# *Organic Materials Management & Composting For Rural, Small, and Tribal Communities*


A guide to assist decision makers, solid waste staff, citizen activists and others in developing and expanding yard debris, food scrap, and other organics management strategies.

Written by Athena Lee Bradley
Northeast Recycling Council, Inc.

With funding from the Rural Utility Services,
United States Department of Agriculture


September 2014

## Acknowledgements

NERC is a non-profit organization that conducts projects in the ten Northeast states, as well as around the country. Its mission is to promote environmental sustainability through materials management. NERC received funding from the United States Department of Agriculture, Rural Utility Services for the "Best Management Practices for Organics & Debris Management in Rural Towns in Maine, New Hampshire, New York, and Vermont" project. Through the project, NERC provided webinars, workshops, resources, and technical assistance.

The following individuals and organizations provided invaluable and generous assistance in the development of this project. The Northeast Recycling Council, Inc. (NERC) would like to appreciate and acknowledge:

- Eric Fedus, who assisted with research and telephone interviews for this document, as well as providing editorial insight.
- Project Advisory Committee Members:

  **Maine**
  - Randall Gray, Solid Waste Management Facility, Town of Skowhegan
  - Mark King, Maine Department of Environmental Protection, Sustainability Unit
  - George MacDonald, Maine Department of Environmental Protection, Sustainability Unit

  **New Hampshire**
  - Theresa Swanick, Board of Selectmen, Town of Effingham
  - Sharon Yergeau, New Hampshire Department of Environmental Services, Solid Waste Compliance Assurance
  - Doug Kemp, New Hampshire Department of Environmental Services, Solid Waste Compliance Assurance

  **New York**
  - Sara S. Idleman, Town of Greenwich and Washington County Board of Supervisors
  - David Gross, Environmental Commission, Town of Woodstock
  - Michelle Leggett, Ulster County Resource Recovery Agency
  - Gary Feinland, New York State Department of Environmental Conservation, Bureau of Waste Reduction and Recycling
  - Terry Laibach, New York State Department of Environmental Conservation - Region 3

  **Vermont**
  - Steve Gould, Town of Chelsea
  - Leesa Stewart, Central Vermont Solid Waste Management District
  - Carey Hengstenberg & Bryn Oakleaf, Vermont Agency of Natural Resources, Department of Environmental Conservation

- The many people who responded to NERC's initial inquiry seeking examples of rural and small town organics management programs

## Table of Contents

This material is based upon work supported under a grant by the Utilities Programs, United States Department of Agriculture. Any opinions, findings, and conclusions or recommendations expressed in this material are solely the responsibility of the author and does not necessarily represent the official view of the Utilities Programs.


TOO GOOD
TO WASTE

# *Organic Materials Management for Rural, Small, and Tribal Communities*

## Introduction

In 1960, *Compost Science*, now *BioCycle,* began publication. Its founder, Jerome Goldstein stated in the inaugural issue's editorial: "We are thoroughly convinced that there is a need to conserve this country's as well as the world's natural resources. We believe that converting municipal and industry organic wastes into useful products would be an effective step forward in a long-range conservation program." More than 50 years later, organic materials continue to be undervalued as a resource.

Discarding organic materials as waste impacts our environment, energy use, and economy, taking up landfill space and contributing to increased greenhouse gas emissions. Organic materials can instead be turned into viable new products, including mulch, compost, fuel, and electricity, helping to create locally-based jobs and supporting local and regional economies.

Focusing on organics material management offers communities a cost-effective opportunity to beneficially develop these resources. This Guidance Document presents best management practices for developing and implementing programs that promote the "hierarchy" of organics management—reduce, reuse (recover), recycle (compost or anaerobic digestion). It is specifically designed as a "how to" guide to meet the needs of rural, small, and tribal communities.

