake them, but also the more potential water pollution through leaching and runoff.[82] In compost-amended soil, only a small percentage of the P and N is water soluble: typically less than 1% of the P is water soluble, though this can vary. Less than 5% of N in soil (whether compost-amended or not) is water soluble.[83]

The level of N and P in compost varies depending on the type of compost feedstock. For example, in leaf and yard trimmings compost, P levels tend to be lower (0.5-0.7%) than composts made from manures, biosolids, and food scraps (1-2%). Similarly, poultry litter and biosolids compost have higher N levels than yard trim-derived compost. (Composting methods and pH can also impact the level of N in compost.)[84] However, while compost has N and P, it is their

availability to leach and runoff that is the critical factor.

Higher C:N Composts Can Bind N

Compost's carbon to nitrogen (C:N) ratio is also a critical factor, as composts that have higher C:N ratios can result in microbial immobilization (or binding) of N in the soil to reduce potential leaching.[85] Feedstocks with a lower C:N, such as poultry manure (C:N of 10-18:1), grass clippings (C:N of 12-25:1), and food scraps (C:N of 18:1), tend to produce a lower C:N compost than a higher carbon feedstock such as leaves (C:N of 40-80:1).[86] Regardless of the feedstock, a proper composting process and mature compost greatly reduce potential N loss in compost-amended soils as compared to soils amended with other nutrient applications such as raw manure and chemical fertilizers. Amending soils with higher C:N composts lets trillions of soil microorganisms stabilize and slowly release N, preventing ground or surface water N pollution during precipitation events. Conversely, N loss from chemical fertilizers increases the risk of water pollution as at least half of the fertilizer applied to fields is often lost to the air or water.[87]

Control Erosion to Control P

P is largely lost in erosion, which is why erosion and sedimentation are so damaging to P levels in waterways. If the soil doesn't erode, the chances of P loss are greatly reduced.[88] Compost prevents erosion, as its glue-like humus content keeps soil particles stuck together and resistant to eroding forces.[89] Compost applied at too high of a rate, however, can increase soil P to levels that exceed the soil's P-binding capacity, resulting in increased soluble P runoff in highly compost-amended soils.[90]

Enhanced Soil Physical Properties Reduce Runoff

While compost can increase potentially transportable soluble P, it can also improve soil physical properties that help reduce runoff containing P, as demonstrated through research conducted by the Virginia Polytechnic Institute and State University. The study found that while a poultry litter-yard trimmings compost increased soil test P concentrations to near environmental thresholds, the risk of P loss through runoff and erosion was reduced threefold relative to an unamended soil control treatment and twofold relative to soils amended with synthetic fertilizer or poultry litter. Results reveal that improved soil physical properties (e.g. infiltration, water-holding capacity, aggregation, organic matter) in compost-amended soils can significantly reduce runoff containing P.[91]

Less Nitrate Loss with Compost

A 2005 study found the percentage of total N loss to be less for all four different composts tested compared to conventional seeding.[92] All composts also produced less nitrate (a highly mobile form of N) loss by the final simulated storm event than conventional seeding and over 50% less than the bare soil control. While composts with high nitrate contents may not be desirable for use near or in surface water, nitrate reductions (especially after initial storm events) are attributed to compost's ability to reduce runoff volume.[93]

Portland Green Streets

In Portland, OR, street planters, curb extensions, and simple green median strips:

- Reduce peak flow cost-effectively 80+%
- Filter pollutants
- Recharge groundwater
- Rehabilitate soil
- Improve pedestrian safety
- Beautify neighborhoods
- Provide volume detention to handle most rain events
- Provide more space to plant trees
- Increase home values
- Alleviate urban "heat island" effect

Source: David Elkin, landscape architect, GreenWorks, Portland, OR. www.sustainablecitynetwork.com

Photo: © City of Portland, courtesy Bureau of Environmental Services

The Importance of a Diverse Composting Infrastructure

One important benefit of composting is its ability to function effectively in a wide range of scales and sizes: small backyard bins, onsite systems at schools and hospitals, farm-based operations, and large low-tech and high-tech regional facilities.

What is needed is a highly decentralized and diverse organics recovery infrastructure 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. Communities embracing such an infrastructure will be more resilient and will better reap the economic and environmental benefits that organics recovery has to offer.

While composting is an age-old technique for cycling organic materials into soil, it is not yet standard operating procedure throughout most of the US. Where it has become institutionalized – such as in San Francisco and Seattle, the systems implemented tend to be centralized, relying on large-scale collection to out-of-town large-scale regional facilities. These cities have had tremendous success composting and as a result are diverting significant portions of their waste stream from disposal. San Francisco now reports that 78% of its municipal solid waste is recycled and composted. Clearly, communities cannot maximize composting and overall diversion levels without providing all waste generators the opportunity to set out their organic discards for collection for composting. But to build more resilient communities and reduce the government and business cost of handling organic material, particularly transportation costs, backyard and onsite composting need to also be encouraged along with community composting at closer-in smaller-scale facilities such as at community gardens, and urban and rural farms. Making the compost-soil-food connection has never been more important.

The food scrap recovery hierarchy shown below – adopted by the City of Glendale, California – is an example of one that prioritizes reducing waste, rescuing edible food, and decentralized composting over centralized systems.

Backyard Composting

Backyard/home composting and grasscycling programs can reduce and avoid collection of a significant portion of the residential waste stream, especially when combined with pay-as-you-throw trash systems, in which residents are charged by volume for the trash they set out for collection. Backyard composting simply means households are composting organic materials in their backyards. Home composting can also

Expanded Food Discard Hierarchy and Strategies for Source Reduction

The City of Glendale's Zero Waste Plan features an expanded list of options for managing food discards in addition to centralized organics recovery programs. Activities located higher up on the list are preferable as they recover organic materials at a higher use value and/or at a lower cost than those at the bottom. The Plan also includes a compilation of source reduction strategies for the food service industry.

Hierarchy of Options for Food Scraps

- Source reduction
- Donation to food banks
- Food to animal feed and direct land application
- Subsidized distribution of compost units and intensive training for residents
- Shared, small-scale, decentralized composting systems for residences and businesses
- Use of discarded organics for production of liquid fertilizers and other value-added products
- Centralized composting of food residuals through drop-off or curbside collection programs

Source: Richard Anthony Associates and Gary Liss Associates, *Zero Waste Action Plan for the City of Glendale, California*, December 2010.

include inside worm or vermicomposting bins. Grasscycling is the practice of leaving grass clippings on the lawn. It benefits the soil by adding organic nitrogen to the lawn, shading the soil, and helping it retain moisture. Cities and counties could offer subsidized mulching mowers, bin distribution programs, monthly classes, and hotline support in addition to a home composting education program that distributes fact sheets and offers occasional classes.

Los Angeles, for instance, offers composting bins for $20 that retail for $100. Seattle has a similar program. Cheverly, Maryland, may be the first Maryland community to do so. A number of communities have offered discounts on mulching mowers for a limited time. In 2007, Contra Costa County, California, for example, offered a $50 price discount coupon and a $20 mail-in rebate for an electric lawn mower through a local hardware store.

In Seattle, food residuals alone comprise one-third of a typical Seattle resident's garbage. As of 2000, 72,100 Seattle households were backyard composting yard debris; 48,500 households were composting food scraps; and 59,200 households were grasscycling. Those who process organics at home save the city a tremendous amount of money. The trend in Seattle and elsewhere is to take an integrated approach to promoting backyard composting. San Jose links backyard composting to natural landscapes. Alameda County (CA) has a Bay-Friendly Gardening Program that connects reducing yard trimmings to protecting local waterways and watersheds that drain to San

Francisco Bay. Seattle's focus has shifted to a Natural Lawn and Gardening Program, of which backyard composting is a component. In many states the Cooperative Extension Service promotes backyard composting to some extent through Master Gardener and Composter programs. There are many how-to booklets for households to follow.

Many cities have city-sponsored Master Composter certificate courses, which are train-the-trainer programs in the art, science, and methods for home composting. Master Composter training is active in 500 locations in North America. The first US program was established in Seattle in 1986.[94] New York City's program has a community service component and was developed in part by the New York City's Bureau of Waste Prevention,

Cheverly, Maryland, Shows 20% of Residents Will Backyard Compost, Saving the Town Money on Disposal Fees

In April 2011, the Town of Cheverly initiated a backyard-composting program for its 1,600 single-family home residents. The goal is for 25%, 400 households, to compost in their backyard within 3 years. The program is run by the non-profit NIE Institute. The Town provided $3,500 in grants and matching grants doubled the funding. SoilSaver compost bins have been purchased direct from the manufacturer or from local discount retailers for $40 to $45. SoilSavers generally retail for $80 and above. Residents nearly doubled the funds raised again by paying $20 for each compost bin.

In the first year and a half, residents have bought 270 compost bins. The Town has seen a corresponding 10% decrease in tonnage and tipping fees. The Town investment has already been paid back in reduced tipping fees. The 270 (20%) single-family residents composting at home have eliminated approximately 77 tons of food scraps and soiled paper from the Town's waste stream, saving it $4,543 in avoided disposal fees in 2012. Total savings are expected to be $168,000 over the 20-year life of the 400 bins.

Source: Personal communication, Douglas Alexander, President NIE Institute, February 2013.