The guide is separated into easy-to-follow sections. It is recommended that you start by taking a look at the Table of Contents. Each section is presented with hyperlinks. The Organics Management Hierarchy—Reduce (Part I), Recover (Part II), Recycle (Part III)—is discussed, along with a wide range of strategies and program options under each facet of the hierarchy. "Action Tips" and "Who's Doing It" sections (case study examples) are also included within each strategy/program.

## Overview

**or•gan•ics**
**noun**

1. Of, relating to, or derived from living organisms: organic matter
2. Yard and landscape trimmings—leaves, grass clippings, and brush
3. Agricultural and land-clearing/forestry debris
4. Manures and biosolids (sludge)
5. Food scraps and food processing residues
6. Non-recyclable/soiled paper—napkins, paper towels, and other paper products[1]
7. Items manufactured from organics—compostable bags, utensils, and plates, cups and other service ware made from corn and potato starch, bagasse, PLA, and similar materials

[1] Food soiled paper, such as stained pizza boxes, uncoated paper cups and plates, used coffee filters, paper food cartons, napkins, and paper towels, usually comes from the kitchen and is not appropriate for paper recycling due to contamination. Food scraps and soiled paper together are often called "source separated organics" (SSO).

Effective organics management presents communities with a significant opportunity for cost savings, economic development, and an enhanced local environment. Organic materials continue to be the largest component of municipal solid waste; comprising around 56% of the materials we send to landfills and incinerators.[2] In the United States, yard trimmings are recycled at just over 57%, while less than 4% of food scraps are currently recovered.[3] This means that some 34 million tons of food is discarded by homes and businesses in the U.S. annually.[4]

Organic materials include not only what we dispose in the trash at home or at work, but also organic "wastes" associated with the goods and services we all consume, including agricultural discards, food processing residuals, and land-clearing debris from construction sites.

Organics management programs that focus on reduction and community-based diversion can be successfully implemented in any community. Success often involves several strategies, including:

- Implementing a variety of management approaches that are relatively low cost, manageable within existing staffing limitations, and draw upon existing resources.
- Identifying an organics management system that fosters the importance of the organics management hierarchy, with an emphasis on reducing materials at their source and keeping organics onsite (where generated) when possible.
- Developing a system that meets state requirements and helps the community comply with state and local waste diversion goals.
- Implementing organics collection and processing options, as necessary, and that fit within existing waste handling practices.
- Considering community or centralized composting—developed locally, regionally, or through partnerships with not-for-profit, farm, or private operations—as a viable organics management option for increased diversion of yard trimmings and potentially food scraps.

*This document explores each of these and provides the framework for designing and sustaining a successful organics management program.*

## Benefits of Organics Management

There are many benefits to managing organics as a valuable resource rather than as waste. These include:

- Reducing disposal needs and costs.
- Homeowners, farmers, landscapers, municipalities, and others using compost to enrich soil; providing valuable nutrients, microbes, and soil structure (helping soil to retain moisture and not compact), and reducing the need for fertilizers and irrigation.
- Using organic materials to make compost—a marketable product—may help to stimulate the local economy through job creation and business development.
- Food scrap composting can lead to reduced waste disposal costs for food waste generators, such as restaurants and grocery stores.

---

[2] Ashley Zanolli, *Sustainable Food Management in Action*, BioCycle, March 2012, Vol. 53, No. 3, p. 48.

[3] US EPA, Office of Resource Conservation and Recovery, *Municipal Solid Waste Generation, Recycling and Disposal in the United States, Tables and Figures for 2012*, February 2014.

[4] See Zanolli above.

- Diverting organics from landfill disposal helps to reduce greenhouse gas emissions.
- Expanding options for organics handling can reduce open burning of yard waste; helping to reduce air pollution impacts and instances of uncontrolled fires.

## Strategies that Support Organics Management Practices

Rural, small, and tribal communities often face challenges to implementing organics diversion and composting programs, ranging from a lack of information about program opportunities, to concerns about costs and regulatory compliance for compost operations. There are many factors that contribute to developing a successful organics management program. Securing the support of decision makers, as well as the citizenry, is a first step for moving forward. A successful program must also be tailored to meet the needs of each community.