Reuse, and Recycling. The course requires 18 to 23 hours of classroom instruction, two field trips, plus 15 hours of supervised community training, and 15 hours of independent projects/community service helping to advance onsite composting in New York City. The course covers: the small-scale composting process, how to use finished compost, how to design and build onsite compost systems, and techniques for teaching others about composting.[95]

Alameda County's Master Composter Training Program is a training program for county residents. Graduates of the program design and implement community outreach projects such as conducting workshops with local organizations, establishing onsite composting at schools, and training East Bay Conservation Corps and AmeriCorps members. Master Composters can also earn college credit upon completion of the program through Merritt College or continuing education and graduate level credits from Cal State East Bay. Teachers can meet their continuing education requirements with this course, and are also eligible for a $200 stipend toward continuing compost activities for classrooms and school gardens.[96]

Promoting grasscycling is a complementary strategy to reduce the amount of yard trimmings set out at curbside. When left on the lawn, grass clippings provide the soil with valuable nutrients. Many communities have developed "Don't Bag It" lawn care outreach programs, including large urban cities such as Houston, Dallas, and Philadelphia.[97] Dallas has a unique program. The City has essentially banned the set-out of grass clippings in order to encourage grasscycling. Residents who still want to dispose of grass clippings can take them to one of the city's three transfer stations or the landfill (or contract with a private hauler). The Dallas Sanitation Services will only pick up bagged grass clippings during a 30-day period of the "scalping" season (mid-March to mid-April), when residents can purchase special use tags (bag tags).[98]

Community Composting

Community composting is essentially community groups, social enterprises and individuals producing compost from yard trimmings and food scraps and using it in their local communities. It is often perceived as only the composting of garden waste, on a small scale, with a voluntary workforce and minimal technical input. While there is nothing wrong with this basic model, community composting can be much more.[99] According to the European Commission funded *Growing With Compost Project*, community composting can encompass:

- training for local unemployed people,
- sheltered work for adults with learning difficulties,
- horticultural therapy activities managing local areas of green space,
- training in key skills and personal development,
- vocational training in subjects such as horticulture and composting,
- community ventures such as sheltered housing,
- city farms,
- community gardens and parks, and
- community cafes and healthy eating projects.[100]

In the UK, the Community Composting Network (CCN), for instance, has launched "The Composting for Local Food Project," which aims to develop and implement a long-term sustainable training and demonstration framework to increase both the quantity and quality of community composting activities for the purpose of growing local food. It will:

1. create opportunities for learning and the development of skills through volunteering, training and job creation;

2. enable communities to manage land sustainably for growing food locally; and
3. stimulate local economic activity and the development of community enterprises concerned with growing, processing and marketing local food.[101]

Specific projects include establishing a network of 12 to 15 training locations or "hubs" spread across England that provide practical and hands-on but diverse training context for the production of compost and its use in growing local food, and developing a course to train the trainers who will then deliver a course to local food growing groups. As part of this effort, individuals from existing and new local food growing groups will be trained to set up and operate their own community composting sites and to use the compost in the production of local food. The program is being set up, in part, because there are no existing courses specifically aimed at community composting for local food production. In addition to meeting this and other needs, the "project addresses a number of key national policies associated with local food, farming, green spaces, biodiversity, carbon sequestration, public health and social cohesion."[102]

In the US, there are a number of community composting projects. Two models are the Lower East Side Ecology Center in New York City and ECO City Farms, in Edmonston, Maryland.

The Lower East Side Ecology Center

The Lower East Side Ecology Center in New York City runs a Community Compost Program, collecting kitchen scraps through an innovative drop off and processing program. The Ecology Center's community compost program began in 1990 at its community garden on East 7th Street. Since 1994 it has also offered a collection program at the Union Square Greenmarket. Community participants can drop off their kitchen scraps in both locations. The collected materials are transported to East River Park and processed in an in-vessel composting system, which coupled with a curing stage, turns kitchen food scraps into compost in about three months. The in-vessel system consists of 16 one cubic-yard-size aerated plastic containers. After 10 -15 days, the materials – one-fifth their original volume – are cured in elongated piles or windrows with red wiggler worms. The finished compost is screened and makes its way back to the market, where it is sold either as compost or as part of its potting soil mix.

ECO City Farms

In Maryland, ECO City Farms is a model community-based composter and urban food producer. Its operations accept local residential and local restaurant food scraps converting them into a fertile soil that is in turn used to grow food for local use. Some of the food has been sold to the same local restaurants whose kitchen scraps were composted, thus exemplifying the closed-loop nature and potential of community composting.

ECO City Farms is a nonprofit dedicated to regenerating urban spaces into productive food oases. It is currently developing and applying many experimental strategies for urban agriculture including innovative composting methods, soil and nutrient management for small spaces, hoop house design and passive solar, specialty crops for urban settings, modular processing kitchens for value-added products and more. Its farm in Edmonston is the anchor of ECO City Farms' programs. ECO City grows vegetables, raises chickens for eggs and keeps bees on its 1-acre farm, a solar- and geothermal-powered site that currently includes five hoop houses. Utilizing simple hoop houses and growing vertically allow the farm to intensively produce a high volume of food in a very small space. The low-cost hoop houses also help control growing conditions, enabling a year-round growing season. From August through December 2012, ECO City Farms cultivated dozens of varieties of greens, lettuces, herbs, root vegetables, shoots and other crops, harvesting more than 600 pounds of produce.

ECO City Farms in Edmonston, Maryland, uses several stages and techniques of composting, including vermicomposting, to produce a soil for use in its produce hoop houses.

Composting and vermiculture (worm composting) form the foundation of its farm. ECO City diverts organic matter from the waste stream, and combines different composting techniques to turn it into fertile soil that supports the production of farm products. The farm accepts compostable material dropped off at its urban farm and at a local weekly farmers market (Riverdale Park Famers Market). It also accepts residential kitchen scraps delivered by Compost Cab, a private niche collection service provider operating in the Washington, DC metropolitan region.

ECO City Farms combines the organic material into static piles, which degrade into compost in four to eight months. After months of composting, some of the material is transferred into one of 16 large 4′x4′x3′ worm bins, where the worms complete the soil processing through vermicomposting. Red wriggler worms consume their body-weight in organic matter every single day, and reproduce every 2 to 3 months. The worm castings are added to the farm's soil, along with a living organic fertilizer known as compost tea, to grow its produce. In the future, plans are to sell the worm castings as soil amendments to other growers, and to eventually provide worms for home composters.

The breadth of ECO City's projects underscores the benefits that community-based composting tied to urban food production can reap. ECO City, for example, has developed a commercial kitchen and teaching space for its urban farm. The project utilizes an "upcycled" sea-shipping container as the structure for the commercial kitchen where food produced on the farm can be washed, processed, stored and refrigerated. The space utilizes renewable energy technologies and maximizes use of low-tech solutions and recycled materials. The project demonstrates low-cost solutions for urban farmers, enables value-added and farm-to-school food entrepreneurial ventures, and shares information in an open source design. Repurposing shipping containers into low-cost urban farm infrastructure addresses a major issue in the profitability of growing food in and around cities and small rural farms. According to ECO City Farms, urban farmers need to get the highest returns for their product, and the ability to properly process, add value to,

and appropriately refrigerate or store their product can mean the difference between a failing food enterprise and a successful one. ECO City continues to expand its knowledge of the logistics, design, construction process, and the cost analysis of repurposing shipping containers into a certified washing/processing station and walk-in refrigerator. Innovation in low-cost farm infrastructure will be applicable to a variety of community food enterprises.

Another key benefit of community-based composting is involvement of the community. ECO City is currently developing a groundbreaking new project to involve low-income families in their operations and education. Partnering with the Port Towns Youth Council, ECO City is teaching local teenagers about composting, sustainable urban agriculture and healthy living. In 2012, thirteen youth took part in the Seed-to-Feed summer program that is helping revitalize the nearby Autumn Woods Apartments, a private low-income housing development in Bladensburg. Program activities included hands-on learning about composting, establishing a fruit and vegetable garden at Autumn Woods, preparing meals in the farm's modular demonstration kitchen, visiting organic and international markets, watching informative documentaries on healthy eating, and even bee-keeping. According to Viviana Lindo, the program's instructor, this type of program provides underprivileged minorities critical exposure to important contemporary issues like resource conservation, energy consumption, and international economics. ECO City Farms founder and CEO, Margaret Morgan-Hubbard says the developing Autumn Woods project will be the first of its kind to create an urban farm and instrumental educational programs at a private low-income housing development. The organization is interested in replicating this model in other areas such as Baltimore and hopes it will serve as a template for other low-income housing projects across the country.

At ECO City Farms, people power makes the farm possible. According to ECO City Farms, "Working hands replace tractors and expertise and ideas come from engaged minds of all ages and backgrounds. Volunteers contributed more than 1,000 hours to ECO City Farms' efforts in 2012, alongside its small and dedicated staff."[103]

Onsite Composting

Composting can also take place on site at institutional venues such as hospitals, schools, and prisons. Small-scale in-vessel composting systems can compost anywhere from a few pounds to over 60 tons a day. Compostable materials are placed in the container and mixed, shredded, and aerated by the system. Some in-vessel systems are fully automated with sensors to monitor temperature, oxygen and moisture. They often use biofilters to reduce or eliminate odors. This method may be appropriate for institutions with large amounts of compostable materials and limited space. Vermicomposting – worm composting – systems are another option. These systems are also available in a variety of sizes ranging from a 10-gallon (2 lb/day) system up to a continuous flow system that could handle all of an institution's food waste (over 60 tons/day).

The benefits of onsite composting are avoided transportation costs and the ability to use finished compost onsite for landscaping and other uses. Onsite composting is truly closed loop recycling. Challenges include start-up equipment, installation costs and access to trained operators who can maintain systems. There are numerous successful programs in operation. The development of case studies, how-to workbooks, and education and promotion tools on specific best management practices for onsite composting could go a long way in addressing challenges.

Residential Curbside Collection for Off-Site Composting

A 2009 survey by the Center for a Competitive Waste Industry identified a total of 121 cities with residential organics programs in North America, 68 of them in the US.[104] A more recent study found that the number of communities in the US with residential organics programs had reached 162.[105] As of December 2010, roughly 8.6 million people – 2.7% of the U.S. population – were living in communities where food scrap recovery was available to at least a fraction of residents. While 81%

programs are located in only three states – Washington, California, and Minnesota – organics diversion programs have also been spreading slowly but steadily to other parts of the Midwest and the country.[106]

According to the December 2010 study, food scrap recovery programs most commonly operate in suburban areas, however they can be found in many types of communities, including rural, urban, small, and geographically isolated communities. The smallest community to report having a residential program has 170 residents, while the largest has 617,300. The average population size is 62,300.

The study also found that while the majority of programs operate in areas where tip fees for municipal solid waste (MSW) are higher than for organics, it is also possible to run successful organics programs without this particular economic incentive.