Decision makers and the public may need to be persuaded of the value in adding organics management as an undertaking for their community. They may feel the program isn't needed or that organics management is too costly. Such perceptions can have many roots, but generally result from a lack of information about the amount of organics being thrown in the trash or "managed" through backyard burning, and the associated wasted resources to the community. As a result, the potential benefits and economic growth opportunities through improved organics management are overlooked.

**Getting Started with Educational Awareness**

The outreach and education effort has two goals: 1) convincing decision makers and "stakeholders" (residents, businesses, schools) to support an organics management program; and 2) fostering participation in the program.

> Outreach and education on the value of organics diversion and composting can be the most important management tool available.

Start by defining the importance of improved organics management. Next, outline the specifics of the program, its goals, and the stakeholders—targeted participants in the program. Include details on the scope of the program, its anticipated benefits, estimated costs, and targeted participants, in order to provide decision makers and participants with the knowledge they need to act.

Gaining participant support for the venture comes next. Citizens and businesses may need to be convinced about the need to change their existing organics management behavior. Address concerns and explain the requested "change" and program requirements, along with the costs and benefits to the participants and the community. Outreach and training are essential to gain support and participation once opportunities are put into place. Education helps to ensure that program participants learn about the program; it promotes participation and provides participants with an understanding of how to manage materials and effectively participate in an organics program.

*The message will be specific to the program, as will be described in detail under each program topic in this document; however, general strategies for creating public awareness are applicable to virtually all education campaigns*. An effective way to begin is to organize a local or regional "organics summit" that brings together decision makers, businesses, schools, haulers, compost operators, residents, and

other stakeholders together to discuss the benefits of organics management and the options that could work in the community.

Public awareness strategies and outreach programs can incorporate a number of relatively low cost activities, including:

**Messaging Rule of Thumb**
Conduct outreach in a minimum of three different ways and at least three different times.

- Speakers bureau and presentations at community meetings, schools, and public events
- Public outreach at local fairs and special events
- Printed materials, including newsletters, bill inserts, brochures, and door hangers, and/or posting resources on websites and social media pages
- Radio, TV public service announcements and ads
- Press releases and ads placed in newspapers and letters to the editor
- A banner on main street and sandwich board signage at road intersections
- Neighborhood and school contests to help create program logos, messages, and mascots and get the word out about new programs and build support
- Interpersonal contact and word of mouth

How are you going to get your message across?

- Use different ways to communicate the same information
- Involve other organizations—Master Gardeners, citizen groups, environmental groups, schools
- Timing—Spring/fall for organics reduction programs and backyard composting
- Get creative, think outside of the box
- Don't reinvent the wheel

<u>Social Marketing</u>

Social marketing has been used to effectively promote waste reduction and recycling to targeted audiences. Applying social marketing techniques for residential organics diversion could include neighborhood contests, door-to-door outreach, pledges, and colorful, targeted messages. Similarly, social marketing techniques for local businesses might involve focus group meetings, hands-on training efforts, and the establishment of business recognition programs.


Social marketing messages are designed to provide consistent information on program expectations, goals, and guidelines targeting specific audiences. Messages would address perceived barriers to participation, such as the "yuck" factor, and provide suggestions and solutions for overcoming concerns.

Social marketing tactics include: Facebook, Pinterest, YouTube, Twitter and other "social" messaging formats. These tactics are free or low cost and designed to reach out to the public, businesses, and other stakeholders with up-to-the-moment messaging.

Universal Messaging

Solid waste programs that incorporate positive, consistent, and universal messaging will be most successful. Logos that are color consistent and simple can be used in all promotional materials—from websites and Facebook pages to promotional brochures, collection containers, and collection vehicle signage. Consider using terms such as food "scraps" not waste. Include clear pictures on all signage, website announcements, fliers, and other promotional materials.