The most common approach to implementing residential organics recovery is adding food scraps to an already existing curbside collection program for yard trimmings. Collection of food scraps in a separate stream or through a drop-off system were less common methods.[107] The typical residential organics program in the US collects organics, including paper, meat and dairy, in 32- to 96-gallon carts year round through a single contracted hauler. Participation is usually voluntary and residents often pay an additional fee. Most programs operate in conjunction with a pay-as-you-throw trash fee system.[108]

Organics programs divert an average of 25 to 30 lbs. per household per week, with food scraps typically making up between 7 and 9 lbs. of the diverted material. The organics diversion rate goes up to 33-37 lbs. when calculations are restricted to participating households only. Participation varies greatly across programs, ranging from 10 to 95%. The higher rates correspond to programs with mechanisms such as mandatory pay or participation, which help boost the number of households engaged in source separation. The average participation rate was in the range of 35 to 40%.[109]

The monthly rate charged for organics collection averaged $7.68 per household. Meanwhile, the average fee for trash collection was $21.79 per household per month. On average, organics collection costs residents about one-third of what they pay for trash collection. The total cost of recycling, organics, and trash collection added up to an average $27.88 per household per month. Less than a third of programs included organics collection fees in their trash rates, while only a quarter reported having a mandatory pay system for organics.[110]

Finally, while more ambitious programs require larger capital investments, this does not necessarily mean higher net costs if opportunities for savings are exploited. For example, more aggressive organics diversion may require moving beyond windrows to costlier, more sophisticated processing systems. At the same time, expanding the range of accepted organic materials opens up the possibility of less frequent collection of trash – especially when pet waste and diapers are included – which can bring about significant savings in avoided collection.[111] When organics diversion is so successful that the amount of trash collected at each household decreases significantly, trucks routes can potentially be eliminated or redesigned to reduce the amount of trips to unload. Lower trash fill-rates as a result of organics diversion can thus bring about even higher savings.[112] For this reason, net expenses for organics collection programs may peak and then decline after all the cost benefits of substantial organics diversion are captured.[113]

Model Program: San Francisco

Diversion rate: 78%

Organics composted (tons/yr.): 220,000[114]

Participation rates: 46% for apartment buildings

San Francisco has the largest, most established urban organics recovery program in the US. The program serves both the commercial and residential sectors, which together generate over 600 tons of food scraps and other organic materials each day.[115] These materials are processed at the Jepson-Prairie Organics Composting Facility located in a rural area 70 miles north of San Francisco.

The program's great success is due in part to a partnership among the City of San Francisco, its residents and commercial and institutional

sectors, and the City's contracted hauler, Recology.[116] California's 1989 AB 939 law requiring municipalities to divert 50% from landfills by 2000 – or face a $10,000 fine if they didn't develop a plan for this diversion level – was also a factor in the program's success, as it provided a favorable climate for the pursuit of the City's ambitious diversion goals.[117]

Organics collection was first implemented in the commercial sector, starting with the wholesale produce district in 1996 and eventually reaching commercial establishments throughout the city. In 1998 and 1999, pilot programs were put in place to test the residential collection of food scraps and soiled paper, in addition to yard trimmings. The residential program then expanded to single-family households throughout the city over a period of four years.

San Francisco has a three-stream collection system for the residential sector; compostable organics, single-stream recyclables, and trash are collected separately in color-coded carts. Organics are collected weekly on a year-round basis, as are recyclables and trash, the latter two in a separate split-bodied, side-loading compactor truck. The City distributes two types of kitchen containers to facilitate source separation of compostables. It also instructs residents to use only compostable liners, such as paper bags or compostable plastic bags, which are available at more than 80 retail outlets in San Francisco.[118]

Collected organics are taken to a transfer station run by Recology. The material is then loaded into trailers and delivered to the Jepson-Prairie facility.[119]

In 2009, participation in residential organics collection was made compulsory through the San Francisco Mandatory Recycling and Composting Ordinance, the first law of its kind in the US.[120] By requiring residents to separate out their compostables and place them in the appropriate container, the City hoped to expand participation beyond 35-40% and bring diversion rates closer to the goal of zero waste by 2020. The City also moved to expand organics collection to apartments, where 60% of the population lives.[121]

The mandatory composting law is backed up by the strong financial incentive of pay-as-you-throw trash fees, in addition to mechanisms for enforcement. The Public Works Department oversees enforcement of the set-out system and issues fines for contamination of the organics or recycling streams. The City's Public Health Department has the authority to put liens on properties for non-payment of collection service accounts, and the San Francisco Department of the Environment is responsible for outreach and education.[122]

Model Program: Toronto

Cost of organics collection and processing: $120-155/ton (about half as much as garbage costs).[123]

In 2002, Toronto began implementation of a mandatory residential organics collection program as part of its strategy to achieve its

ambitious waste diversion goals.[124] The "Green Bin Program" collects almost all organics beyond yard trimmings, including food scraps, coffee grounds and filters, tea bags, house plants, soil, diapers, sanitary products, animal waste (including cage bedding and cat litter), soiled paper and paper packaging. Ninety percent of Toronto's single-family households currently participate in the program, and efforts are underway to include apartments, condominiums and co-ops.[125] As of August 2010, 15% of multi-unit buildings had been introduced into the program.[126]

Toronto uses a split compacting vehicle for collection. Source-separated organics are collected weekly on one side of the truck, while the other side is used on alternating weeks for single-stream recyclables and residual waste. Toronto is the first large North American city to cut trash collection to once every other week. Adding organics collection weekly allowed it to do this. Less frequent trash collection has resulted in increased organics recovery rates.[127] The City provides residents with a small food scrap bin for use in the kitchen, plus a 16-gallon latched and wheeled green cart for set out of food scraps at the curb, which can be lined with plastic bags for convenience.[128] Yard trimmings are collected separately; the schedule varies depending on the season.

Collection workers also act as enforcers of the source-separation mandate. They do not hesitate to reject improperly sorted materials, often leaving contaminated recycling bins or trash littered with organics standing at the curb. An accompanying note explains the transgression.[129]

Given the diversity of materials in Toronto's organic stream, much experimentation has been necessary to determine the most effective processing system. Yard trimmings are composted at windrow compost facilities, which have lower processing costs than those accepting food scraps too. In the case of source-separated food scraps, a hydropulper is first used to spin materials into a liquid pulp and effectively remove contaminants – including plastic bags and the plastics in diapers – which make up 20% by weight. The resulting "pulp" is then anaerobically digested to produce biogas. The remaining digestate is taken to a separate facility where it is composted.[130] Currently the biogas is only flared, but the City has plans to build a new state-of-the art anaerobic digestion facility that will upgrade the biogas to biomethane for use as a natural gas fuel and for cogeneration.

Odor problems as a result of organics processing have posed a challenge, but are slowly being overcome thanks to improvements in learning how to manage mixed organics streams. Some processing facilities are government owned, but the city has also had to work with private contractors to achieve additional capacity. Plans are currently underway to build a second government-owned anaerobic digestion facility, which will capture the biogas produced and – with a 94,000 ton-per-year capacity – bring Toronto closer to self-sufficiency.[131]

The biggest challenge for the City for Toronto has been securing enough processing capability to manage increasing quantities at the same time that operational problems have caused several facilities to temporarily shut down.[132] In spite of these setbacks, Toronto's organics recovery program makes economic and environmental sense. In addition to bringing savings in avoided disposal costs, it has extended the life of the local landfill by at least 7 years.[133]

Austin, TX: An Interesting Case Study

The City of Austin embraced zero waste planning January 2009 and in December 2011, adopted a 321-page zero waste operational plan, entitled *The Austin Resource Recovery Master Plan*.[134] The foundation for the City's zero waste planning efforts is the United Nations Urban Environmental Accords, which the City signed in 2005. The Accords are a set of 21 actions that the United Nations asked city governments to adopt and implement. The following three Accord actions are incorporated into Austin's resource recovery master plan:

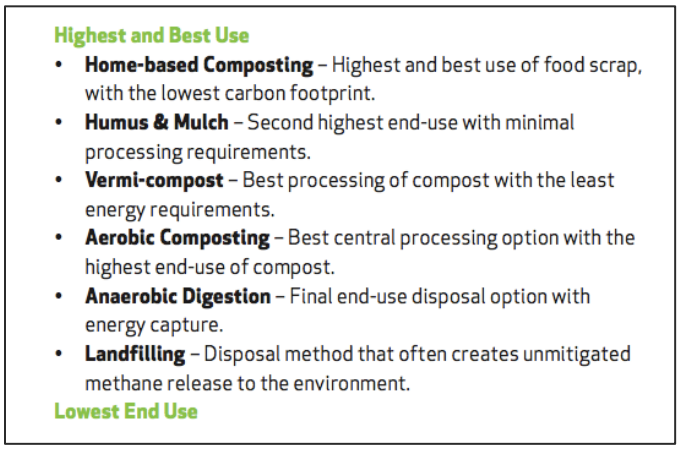
- Implement "user-friendly" recycling and composting programs to reduce per capita solid waste sent to landfill and incineration by 20 percent by 2012;
- Adopt a citywide program that reduces the use of a disposable, toxic or nonrenewable product category by at least 50 percent by 2012; and

- Establish a policy to achieve Zero Waste going to landfills and incinerators by 2040.

In Austin, organic materials are the largest fraction of the discard stream, representing more than 47 percent of materials landfilled. As a result, organic materials recovery is a central part of the City's zero waste plan. But Austin may perhaps be unique in its official recognition of the benefits of a decentralized composting infrastructure:

> "…decentralized composting processes can reduce the carbon footprint of collection and transportation while consuming organics in more localized situations that do not require large organized collection programs.
>
> The [Austin Resource Recovery] Department recognizes that, in addition to helping the City achieve its Zero Waste goals, composting also addresses the community's interest in enriching the region's soil, strengthening sustainable food production and completing the food cycle. These additional benefits were identified by the Sustainable Food Policy Board's December 2010 letter to the Austin City Council and were considered while developing the Department's Master Plan."[135]

As a result, the City has adopted a highest and best use philosophy for city collection programs of residential food scraps to guide its planning.[136] In addition to the eventual rollout of a citywide household yard trim and food scrap collection program, the Austin Resource Recovery Department (previously the Solid Waste Services Department) is first initiating the following new programs:



- Expanding its home composting incentive program to encourage the development of home and onsite composting; and
- Establishing composting trainings at community gardens and implementing a junior composter and master composter training program.

Furthermore, because the Austin Resource Recovery Department directly controls only a portion of the organic materials generated citywide, the City acknowledges it will have the most impact on increasing diversion of organic materials through new policy drivers. These policies would include requiring diversion of organic materials by residential and commercial generators and at City offices and facilities, and requiring diversion of organic materials at all special events.

Obstacles to Increasing Organics Recovery

Despite many compelling drivers, there are a number of obstacles to widespread implementation of organics recovery systems, particularly decentralized systems. Obstacles include:

- Lack of policies reinforcing the solid waste management hierarchy that prioritizes source reduction and reuse followed by recycling and composting
- Cheap landfill disposal fees
- Deep pockets of the landfill and incinerator industry to lobby effectively for renewable energy subsidies
- Landfill gas recovery companies, such as Waste Management Inc., working to overturn state bans on landfill disposal of yard trimmings

- Increasing consolidation and vertical integration of the organics recovery industry
- Lack of organic material receiving facilities or infrastructure (i.e., composters and anaerobic digesters)
- Lack of affordable compost hauling services
- Out-of-date state permitting regulations for composters and anaerobic digesters that often treat organics recovery facilities as solid waste disposal operations
- Unlimited set-out of residential trash allowed in most communities free of charge
- Lack of training programs and best practice toolkits for backyard, community and onsite composting
- Difficulty in finding adequate land for composting operations
- Difficulty securing tonnage feedstock guarantees for organics receiving facilities (needed to attract investment)
- For onsite composting, securing the proper mix of ingredients for optimal composting conditions and having trained staff adequately maintain the composting system
- For food scrap generators, ready access to affordable composting services and collection programs that do not overburden staff and customers
- Perception that starting composting is too costly because it involves start-up costs such as new collection bins or containment equipment, training/educating staff and citizens, and separate add-on hauling fees
- Inability of food scrap generators to realize savings on reduced trash collection by renegotiating hauling contracts (especially if hauling is included in lease agreements)
- Poorly operated compost facilities that ultimately give a bad name to composting
- A new class of persistent herbicides called "pyridine and pyrimidine carboxylic acids" that has been designed for use in hayfields, horse pastures, agricultural crop production, golf courses, right-of-ways, and lawns to kill off unwanted weeds and to remain effective for several months to years. When found in compost and soils in minute concentrations (as low as 1 part per billion), these persistent herbicides directly harm a wide range of sensitive crops (e.g., tomatoes and beans), threatening the economic viability of many industries, including the multi-billion dollar composting industry in the United States.[137]

Policies Needed to Promote Composting and Other Forms of Organics Recovery

Local and state government policies are needed to overcome lack of infrastructure and other obstacles to diverting organic materials from disposal. Many of the policies presented below were initially put together for the National Capital Region Organics Task Force by the Institute for Local Self-Reliance and Coker Composting & Consulting. The list now also incorporates some of the specific strategies recommended for action in Massachusetts by that state's Department of Environmental Protection and its external stakeholder process.[138]

In addition, in its report to The Maryland General Assembly, the Maryland Statewide Composting Workgroup identified 15 priority recommendations to support composting in the state. These recommendations are listed in Appendix A.

Local:

- Adopt a highest and best use hierarchy that prioritizes source reduction, food rescue, home-based composting, and community-based and on-farm

composting over large centralized composting facilities

- Start an edible food donation program
- Promote backyard composting and grasscycling and start a Master Composting training program
- Target a wide range of yard debris for composting (grass, leaves, brush, garden trimmings, Xmas trees)
- Offer curbside collection service year-round, with option to not collect in/require off-season
- Ban collection of yard trimmings in plastic bags; require set-out in kraft bags or reusable containers
- Require weekly yard debris separation and set-out
- Require landscapers to recover yard trimmings for composting
- Ban yard trimmings from waste transfer stations, landfills and incinerators
- Set up drop-off sites for materials not collected at curbside (such as pumpkins, Xmas trees, garden trimmings)
- Give preference in purchasing to locally-produced compost
- Require all public agencies to adopt yard waste reduction practices such as controlled irrigation, precise fertilization usage, grasscycling, selective pruning, onsite composting and mulching/backyard composting, proper organic materials applications, and environmentally beneficial landscape design. Encourage residences, businesses, and institutions to adopt these practices.
- Pilot a residential project to compost food residuals (such as curbside collection with yard trimmings, curbside collection without yard trimmings, or drop-off collection)
- Consider creating a hybrid yard trimming program that collects some household organics but not the full range covered by most food scrap programs. (Cedar Rapids, Iowa, for instance, also includes fruit debris such as apple peelings and cantaloupe rinds, and soiled paper products such as tea bags, paper towels and paper plates.)
- Pilot a government cafeteria food residual collection and composting project
- Pilot composting food residuals and compostable food service ware at public events or publicly sponsored events
- Require submittal of a composting plan in order to obtain a street closure permit for a public event
- Implement purchasing specifications for compostable food service ware (such as products must be certified as compostable)
- Integrate plans to incorporate food residual recovery into solid waste management plans
- Ban the use of non-essential pesticides on all public and private property
- Maintain a user-friendly comprehensive easy-to-navigate web site dedicated to all aspects of composting from how-to-backyard-compost with rodent-free bins to a list of compost facilities and how to donate edible food
- Establish compost-amended soil requirements (minimum organic matter content for post-construction disturbed soils)

State:

- Establish a minimum 75% recycling goal by 2030. A 2011 MD Solid Waste Study Work Group recommended that Maryland's voluntary waste diversion goal be increased from the current goal of 40% to 60% by 2020 to be consistent with the recycling and waste diversion goals in the Maryland Climate Action Plan. In 2013, MDE proposed to the MD General Assembly a 80% goal by 2028/2030 (slower schedule for smaller counties). The 75% goal matches California's and would position

Maryland to become a leader among the states.

- Adopt a highest and best use hierarchy that prioritizes source reduction, food rescue, home-based composting, and community-based and on-farm composting over large centralized composting facilities
- Implement a per-ton surcharge on all disposal facilities (transfer stations, landfills, and trash incinerators) to create revenue to fund recycling and composting initiatives and create financial incentives to reduce trash
- Establish a moratorium on building new trash incinerators (with or without "energy recovery") until new rules regulating composting facilities and programs and policies to support composting are in place
- Assess sources and amounts of yard trimmings and food scraps to enable organic material generators and processors to make sound infrastructure investments and help direct government programs
- Develop sector specific best management practices for organics collection programs (supermarkets, hotels, schools, residential, etc.)
- Establish technical assistance and grant programs to divert food scraps from public colleges/universities, hospitals, and correctional facilities and loan programs for private facilities diverting organics
- Provide financial assistance to existing and potential haulers to initiate organics collection efforts (as long as this financial assistance does not put onsite and small-scale composters at a competitive disadvantage)
- Support efforts to collect organics from residential sources
- Ban yard trimmings from landfills and incinerators
- Ban commercially generated organic materials from landfills and incinerators (if organic materials recycling facilities exist within 20 miles of point of generation)
- Ban use of conventional plastic bags for yard trimmings collection in specific metropolitan areas
- Require all state agencies to adopt yard waste reduction practices such as controlled irrigation, precise fertilization usage, grasscycling, selective pruning, onsite composting and mulching/backyard composting, proper organic materials applications, and environmentally beneficial landscape design. Encourage residences, businesses, and institutions to adopt these practices
- Require cities and counties or service providers to create the opportunity to recycle, including the establishment of "an effective residential yard debris collection and composting program that includes the promotion of home composting of yard debris, and that also includes either: (a) Monthly or more frequent on-route collection of yard debris from residences for production of compost or other marketable products; or (b) a system of yard debris collection depots conveniently located and open to the public at least once a week…'Yard debris' includes grass clippings, leaves, hedge trimmings and similar vegetative waste generated from residential property or landscaping activities, but does not include stumps or similar bulky wood materials."
- Incentivize use of compostable bags for collection of yard trimmings by allowing tax deductions on State income tax for bag purchases
- Incentivize use of backyard composting bins by allowing tax deductions on State income tax for backyard bin purchases
- Launch an education and outreach campaign to highlight composting and compost use.

State Composting Infrastructure Development Policies:

- Develop sample zoning ordinances that define composting, composting facilities and acceptable land uses by right, or by conditional approval
- Assess and support development of onsite food residual management solutions
    - Research and test onsite collection and treatment technologies
        - In-vessel composting unit case studies
        - Gather independent evaluations of technologies
    - Support through targeted grants and loans
        - Grants for capital cost of onsite systems at public facilities
        - Low interest loans for capital cost of onsite systems at private facilities
- Develop FAQ document to address public questions and concerns over different types of facilities/technologies
- Encourage municipal expansion of existing composting operations and siting of new operations
- Establish simple certification form for small organics operations at municipal sites
- Identify financial and technical assistance for companies interested in establishing and expanding composting facilities, including grants, loans, and job training programs
- Encourage new private development or expand existing organics management capacity
    - Provide aggressive low-interest loans
    - Offer pre-permitting assistance
    - Promote more capitalization of and technical assistance to existing farm composting/AD operations to help meet local capacity needs
    - Support new farm operations
    - Leverage and coordinate funding assistance across state financial assistance programs
- Streamline regulations/permitting programs:
    - Adopt performance based permitting regulations for composting facilities (time/temp; air/odors; stormwater quality) that include carve-outs for small-scale and onsite operators
    - Consider operations that collect, process, and recover organic materials as recycling facilities not solid waste facilities (note: MD House Bill 1440, passed in the 2013 legislative session, authorizes MDE to issue regulations exempting organic material capable of being composted from the definition of solid waste)
    - Provide a clear permitting pathway
    - Allow small on-farm food scraps composting with only registrations, not permits (set appropriate thresholds, e.g., less than 250 tons/year)
    - Increase flexibility for meeting financial assurance by allowing periodic payments into depository financial instruments
    - Require all permitted composting facilities have at least one operator trained via a national or state compost operator training program
    - Train all regulators in the basics of composting and organics diversion

State Compost Usage Encouragement Policies:

- Adopt and endorse a variety of compost uses in State guidance and manuals such as MDE's Soil Erosion and Sediment Control Manual and Stormwater Design Manual.

- Take affirmative steps to explore and encourage the use of compost and compost products, including as bioretention soils, green roof soils, and for roadway projects and slopes.
- Increase funding to cooperative extensions to develop compost usage and benefit education programs for homeowners and landscapers in counties and municipalities
- Increase funding to appropriate state agencies to develop compost usage database for web-based downloads of technical information on crop yield increases and disease suppression, sediment loss reduction and erosion prevention, and acid mine drainage remediation due to compost use
- Require state departments of transportation and other agencies to procure soil amendments by specifying composts certified by the US Composting Council's Seal of Testing Assurance program
- Develop specifications for high-value applications for high-quality compost products
- Establish compost-amended soil requirements (minimum organic matter content for post-construction disturbed soils)
- Give preference in purchasing to in-state-produced compost, or even better, require the state to purchase compost from facilities registered and compliant with the state

Statewide Economic Incentives:

- Require "Pay-As-You-Throw" solid waste programs in all municipalities
- Promote Industrial Revenue Bond programs for composting facility construction capital
- Encourage Economic Development Authorities to include compost facility sites in their portfolios of industrial sites
- Monetize greenhouse gas (GHG) emissions reductions from food scraps diversion from landfilling (~ 0.87 MT CO2eq per ton diverted) by acting as carbon credits aggregator and refunding carbon credits to host municipalities
- Monetize GHG emissions reductions from carbon sequestration due to compost use as a soil amendment (~ 0.35 mt CO2eq reduced/ton used) in same fashion as above
- Incentivize agricultural usage of compost by allowing income tax deductions for purchase price and income tax credits for reductions in nitrous oxide GHG emissions due to replacement of nitrogen fertilizer usage with compost
- Explore other tax policy tools to encourage composting

Other Statewide:

- Maintain a user-friendly comprehensive easy-to-navigate web site dedicated to all aspects of composting from how-to-backyard-compost with rodent-free bins to a list of compost facilities and state regulations
- Target large generators such as by providing handbooks, resources, and technical assistance (e.g., supermarkets, hospitals, schools, state fairs) on how and where to compost
- Establish a voluntary Supermarket Recycling Program Certification that encourages supermarkets to develop sustainable programs for recycling and reusing organics and other materials
- Provide compost use training, and compost use specifications and guidance
- Set tiered materials recovery and waste reduction goals (such as 75% recovery and caps on annual increases in waste generation)
- Implement purchasing specifications for compostable food service ware (such as products must be certified as compostable)
- Prohibit the use of nebulous, false claims like "biodegradable" in plastic

packaging by requiring that environmental claims can only be made if the terms used are verified by an existing ASTM standard specification

- Require each county develop and adopt a recycling plan that includes the recycling of yard trimmings and food residuals

Massachusetts: One State Model Worth Looking At

Every state in the union can increase the amount of yard trimmings and food scraps recovered. Many are actively doing so. Almost 20 states have or are in the process of revising their permitting regulations for compost facilities. Maryland is not alone.