**Effective Promotion**

- Consistent messaging
- Consistent colors
- Positive
- Real images
- Address perceived/real barriers to participation
- Provide suggestions & solutions






COMPOST
• Food scraps
• Napkins
• Wooden Coffee Stirrer
• Compostable items from Courtyard Café:
• Paper clamshell containers
• Coffee cups (recycle lids)
• Coffee sleeves
• Soup containers (recycle lids)
Look for the composting symbol!
TRASH
• Plastic silverware
• Condiment packets
• Styrofoam
• Plastic bags
• Candy Wrapper
• Tissues
Confused? Anything that is not recyclable or compostable goes here!
RECYCLE
• Plastic clamshell containers
• Coffee cup lids
• Soup container lids
• Aluminum cans
• Glass bottles
• Plastic bottles & disposable containers (# 1-7)
• Paper & cardboard
Look for the recycling arrow!

**Funding Policies and Programs**

Many communities continue to pay for solid waste programs through general taxes or property taxes. Often decision makers and residents do not know what landfill disposal or incineration of organics is costing the community. Similarly, if private sector hauling services are provided, residents and businesses may not know what is included in their service charge.

> Solid waste disposal "cost awareness" is the first step in providing financial incentives for organics management. Informing decision makers and residents about the actual costs of trash disposal and the potential to reduce costs through organics reduction and diversion can help to gain support for better management practices.

Differential rates for waste disposal services foster desirable behavior (such as waste reduction and diversion) by providing a financial incentive. Tiered rate programs, called volume-based rates or "pay-as-you-throw" (PAYT), apply a variable rate pricing to customers based on the amount of waste disposed. The more waste disposed, the greater the customer cost, thus encouraging reduction and diversion. These incentive programs offer communities a successful mechanism for both funding and fostering improved organics management.

If residents pay a regular fee for trash disposal, charging less for the disposal of separated organics than for trash or embedding fees for collection of organic materials into the residential trash rates would also provide an incentive for residents to separate organics and save money by doing so.

Similarly, if a landfill or transfer station allows private hauler dumping, charging a lower "tipping" or disposal fee for separated organics provides a financial incentive to haulers to provide organics collection services. Charging sales taxes, surcharges, or special fees (such as licensing fees) on solid waste collection, but not on organics collection also offers an incentive to haulers to provide organics collection.

Ordinances or licensing requirement for haulers servicing commercial establishments to promote organics collection can also be adopted. One option is to require that all haulers providing commercial trash service also offer food scrap collection at no extra fee. The fees for organics service would be partially or fully embedded in commercial trash rates. Outreach and education is essential to ensure that commercial generators know that they are paying for service (through their trash disposal) and how they can participate in food scrap diversion.

**Bans and Mandates**

Restricting or banning of open burning contributes to more environmentally-sound organics management. Residents and even communities will continue to burn leaves and yard waste unless regulations are in place to restrict or ban burning. Education about management alternatives and benefits can help to achieve compliance with burning bans and help to overcome engrained cultural acceptance of burning.

Banning organics from disposal in landfills and incinerators promotes diversion if the ban is successfully enforced and effective education and organics diversion programs are in place. Disposal bans provide a way to draw attention to the benefits of organics diversion and the options for organics waste reduction and recycling. Bans work well since most residents, institutions, and even businesses at least have some options for managing organics through reduction and onsite composting.

Mandatory regulations require organics generators to participate in a designated program. Mandatory programs can be effective if a satisfactory organics collection and processing system is in place and flexibility is included to allow for organics reduction and recovery options. Mandatory ordinances can be adopted and enforced at the local level, where landfill bans are typically more easily applied at the state or regional jurisdictions.

> Promotion of organics management programs available to residents, institutions, and businesses (including landscapers and gardeners), work in concert with bans and mandatory regulations for effective compliance and increased organics diversion.