In many ways, Massachusetts is ahead of the curve when it comes to promoting composting. It was the first state, for instance, to provide composting technical assistance to large food scrap generators such as supermarkets. In 2003, the Massachusetts Department of Environmental Protection (MassDEP) partnered with the Massachusetts Food Association (MFA), through a Memorandum of Understanding, to establish a voluntary Supermarket Recycling Program Certification that encourages supermarkets to recycle organics and other materials. MassDEP has developed materials to assist supermarkets in developing effective recycling, composting, and diversion programs including the *Supermarket Composting Handbook* which is a step-by-step manual for setting up a composting program in a supermarket; lists of facilities that accept supermarket compostables and haulers that pick up the materials; and an application for technical assistance. Dozens of supermarkets in the state now compost.

The state also has in place material disposal bans, which cover leaves and other yard trimmings. The waste ban effectively signals to organics recovery markets that large volumes of material will be available on a consistent basis.

In 2010, Massachusetts issued its draft "2010-2020 Solid Waste Master Plan: A Pathway to Zero Waste." The document calls for keeping the state's current moratorium on new incinerators; expanding reuse, recycling and composting; ensuring greater producer responsibility for materials; and promoting recycling businesses and jobs.

The Solid Waste Master Plan set a specific objective to divert at least 35% of food waste from disposal by 2020, which would result in more than 350,000 tons per year of additional diversion activity from targeted businesses and institutions such as hotels, convention centers, supermarkets, and food waste processors.

To meet this goal, MassDEP held numerous stakeholder meetings in 2011 to develop an Action Plan. The Action Plan, released May 2012, lays out programs and initiatives to be pursued over the next several years and identifies the primary barriers to achieving the Commonwealth's organics diversion objective.[139] Barriers include:

Data Analysis – Lack of Information on Sources and Amounts of Food Waste: Stakeholders need better information on organics generation and disposal. This information helps generators, collectors and processors of organics make sound infrastructure investments. This information also helps direct government assistance programs.

Collection Infrastructure – Lack of Collection and Separation Systems at Generators: Generators need more information, research and technical and financial support to build more robust collection and management systems. To stimulate competition and reduce costs, more collection service is needed. Generators need to know who can provide service and be able to negotiate for service amongst multiple collectors. Haulers of organics need to achieve route density in order to provide competitive collection services. New collection methods and technologies need to be reviewed and tested.

Processing Capacity/ Market Development – Insufficient Processing Capacity & Lack of End-Markets For Products: Once collected, source separated organics must have a place to go. Although Massachusetts has a number of entities accepting organics for processing and this

number is growing, additional capacity is still needed. Once processed, finished products need to find a home. Although there are consistent and sufficient outlets for compost, developing and promoting higher value compost products and uses that increase revenue for processors will help drive down overall system costs thereby improving the cost-effectiveness of organics diversion.

Regulatory Reform/Waste Ban – Regulatory Environment that Is Unclear and Considered Cumbersome, Need for Steady Supply of Source Separated Organics: The lack of clear permit pathways for organics processing facilities that employ advanced technology such as anaerobic digestion, and concerns about the applicability of the local site assignment process to such facilities, has been a barrier to the expansion of organics capacity in the Commonwealth.

Revising the State's solid waste siting regulations to address these issues will help facilitate development of new and expanded capacity. Public and private investment in collection systems and processing capacity of organics is contingent on these entities having confidence that a sufficient amount of organic material will be available. While some generators have established programs without a ban, a waste ban is necessary to drive widespread adoption of organics diversion.

The Action Plan lays out an ambitious list of actions to address each identified barrier, from establishing technical assistance and grant/loans programs to promulgating organics ban regulations.

What happens in Massachusetts will set an important precedent for how organics could be dealt with throughout the country.

Key Findings

Composting can divert significant materials from disposal

- Composting yard trimmings already diverts more than 780,000 tons per year of Maryland's waste from disposal, representing more than a quarter of material recycled.
- Expanding composting for food scraps will be important for counties to meet higher recycling levels.
- Almost one-half of typical household garbage set out at the curb is compostable. A pilot food scrap collection and composting program in Howard County indicates that food scraps alone make up one-quarter of residential material.
- Communities elsewhere, such as San Francisco, that have comprehensive composting programs including food scrap recovery, have surpassed 75% recycling levels.
- In Maryland, the potential to expand composting is enormous; more than 1 million tons of yard trimming and food scraps are estimated disposed each year.

Composting and using compost create jobs

- Composting (including mulching and natural wood waste recycling) operations in Maryland already sustain more total jobs than the state's three trash incinerators, which handle almost twice as much tonnage.
- Jobs are sustained in each stage of the organics recovery cycle: manufacturing compost as well as using compost.
- On a per-ton basis, composting in Maryland employs two times more workers than landfilling, and four times more than the state's trash incinerators.
- On a per-dollar-capital investment basis, for every $10 million invested, composting facilities in Maryland support twice as many jobs as landfills and 17 more jobs than incinerators.
- Wages at composting facilities typically range from $16 to $20 per hour.
- 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 job 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 can help protect the Chesapeake Bay watershed

- Healthy soils are essential for protecting the Chesapeake Bay and other watersheds.
- Compost is the best way to add organic matter – which is vital to soil quality – to soils.
- When added to soil, compost:
    1. Reduces non-point source pollution by binding pollutants and absorbing water, reducing erosion and sedimentation.
    2. Improves the quality of soil, retaining moisture and reducing the need for fertilizers, pesticides, and fungicides.
- Compost helps reduce stormwater runoff because it can hold up to 20 times its weight in water.
- Compost helps manage nutrient-laden stormwater and agricultural runoff by serving as a filter and a sponge. Its high porosity and permeability allow contaminated stormwater to infiltrate at much higher rates than most existing soils, especially those compacted via human development. Once in compost-amended soil, toxins and pollutants begin to break down. Compost immobilizes and degrades pollutants, improving water quality. It has the ability to bind heavy metals, pesticides, herbicides, and other contaminants, reducing both their leachability and absorption by plants.
- Compost-based products are identified as best management practices for controlling erosion and sediment in construction activities and for post-construction stormwater management. Examples: compost socks to trap sediment and for slope stabilization, compost vegetated cover, compost engineered soil, compost vegetated filter strips, and compost bioswales.
- Compost-based products for erosion control and stormwater management have the ability to filter and remove up to 99% of bacteria, 73% of heavy metals, 92% of nutrients, and 99% of hydrocarbons from stormwater.
- Compost, when added to soil, can reduce contamination of urban pollutants by an astounding 60 to 95%.

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.
- Smaller composting facilities have a higher job-to-ton ratio. In Maryland, on

a per-ton basis, small-scale composting facilities employ six times the number of jobs as landfills and eleven times more than incinerators.

- Several small-scale food scrap composting operations have opened in Maryland the last three years, demonstrating the viability of locally-based systems: ECO City Farms, an urban farm in Edmonston; Chesapeake Compost Works, a private enterprise in Curtis Bay, Baltimore; and a Howard County government site to process material from a residential pilot.
- 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.
- By developing a diverse infrastructure, Maryland can become a model for other states to emulate.

Policies are needed to expand composting and compost use in Maryland

- Local and state policies are needed to overcome lack of infrastructure and other obstacles to compost expansion, such as permitting restrictions. Permitting and regulations are top challenges to composting facilities' financial viability and their opportunities for expansion. Maryland composters also point to financing and lack of demand for compost as obstacles to expansion.
- An emerging industry of companies that use compost and compost-based products for erosion control and watershed protection is looking to expand in Maryland and the Mid-Atlantic region, and can benefit if policies that promote composting and compost use are implemented.
- The State has a critical role in supporting and encouraging composting at the local level. It can provide technical assistance to local jurisdictions, for instance, on best management practices, but it also needs to take a leadership role in facilitating the development of an expanded compost infrastructure. New rules are needed to clarify environmental requirements, exempt small facilities, and ensure all facilities protect public health and the environment by meeting performance standards.
- The MD General Assembly should address all 15 recommendations of a Statewide Composting Workgroup, convened in 2012 as a result of MD House Bill 817, and should consider many additional policies that would support expanding composting in Maryland (e.g., pay-as-you-throw trash systems, encouragement of a decentralized composting infrastructure, a moratorium on building new trash burners, implementation of a per-ton surcharge on all disposal facilities to fund recycling and composting initiatives, establishment of a 75% recycling goal by 2030, and compost-amended soil requirements).

Conclusion

Maryland is at a crossroads. Its recycling rate has stagnated at around 40% for more than a decade, and counties are only required to recycle 35% by 2015 (20% if they have populations under 150,000). 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 state in other important ways too.

At the same time, Maryland struggles to increase its recycling levels, the Chesapeake Bay watershed continues to suffer from excessive nitrogen and phosphorus levels due to nutrient-laden runoff pollution, despite decades of attention. 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. Healthy soils are essential for protecting local watersheds. Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions: water infiltration; 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.

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 in Maryland. 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.

Maryland has numerous 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.

ILSR also recommends the creation of a comprehensive food recovery strategy to 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 the State continues to approve new waste incinerators and pass policies that encourage trash burning.

Legislation passed in 2012 provides subsidies for burning trash under the guise of renewable energy credits. And an unsuccessful bill proposed by the incinerator company Covanta during the 2013 legislative session would have driven more trash to incinerators by establishing landfill diversion goals and penalties for landfill disposal but not for burning (SB799). Covanta is already working to get it reintroduced in 2014. Large trash burners are planned in Frederick County (1,500 ton-per-day capacity) and in the City of Baltimore (4,000 ton-per-day capacity), two communities that have yet to develop comprehensive programs to recover source-separated organics. 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, and undermine waste reduction and economic development efforts, and compete with the introduction of comprehensive food scrap composting systems.

One major finding of this report is that the state's composting operations, on a per-ton and a per-dollar-capital-investment basis, sustain more jobs than its landfills or incinerators. For every

10,000 tons per year flowing to an incinerator, one job is sustained. Data from 6 of the state's 22 municipal solid waste landfills, indicate landfills sustain two jobs per 10,000 tons per year landfilled. In contrast, half of the state's 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.

Based on data gathered for this report, if the estimated 1 million tons of organic materials now disposed in Maryland were instead composted at a mix of small, medium, and large facilities and the resulting compost used within the state, 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 the state's landfills and incinerators, this tonnage only supports 120 to 220 jobs.

By establishing a moratorium on building new trash incinerators while the State puts in place new regulations and support for composting, Maryland will be better positioned to reap the rewards of expanded composting and compost use: jobs, better soil quality, a healthier Chesapeake Bay, reduced greenhouse gas emissions, and more resilient communities.

ILSR recommends a comprehensive composting strategy for Maryland: 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. If implemented, such a strategy would make Maryland a national leader.

End Notes

[1] Robert Rynk et al., *On-Farm Composting Handbook* (Ithaca, New York: PALS, 1992).

[2] EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010, http://www.epa.gov/osw/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf

[3] Maryland Department of the Environment, *Maryland Solid Waste Management and Diversion Report, 2011 (Calendar Year 2010 Data)*, November 2011, available at http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/StateAgencyRecycling/Documents/%2711%20MSWMDR.pdf

[4] ILSR calculation based on Maryland Department of Environment, *Maryland Solid Waste Management and Diversion Report – 2011 – (Calendar Year 2010 Data),* Nov. 2011, p. 26, and US EPA waste characterization data indicating 13.9% of municipal solid waste disposed is food scraps and 13.4% is yard trim.

[5] Howard County Department of Public Works Environmental Services Recycling Division, *Food Scrap Pilot Curbside Program Report: August 2010 – January 2011*, available online at http://www.howardcountymd.gov/foodscraps.htm.

[6] John Davisson, "STEP-UP Wins Award for Kitchen Waste Compost Program," Riverdale Park-University Park Patch, June 16, 2012, online at http://riverdalepark.patch.com/articles/step-up-wins-award-for-kitchen-waste-compost-program.

[7] "UP Households Needed for Kitchen Waste Compost Program," Small Town Energy Program web site, November 21, 2012. http://smalltownenergy.org/households-needed-kitchen-waste-compost-program

[8] Susan S. Lang, "'Slow, insidious' soil erosion threatens human health and welfare as well as the environment, Cornell study asserts," Online Chronicle, University of Cornell, Ithaca, New York, March 20, 2006. Available online: http://www.news.cornell.edu/stories/march06/soil.erosion.threat.ssl.html

[9] Personal communication, Wayne King, US Composting Council and Erth Products, Plains, Georgia, September 2011.

[10] Personal communication, Rod Tyler, Filtrexx International, LLC, January 2013.

[11] Personal communication, Barrie Cogburn, Texas DOT (retired), January 2013.

[12] "Erosion Control with Recycled Materials," U.S. Department of Transportation Federal Highway Administration, *Public Roads*, 67 (2004): No. 5, accessed December 2012, http://www.fhwa.dot.gov/publications/publicroads/04mar/03.cfm

[13] Barrie Cogburn, Op. Cit.

[14] "Erosion Control with Recycled Materials," U.S. Department of Transportation Federal Highway Administration, Op. Cit.

[15] Barrie Cogburn, Op. Cit.

[16] "Erosion Control with Recycled Materials," U.S. Department of Transportation Federal Highway Administration, Op. Cit.

[17] Personal communication, Bert Lary, Landscape Contracting and Irrigation Inc., February 2013.

[18] Personal communication, Greg Guldahl, Wims Environmental Construction LTD, February 2013.

[19] Personal communication, Duffy McKenzie, USA Erosion Inc., February 2013.

[20] Rod Tyler, Op. Cit.

[21] Personal communication, Wes Allen, Envirotech Environmental Consulting, Inc., January 2013.

[22] Personal communication, Bruce Blessing, Blessing Greenhouses and Compost Facility, December 2012.

[23] Personal communication, Rick Lee, Blessing Greenhouses and Compost Facility, February 2013.

[24] Wes Allen, Op. Cit.

[25] Personal communication, Jason Dorney, MCS Inc., January 2013.

[26] Personal communication, Shirley Holstein, Filtrexx International, LLC, January 2013.

[27] Personal communication, Matt Owings, Oreg, January 2013.

[28] Personal communication, Jeff Opel, Gold Leaf Group, January 2013.

[29] Ann English, "Compost: Part of the RainScapes Strategy for Reducing Runoff and Improving Water Quality," Montgomery County DEP, November 7, 2012, Presentation at the 7th Annual Potomac Watershed Trash Summit, http://www.ilsr.org/1national-capital-region-organics-task-force-compost-amended-soil/ (scroll down to "Presentations and Meeting Documents")

[30] Personal communication, Ann English, RainScapes Coordinator, Montgomery County DEP, January 2013.

[31] Ann English, "Compost: Part of the RainScapes Strategy for Reducing Runoff and Improving Water Quality," Montgomery County DEP, Op. Cit.

[32] Personal communication, Toni Bailey, Gracefully Green, LLC, January 2013.

[33] Personal communication, Edamarie Mattei, Backyard Bounty, January 2013.

[34] Personal communication, Ann English, Op. Cit.

[35] Personal communication, John Shorb, John Shorb Landscaping Inc, January 2013.

[36] Personal communication, Jonathon Shober, The Brickman Group, LTD, February 2013.

[37] "Why Build Healthy Soil," Washington Organic Recycling Council's (WORC) Soils for Salmon Project, accessed November 2012, http://soilsforsalmon.org/why.htm

[38] Personal communication, Ruth Quade, City of Greeley Water Department, July 2012.

[39] "Rainscapes Rewards Program," City of Gaithersburg Maryland, accessed February 2013 http://www.gaithersburgmd.gov/poi/default.asp?POI_ID=1670&TOC=107;83;388;1670;

[40] "The Sustainable Sites Initiative," American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at The University of Texas at Austin and the United States Botanic Garden, accessed December 2012, http://sustainablesites.org/

[41] Personal communication, Ann English, Op. Cit.

[42] WORC, Op. Cit.

[43] Composting Council Research and Education Foundation, *A Watershed Manager's Guide To Organics: The Soil And Water Connection* (1997), 6.

[44] Rick Lee, Op. Cit.

[45] Jason Dorney, Op. Cit.

[46] "Rising fertilizer costs reveal another side of oil market," Coastal Point, accessed January 2013, http://www.coastalpoint.com/content/rising_fertilizer_costs_reveal_another_side_oil_market

[47] "Composting Makes ene Project," Institute for Local Self-Reliance and USGS State Water Resources Research Institute Program, accessed January 2013, http://water.usgs.gov/wrri/2012grants/2012DC142B.html

[48] Barrie Cogburn, Op. Cit.

[49] WORC, Op. Cit.

[50] Washington State Department of Ecology, *2012 Stormwater Management Manual for Western Washington* (2012), 5-8, accessed January 2013, https://fortress.wa.gov/ecy/publications/publications/1210030.pdf

[51] Composting Council Research and Education Foundation, Op. Cit.

[52] "About west marin compost," West Marin Compost, accessed December 2012, http://westmarincompost.org/?page_id=225

[53] "What is a TMDL," US EPA, accessed February 2013, http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overviewoftmdl.cfm#responsibility

[54] "Frequently Asked Questions about the Bay TMDL," US EPA, accessed February 2013, http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/FrequentlyAskedQuestions.html

[55] US EPA, *Decision Rationale Total Maximum Daily Loads For Polychlorinated Biphenyls (PCBs) Tidal Potomac & Anacostia River Watershed in the District of Columbia, Maryland and Virginia*, accessed April 2013, http://www.epa.gov/waters/tmdldocs/PotomacPCBTMDLDR.pdf

[56] "Frequently Asked Questions about the Bay TMDL," US EPA, Op. Cit.

[57] "USCC factsheet: Using Compost Can Reduce Water Pollution," U.S. Composting Council, accessed October 2012, http://compostingcouncil.org/admin/wp-content/uploads/2010/09/Using-Compost-for-Reducing-Water-Pollution.pdf

[58] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[59] WORC, Op. Cit.

[60] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[61] "Soil Quality Technical Note No. 5, Managing Soil Organic Matter: The Key to Air and Water Quality," United States Department of Agriculture NRCS-SQI, accessed October 2012, http://soils.usda.gov/sqi/concepts/soil_organic_matter/files/sq_tn_5.pdf

[62] Washington State Department of Ecology, https://fortress.wa.gov/ecy/publications/publications/1210030.pdf

[63] WORC, Op. Cit.

[64] "The Science and Practice of Sustainable Sites: Practical Implementation of Soil Protection & Restoration," WA Chapter of the ASLA, UW Botanic Gardens, and Seattle Public Utilities 9/27/11 Seminar Presentation, accessed October 2012, http://depts.washington.edu/uwbg/docs/sites/Sites_Soil_McDonald_Stenn_Berger.pdf

[65] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[66] "Drought Resistant Soil, Agronomy Technical Note," Appropriate Technology Transfer for Rural Areas (ATTRA), NCAT, USDA, accessed December 2012, http://www.clemson.edu/sustainableag/IP169_drought_resistance.pdf

[67] WORC, Op. Cit.

[68] Composting Council Research and Education Foundation, Op. Cit., p. 14.

[69] Ibid, p. 8.

[70] "Field Guide to Compost Use," The US Composting Council, accessed May 2013, http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/1330/Field_Guide_to_Compost_Use.pdf

[71] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[72] WORC, Op. Cit.

[73] WORC, Op. Cit.

[74] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[75] WORC, Op. Cit.

[76] "Soil Quality Technical Note No. 5, Managing Soil Organic Matter: The Key to Air and Water Quality," USDA, Op. Cit.

[77] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[78] Britt Faucette, "Compost In The Green Infrastructure Toolbox," *BioCycle*, October 2010, p. 33.