Food waste disposal bans or mandatory diversion of food scraps, while not currently widely adopted in the U.S., can lead to increased diversion of all organics and could be successfully included in an "organics ban" or "mandatory organics recycling" program. Both bans and mandatory laws can be phased-in to allow for effective organics management options, such as compost collection, to be in place.

**Regional Cooperation and Private-Sector Incentives**

Regional planning and cooperation that unites rural and small communities with regional entities (counties and solid waste districts) can be an important strategy to lower program costs and expand the range of program options available. For example, use of regionally shared mobile processing equipment (e.g., wood/brush grinders) or leases for mobile grinding contractors provides communities with a low cost processing opportunity without the need to invest in equipment. Statewide or regional sales of compost bins and home digesters can promote onsite management of organics.

Another opportunity presented by regional cooperation is to collaborate with private industry to help identify sites for the collection and/or processing of organics, to be owned and operated by the company, or using public land but privately managed. The economies of scale offered by regional collaboration can make siting a compost operation more attractive.

Hauler incentives, such as a reduction in contract or franchise fees, revenue sharing opportunities, or an extended contract can help to promote hauler support of organics collection. These incentives are based on "performance metrics" such as the number of households signed-up for organics collection, tonnage diverted, etc.

**Additional Support Strategies**

Once programs are implemented, data collection and reporting on participation levels, material quantities and quality, environmental benefits and impacts, job creation, and diversion program costs and revenues is essential to track and report to stakeholders.

> As will be presented in this guidance document, policies and programs that promote the organics management hierarchy—reduce, reuse, and recycle—are most cost effective and successful.

Lack of organics collection infrastructure and composting capacity impacts the ability of communities to implement composting. Permitting and regulatory hurdles can make it difficult to establish organics processing facilities, especially for food scraps. State and local regulatory measures and permitting rules that work to promote the siting of environmentally-sound processing of organics, including food scraps, will serve to foster increased organics handling capacity and present communities with more options for organics management.

State, regional, and tribal governments can assist by developing model zoning ordinances for compost operations, adopting performance-based permitting regulations, promoting community, on-farm, and private sector food scrap composting or incorporation into anaerobic digestion systems, training state and local regulators in compost best management practices, and establishing consistent guidelines for training compost operators.

## Part I: Reducing Organics Discards

Keeping organics onsite—at residences, schools, institutions, government buildings, and businesses—or not producing them in the first place, offers the most cost effective organics management solution. These practices save money by reducing offsite organics management and collection needs.

**Organics Management Hierarchy**

**Reduce**
- Smart Landscaping
- Grasscycling
- Leaf Mulching
- Food Waste Reduction

**Reuse**
- Food Recovery
- Food to Animals

**Recycle**
- Backyard Composting
- Home Digester
- Vermicomposting
- Neighborhood Composting
- School & Special Event Composting
- Community Composting
- Centralized Composting
- Anaerobic Digestion

**Smart Landscaping**

Landscaping that incorporates local and regional native plants (xeriscaping) and "edible landscapes" results in less yard waste. Smart landscapes are easier to maintain, typically healthier and more resilient, tend to be better adapted to local soil conditions and climate, and offer benefits to local wildlife. Encouraging residents to plan lawns in accordance with their family needs (e.g., smaller lawns if there are no children in the family) can significantly reduce maintenance, fertilizer applications, and grass clippings generation.

**Grasscycling**

During the growing season as much as half or more of yard waste is grass clippings. "Grasscycling" presents a no cost, simple and easy organics management solution. Instead of raking and bagging clippings, the grass is left on the lawn when mowing to be "recycled" back into the lawn. Grasscycling saves labor and eliminates the need to purchase disposal bags.

Grass clippings decompose quickly and allow valuable nutrients to return to the soil, reducing requirements for additional fertilizing. The practice does not harm lawns and does not contribute to the growth of thatch. Grasscycling is commonly practiced on large grass areas such as parks, golf courses, and sport fields where bagging of clippings is not feasible. Specialized "mulching" mowers are available from most major manufacturers. These mowers chop clippings into smaller pieces for quicker decomposition. Retrofit kits are also available to convert a standard lawn mower into a mulching mower. But any lawnmower can accomplish the same result for home or landscaper use.