[79] Britt Faucette, "Designing with Nature: LID & Pollution Prevention with Compost BMPs," Filtrexx International LLC, Compost BMPs: EPA-WIP/TMDL Challenge Seminar, Annapolis, Maryland, March 2013.

[80] Nitrogen and Phosphorous," Chesapeake Bay Foundation, accessed April 2013, http://www.cbf.org/how-we-save-the-bay/issues/dead-zones/nitrogen-phosphorus; and Chesapeake Bay Commission, Chesapeake Bay Foundation, Maryland Technology Development Corporation, and Farm Pilot Project Coordination, Inc., *Manure to Energy: Sustainable Solutions for the Chesapeake Bay Region* (2012), p. 5, http://www.chesbay.us/Publications/manure-to-energy%20report.pdf

[81] "NPDES: Compost Blankets," US EPA, accessed April 2013, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118

[82] "How Healthy Are Our Waterways: Water Quality Monitoring," Longwood University, accessed February 2013, http://www.longwood.edu/cleanva/images/sec5.wqmchapter.pdf

[83] Personal communication, Gregory Evanylo, Virginia Tech, February 2013. The fraction of water soluble N in compost is typically no greater than that in non-compost-amended soils.

[84] Personal communication, Craig Coker, Coker Composting and Consulting, December 2012 and April 2013.

[85] Gregory Evanylo, Op. Cit., March 2013

[86] "Earth-Kind Landscaping: Chapter 2, Composting Fundamentals," Texas A&M Agrilife Extension, accessed February 2013, http://aggie-horticulture.tamu.edu/earthkind/landscape/dont-bag-it/chapter-2-composting-fundamentals/

[87] Ecological Society of America. "Human Alteration of the Global Nitrogen Cycle: Causes and Consequences." *Issues in Ecology,* no. 1 (1997): p. 13, http://cfpub.epa.gov/watertrain/pdf/issue1.pdf; personal communication, Jim McNelly, Renewable Carbon Management, November 2012; and personal communication, Benny Erez, Senior Technical Advisor, ECO City Farms, Edmonston, Maryland, May 2013.

[88] Craig Coker, Op. Cit.

[89] Composting Council Research and Education Foundation, Op. Cit., p. 8.

[90] Spargo, John T., Gregory K. Evanylo, and Marcus M. Alley. "Repeated compost application effects on phosphorus runoff in the Virginia Piedmont." *Journal of Environmental Quality* 35, no. 6 (2006): 2342-2351.

[91] Ibid, p. 2349.

[92] Faucette, L.B., C.F. Jordan, L.M. Risse, M. Cabrera, D.C. Coleman, and L.T. West. "Evaluation of stormwater from compost and conventional erosion control practices in construction activities." *Journal of Soil and Water Conservation* 60, no. 6 (2005): 288-297.

[93] Ibid, pp. 294-295.

[94] Seattle's Master Composter training program is now hosted by Seattle Tilth Association, http://seattletilth.org.

[95] See the NYC Master Composter Certificate Course web site: http://www.nyc.gov/html/nycwasteless/html/compost/compostproj_mastercomposter_course.shtml.

[96] See Alameda County's Master Composter Training web site: http://www.stopwaste.org/home/index.asp?page=170

[97] See for instance, the City of Houston's Grasscycling web site at: http://www.houstontx.gov/solidwaste/grasscycling.html and the City of Philadelphia's web page at: http://www.philadelphiastreets.com/recycling-grass.aspx

[98] See the North Central Texas Council of Governments' web page on "City of Dallas Recycling," at: http://www.timetorecycle.com/residential/program_details.asp?citycode=1085. Scalping is a landscaping practice that involves cutting grass very close to the ground.

[99] See, for instance, the UK Community Composting Network case studies at: http://www.communitycompost.org/index.php/casestudies.

[100] "Growing With Compost: Creating Opportunities for Adult Education and Social Employment Through Sustainable Organic Waste Management," http://www.growingwithcompost.org, browsed June 9, 2012.

[101] Richard Pearce and Cath Kibbler, *Community Composting for Local Food Project Business Plan Summary, 2011-2014*, Community Composting Network, Sheffield, England, undated. Available online at http://www.communitycompost.org/Recruitment/Community_Composting_for_Local_Food_Summary.pdf

[102] Ibid, p. 7.

[103] Personal communication, Margaret Morgan-Hubbard, ECO City Farms, April 2013

[104] Peter Anderson, Gary Liss and Peter Sherman, *Beyond Recycling: Composting Food Scraps and Soiled Paper,* Center for a Competitive Waste Industry with Gary Liss and Associates, January 2010, p. 23.

[105] Juri Freeman and Lisa Skumatz, *Best Management Practices in Food Scraps Programs*, Econservation Institute (Superior, Colorado), prepared for Materials Management Branch, Land and Chemical Division, US EPA Region 5, December 2010, p. 14.

[106] Ibid, pp. 7, 13.

[107] Ibid.

[108] "Food Scraps Programs in the United States," *BioCycle*, July 2011, p. 20.

[109] Freeman and Skumatz, Op. Cit., p. 8.

[110] Ibid, p. 9.

[111] Anderson et al., Op. Cit., pp. 42-43.

[112] Ibid, p. 44.

[113] Ibid, pp. 42-43.

[114] Dan Sullivan, "Zero Waste on San Francisco's Horizon," *BioCycle*, July 2011, p. 28.

[115] San Francisco Environment, *Composting,* http://www.sfenvironment.org/our_programs/topics.html?ssi=3&ti=6 (accessed August 2011)

[116] Sullivan, p. 28.

[117] "Food Scraps Programs in the United States," *BioCycle*, Op. Cit., p. 29.

[118] Anderson et al., Op. Cit., pp. 32-33.

[119] Jepson Prairie Organics, *Compost Process*, http://www.jepsonprairieorganics.com/compostprocess.htm (accessed July 2011)

[120] Sullivan, Op. Cit., p. 28.

[121] Anderson et al., Op. Cit., pp. 32-33.

[122] "Food Scraps Programs in the United States," *BioCycle*, Op. Cit., p. 30.

[123] "Greater Toronto at Full Steam with Residential Organics Programs," *BioCycle*, August 2010, p. 38.

[124] City of Toronto, *Garbage and Recycling: Green Bin Program*, http://www.toronto.ca/greenbin/background.htm (accessed July 2011)

[125] Anderson et al., Op. Cit., pp. 37-38.

[126] "Greater Toronto at Full Steam with Residential Organics Programs," *BioCycle*, Op. Cit., p. 40.

[127] Anderson et al., Op. Cit., p. 38.

[128] Ibid, p. 37.

[129] "Greater Toronto at Full Steam with Residential Organics Programs," *BioCycle*, Op. Cit., p. 39.

[130] City of Toronto, *Garbage and Recycling: Green Bin Program*, Op. Cit.

[131] "Greater Toronto at Full Steam with Residential Organics Programs," *BioCycle*, Op. Cit., pp. 41-42.

[132] Ibid, p. 36.

[133] Ibid, p. 38.

[134] City of Austin, Resource Recovery Department, *The Austin Resource Recovery Master Plan*, December 11th, 2011. Available online: http://www.austintexas.gov//sites/default/files/files/Trash_and_Recycling/MasterPlan_Final_12.30.pdf

[135] Ibid, pp. 105-106

[136] Ibid, p. 107.

[137] See for instance, US Composting Council, *USCC Position Statement: Persistent Herbicides*, http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/9199/USCC%20Position%20Statement%20on%20Persistent%20Herbicides%20FINAL.pdf.

[138] Massachusetts Department of the Environment, *MassDEP Organics Study and Action Plan*, May 10, 2012, available online at: http://www.mass.gov/dep/public/committee/swacorg.htm

[139] Ibid.

Appendix A: Priority Recommendations of the MDE Composting Workshop

To meet the stipulations of House Bill 817, Environment – Composting (Chapter 363, Acts of 2011), which became effective July 1, 2011, the MD Department of the Environment (MDE) convened a Composting Workgroup that included representatives from the MD Department of Agriculture (MDA), MD Environmental Services (MES), the composting industry, local governments, and other stakeholders. The Workgroup met May-December 2012. It identified obstacles to increasing composting, studied current law and regulations related to composting, and heard presentations from other states.

The Workgroup's final report to The Maryland General Assembly includes 15 priority recommendations:

1. The General Assembly should pass legislation amending Article 9, Subtitle 17 of the Environment Article to authorize MDE to issue regulations governing the design and operation of composting facilities and to exempt facilities subject to such regulation from the requirement to obtain a Refuse Disposal Permit.
2. The General Assembly should pass legislation amending Article 9, Subtitle 1 of the Environment Article to authorize MDE to issue regulations exempting organic material capable of being composted from the definition of solid waste if such material is composted in compliance with the new composting regulations. This will allow MDE to permit and regulate composting facilities under new compost-specific regulations and outside of the Refuse Disposal Permit scheme, while maintaining the Refuse Disposal Permit as an option for the highest-risk facilities, such as MSW [municipal solid waste] composting facilities.
3. Maryland should consider adapting the US Composting Council (USCC) model composting regulations for use as a basis for Maryland regulations once the model regulations are finalized. Maryland's regulations should establish minimum performance-based standards and appropriate individual standards for composting facilities based on type of feedstock, size or volume of operations, and environmental and public health risk.
4. MDE should work to create a single application for composting that would include both discharge requirements issued by MDE's Water Management Administration (WMA) and any requirements issued by the MDE's Land Management Administration (LMA) related to solid waste or recycling. Under this system, the applicant would provide a single application for a composting facility, reviewed on the basis of feedstock type, size of operations, and environmental and public health risk.
5. Revenue sources should be specifically set aside and directed toward funding for composting education and outreach activities. Funding must also be identified to establish a composting regulatory program in Maryland. Dedicated funding for a minimum of 1 full time equivalent (FTE) for MDE to develop outreach and education and to promote composting in the State is necessary. These revenues may be generated by increasing revenues to special funds or by dedicating general funding. New revenue sources could include a registration fee, permit fee, or certification fee for compost facilities. In the early 1990's and again in the early 2000's, MDE's LMA had three FTEs dedicated to outreach and education for the State. Funding for specific projects to boost compost industry growth is needed in the near term, including funds for mapping and surveying large food scrap generators and developing model local zoning codes.
6. Standards for design and operations should be based on available science and established national public health and relative environmental risk assessment protocols associated with feedstock or type of composting facility. Volume of materials, area, time and temperature of processing are likely to be areas for regulation. Best management practices (BMPs) for design and operation of compost facilities will be developed. MDE should continue to work with stakeholders, including Technical Subgroup members and experts from University of Maryland, to develop and refine these standards.

7. The State should endorse a variety of compost uses in its guidance and manuals as follows:
   - MDE's Soil Erosion and Sediment Control Manual and Stormwater Design Manual should be updated to encourage the use of compost and compost products for a wide variety of sediment and erosion control and stormwater management purposes.
   - The State Highway Administration's (SHA) Materials and Technology Division should maintain up-to-date lists of specific approved compost and compost products (such as compost berms, filter socks, and blankets) for use in roadway projects and other applications.
   - MDE, MDA, and MES should work with the State Highway Administration Recycled Materials Task Force to educate SHA on the uses of compost and to encourage approval of compost for a wider variety of uses.
8. State and local agencies should take affirmative steps to explore and encourage composting and the use of finished compost, including developing pilot projects. All State and local agencies should take affirmative steps to use compost and compost products as appropriate, including as bioretention soils, green roof soils, and for roadway projects and slopes.
9. The Department of Business and Economic Development (DBED), local economic development agencies, MDA, MES, and MDE should work together to identify financial and technical assistance for companies interested in establishing and expanding composting facilities in Maryland, including grants, loans, and job training programs. The agencies should also support the compost industry by identifying end markets for compost generated in the State.
10. The Maryland Agricultural Education Foundation and University of Maryland Extension should be used as resources for composting education and technical assistance.
11. DBED and local economic development agencies should assist in identifying properties able to manage organics, including any brownfield sites, large farms, or State or locally owned property such as detention centers. Funding should be provided for DBED and local economic development agencies to carry out this task.
12. MDE, MDA, and local governments should launch an education and outreach campaign to highlight composting and compost use.
13. New composting legislation and regulations should allow flexibility to accommodate conditions that are as safe or safer than the requirements prescribed. This may be accomplished through a clearly defined variance process and/or through an approval process for pilot projects.
14. Backyard composting should be exempt from State regulation. Composting at community gardens would be exempt from a LMA compost facility permit if the site falls under the small facility exemption threshold, which is to be determined.
15. On-farm composting should be exempt from permitting if the materials being composted are generated on site, composted on site, and used on site in accordance with MDA nutrient management requirements. A farmer who takes feedstocks from off site, composts on the farm, and uses the compost on site, should be required to register with MDE. An evaluation would be performed based on the registration information to determine if permits are required. A farmer who wants to distribute or sell his compost will likely need a general stormwater permit, must be certified by MDA, and should be subject to the same operational requirements as other composting operations, including any new LMA composting facility permit requirement. Local Soil Conservation Districts should provide model soil and water conservation plans to covering pad, drainage and other requirements for on-farm composting operations. MDE stormwater requirements may supersede the soil and water conservation plan requirements, however.

Source: MDE, *Composting Workshop Final Report*, prepared for The Maryland General Assembly, January 2013. Available: http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/Publications/Documents/composting_workgroup_final_report_1-2013000%20(1).pdf

Appendix B: Permitted Natural Wood Waste Recycling Facilities in Maryland

Jurisdiction	Facility	Material Recycled (2010 tons)
Anne Arundel	A-A Recycle & Sand	17,202
	Bronson Contracting, Inc.	2,936
	L and W Recycling	35,000
Baltimore Co.	King Mulch and Pallet	6,990
	Edrich Lumber	55,931
	Northwest Recycling	20,455
	Wirtz & Daughters	15,272
	Hollins Organic Products	13,581
Calvert	Sawmill Road Natural Wood Waste Recycling Facility	15,203
Caroll	C.J. Miller	8,532
	Recycled Green Industries	32,775
Cecil	Grass Busters Landscaping	-
	ALC Stump & Brush Recycling	450
Charles	Maxi Mulch	957
	James E. Hill	1,606
Frederick	Butler Wood Recycling	1,609
	Bussard Brothers Landscape	5,000
Harford	Arthur D. Heston	570
	Crouse Construction Co.	-
	T and M Mulch Natural Wood Waste Recycling Facility	4,501
	Comer Construction, Inc.	16,631
Howard	Jerom M. Carlin	30,195
Montgomery	Twin Ponds Farm	1,164
	Acme Biomass Reduction	17,741
Queen Anne's	Baker Rubble Landfill	1,977
Talbot	Dependable Sand and Gravel Co.	1,172
Wicomico	Dunn's Tractor Service	-
	Eastern Shore Forest Products	600

Source: Maryland Department of the Environment, “Maryland Solid Waste Management and Diversion Report, 2011,” November 2011, pp. 15-16. Available online at: http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/StateAgencyRecycling/Documents/%2711%20MSWMDR.pdf

Appendix C: ILSR's Compost/Mulch/Natural Wood Waste Survey

Compost/Mulch/Natural Wood Waste Survey

Please complete this survey for your facility as fully as possible, providing the most recent data available. The data you provide will be used to document the contribution your business makes to Maryland's local and regional economy and to help identify obstacles to expanding composting and natural wood waste reclamation and how these can be overcome.

Section A: Contact and Facility Information

Today's Date (MM/DD/YYYY):

Contact Name:

Job Title:

Company Name

Facility Name (if different from company)

PO Box/Street:

City:

State:

Zip:

County:

Phone number (xxx-xxx-xxxx):

Cell or other phone number (xxx-xxx-xxxx):

Email:

Primary SIC Code:

Primary NAICS Code:

Owner:

Operator:

Facility classification:

Public
Private
Public/Private

Facility design capacity (tons or cubic yards per year, please specify):

Actual annual throughput of incoming materials processed (tons or cubic yards per year, please specify):

Year facility constructed:

Note: You will be able to return to any page to review your data before submitting.

Section B: Employee Information

1. Total number of Full-Time Equivalent (FTE) employees working at the plant:

2. Total actual full-time employees:

3. Total actual part-time employees:

4. Total number of FTE skilled workers:

5. Total number of FTE unskilled workers:

6. Range in hourly wages (min-max):

7. Average hourly wage:

8. Please indicate the types of jobs at the facility:

Vehicle Drivers
Other Equipment Operators
Supervisors/Management
Business Development
Marketing and Development
Communications/PR
Accounting
Contract Workers
Volunteers
Other

Section C: Opportunities for Growth

1. Total acreage of site:

2. Acreage used for composting or natural wood waste activities (unloading area, material feedstock storage, active composting, curing, grinding, product storage, etc.):

3. Can you take more material? If so, how much more (please specify by ton or cubic yards per year)? What types?

4. If you do not accept food residuals would you be willing to accept them? Under what conditions?

5. Are you interested in expanding your compost or wood reclamation operations?

- Yes
- No

6. If “yes,” what are your obstacles? (check all that apply)

- Access to land
- Financing
- Regulatory or permitting issues
- Guaranteed feedstock
- Competition with other facilities
- Lack of market demand for compost or other products
- Other

7. What challenges hinder the cost effectiveness of your facility?

- Regulations/permitting
- Contamination of feedstock/incoming material
- Competition of other facilities
- Lack of market demand for compost or other products
- Other

8. What kind of public and/or private sector assistance would help you overcome these obstacles?

Press "Prev" at any time to review your answers

Section D: Material Flow

1. Please indicate the types of materials accepted by the facility (check all that apply):

- Leaves
- Grass
- Brush/Branches
- Logs/Stumps/Other wood
- Plant Trimmings
- Wood Pallets
- Land clearing debris
- Manure
- Other farm/Agricultural waste
- Compostable food-service ware/ Packaging
- Paper products
- Food waste (pre- and or post-consumer)
- Food processing waste (pre-consumer)
- Biosolids
- Other

2. Please indicate the source of your incoming materials (check all that apply):

- Residential
- Municipalities/Other government
- Commercial Landscapers
- Greenhouses/Nurseries/Horticulture
- Hospitals
- Restaurants
- Supermarkets
- Prisons
- Farms/Agriculture
- Other Businesses
- Other

3. Estimated percentage from public sector (vs. private sector):

4. Please estimate the distance the incoming materials travel prior to arriving at your facility

5. Geographic area(s) serviced please check those that apply:

- Allegany County
- Anne Arundel County
- Baltimore County
- Baltimore City
- Calvert County
- Carroll County
- Cecil County
- Charles County
- Dorchester County
- Frederick County
- Garrett County
- Harford County
- Howard County
- Kent County
- Montgomery County
- Prince George's County
- Queen Anne's County
- St. Mary's County
- Somerset County
- Talbot County
- Washington County
- Wicomico County
- Worcester County
- Virginia
- District of Columbia
- Other States

6. Please estimate the percentage of your products that go to the following buyers/users (percentage by tonnage or cubic yards):

a. On-site, %

b. Landscapers, %

c. Nurseries/Horticulture, %

d. Commercial Use. %

e. Community Gardens, %

f. Residential, %

g. Farms/Agriculture,%

h. Other (please specify type and percentage)

7. Please estimate the distance your finished products travel after leaving your site?

8. Please estimate the percentage of product sales:

a. Inside Maryland (tonnage or cubic yards, please specify)

b. Inside Maryland (revenue)

c. Outside Maryland (tonnage or cubic yards, please specify)

d. Outside Maryland (revenue)

9. Please indicate the type of products you sell or distribute (check all that apply)

- Compost
- Other soil amendments
- Shredded or chipped wood
- Bulk products
- Bagged products
- Other

Press "Prev" at any time to review your answers

Section E: Facility Processes

1. Does your facility accept material in non-compostable plastic bags?

- Yes
- No

a. If “yes,” is there a debagging process?

- Yes
- No

2. Composting or other reclamation process used at the facility (check all that apply):

- Static Piles, in windrows
- Static Piles, not in windrows
- Forced aerated static piles
- In vessel composting
- Vermi composting
- Wood chipping/grinding
- Other

3. Do you have a permeable surface or an impermeable pad?

Permeable Surface

Impermeable Pad

Section F: Economic Information

1. What is the range of tip fees (per ton or per cubic yard, please specify) at the facility (min-max)?

2. Average or most common tip fee?

3. What is your total annual revenue?

4. Estimate the percentage of your annual revenue from tip fees:

5. Estimate the percentage of your annual revenue from sale of product:

6. Capital cost of initial site construction and all equipment ($$):

7. Capital cost and year of any site upgrades and new equipment purchases ($$, YYYY):

Section G: Additional Information

1. Besides the number of jobs you sustain and wages you pay, can you provide any other figures on how your enterprise benefits the local economy (such as taxes paid to the city or state, license fees, value added to recycled materials, taxable revenues, multiplier impacts)?

2. Is there anything else you would like us to know?

Thank you for filling out our survey!