Tips for promoting grasscycling success:
- Keep mower blades sharp
- Cut the grass only when it is dry
- Do not remove more than one third the length of the grass height at each mowing
- Water and fertilize lawn as needed

**Leaf Mulching or Mowing in Place**

Similar to grasscycling, leaf mulching presents another low cost organics management solution suitable for any community. Mowing over or shredding leaves in place is simple and saves residents and landscapers time and money. Mulching leaves in place is much easier than raking, bagging, or blowing them to the curb. Once finely shredded, leaves will continue to decompose adding valuable nutrients to soil and improving soil structure. Like grasscycling, a regular lawnmower can adequately shred leaves to make mulching possible.


Tips for promoting leaf mulching success:

- Mow leaves directly on the lawn into fine pieces which will decompose over winter
- Rake leaves on pathways or driveways into piles, mow over, and use as mulch for gardens or pile for backyard composting

**Food Waste Reduction**

According to a National Resources Defense Council report, around 40% of all edible food in the United States is wasted.[5] Better food management practices can be easily implemented at home, schools, institutions, and at commercial food outlets (including restaurants, bakeries, and grocery stores). Smart food handling techniques can reduce food discards that result from improper storage and handling, overproduction, expiration, spoilage, as well as from preparation trimmings. General tips on food waste reduction include: improving food preparation procedures; adjusting portion sizes; and, monitoring food expiration dates.

Businesses can determine how much recoverable food is generated by conducting an assessment of their current practices, looking at how much food waste is thrown out before preparation (spoiled food), from food preparation (trimmings), and the amount of food thrown out by customers (for better "portion management"). Easy tracking methods can be adopted to determine how much food waste can be avoided and what may be suitable food for food recovery or donation (see below).

There are many more ideas available to both residents and businesses on ways to manage food so that waste is prevented and purchasing and disposal costs are reduced. See the resources in Attachment A.

**Opportunities and Action**

Successful organics reduction programs require effective outreach and education. Most residents already have a lawn mower, so no additional equipment is needed for grasscycling or leaf mulching. Landscapers benefit by adopting the practices since they do not need to spend time raking, bagging, and hauling the materials away. Similarly, food waste reduction practices are relatively low cost and simple to adopt.

[5] Natural Resources Defense Council, *Your Scraps Add Up: Reducing Food Waste can Save Money and Resources*, March 2013.

Action Tips:

- Foster education that promotes the incorporation of native and edible plants suitable for yard landscapes.
- Post grasscycling, leaf mulching, and food waste prevention tips on community websites.
- Use social media, including Facebook and Twitter, at the beginning of the fall to promote leaf mulching and again in early spring to promote grasscycling.
- If budgets allow, distribute posters, fliers, and pamphlets.
- Incorporate organics reduction into home composting workshops.
- Reach out to agricultural extension agencies for expertise, resources, and volunteers.
- Consider adopting a resolution requiring or promoting native plants, grasscycling, and leaf mulching.
- Communities can lead by example—landscape public buildings and right-of-ways with native shrubbery; practice grasscycling and leaf mulching.
- If staffing is available, provide training in food waste reduction, recovery, and composting to grocery stores and restaurants (see below).

The key to reduced yard waste is to let residents and business owners know that reduction practices contribute to healthy yards, are easy to implement, and generally result in less time and money spent.

**Who's Doing It?**

- Springfield Township in southeast Michigan (population 13,940), has a native landscape project that includes a Native Plants CD-ROM and Homeowner's Series: a searchable database containing photos and information on more than 230 plants native to Springfield.
- Harwinton, a town in Litchfield County, Connecticut (population 5,283) offers an informative webpage providing specific information on lawn care maintenance incorporating grasscycling.
- Irvington, in Westchester County, New York (population 6,468) promotes a catchy "Love 'Em and Leave 'Em!" leaf mulching campaign. Initiated by Irvington, the program has spread around the County. The Love 'Em And Leave 'Em website has resources targeting both residents and landscapers, including a toolkit with sample resolutions, presentations, posters, videos, and more.
- EPA and the West Coast Climate and Materials Management Forum developed the Food: Too Good to Waste toolkit which can be customized and used by any community. The toolkit demonstrates how to reduce wasteful household food consumption by focusing on social marketing incentives and messages directed at individuals within targeted communities.

## Part II: Food Recovery

### Food Donation


Food "waste" is often not "waste,' but discarded food that is nutritional and safe to use. In 2012, an estimated 14.5 percent of American households were food insecure at least some time during the year, meaning they lacked access to enough food for an active, healthy life for all household members.[6] Promotion of food donation is one way that communities can work to reduce and better manage food discards, while also providing social benefits for the community. Businesses benefit from food donation through reduced disposal costs and opportunities for potential tax benefits.

A food bank is typically a charitable organization that solicits and warehouses donated food and other items. Collected food is distributed to community agencies which serve people in need, often servicing hundreds of community-based organizations in large geographic areas. Food banks will usually accept foods that are packaged or can be stored for a period of time. Food recovery or rescue programs (often affiliated with homeless shelters) usually redistribute perishable foods locally, such as already prepared food from caterers, restaurants, and cafeterias.

### Farm Gleaning

An opportunity to reduce farm discards and assist those in need is a "farm gleaning" program, where crops are gathered from farmers' fields that have already been harvested and the remainder is not economically profitable to harvest or is left unsold. There are organizations that work with farmers to establish distribution of "gleaned" crops to local food distribution networks or organizations.

### Food to Animals

Food that is no longer safe for people to eat may be of use as livestock feed. "Food to animal" opportunities may particularly benefit rural, agricultural areas. Food processing facilities, supermarkets, and restaurants, can reduce food wastes by sending them to farms for use as livestock feed, thus reducing disposal needs. Livestock producers can benefit by saving money on feed costs.

Farms will typically offer collection services or contract with a local hauler to offer these services. Often most or all food scraps are acceptable, including post-consumer scraps. However, some states prohibit meat products from being used as livestock feed. Alternatively, before being fed to livestock, food scraps may be required by state or local regulation to be cooked to eliminate the potential for harmful bacteria. Check with state agricultural agencies for regulations that apply.

[6] Alisha Coleman-Jensen, Mark Nord, and Anita Singh, *Household Food Security in the United States in 2012*, Economic Research Report (ERR-155), September 2013, p. 41.

**Opportunities and Action**

Similar to organics reduction programs, successful action on food recovery at the community level focusses on promotion and education. Private food donations to food recovery agencies in rural areas are often limited because there are fewer big businesses—such as grocery stores or restaurants—to make donations. Community involvement in promoting food donation can help to raise awareness of the benefits for smaller commercial food waste generators to participate.

Rural areas may have limited food recovery organizations in their immediate area, but are generally served by a regional food bank. These regional food banks typically work with local charities or churches to provide food recovery opportunities. Mobile pantries are used to fill a void in rural areas without active food distribution networks. Food is shipped in boxes to a mobile pantry site, such as a church, for distribution to residents. Animal feed opportunities are contingent on the feed needs and handling abilities of area farmers.

Action Tips:

- Before promoting food donation or food to animals programs, check local and state regulations.
    - Food donation is covered by the federal Good Samaritan Act, but there are important health and safety guidelines that must be included in any outreach on food recovery.
- Conduct outreach to food recovery agencies to find out the services they offer (e.g., pick-up), the types of acceptable food items, storage requirements, and other specifications.
    - Keep in mind that for rural areas, these organizations may be regional or even statewide.
- Work with businesses to conduct a waste assessment, set a goal for food scrap reduction, and become aware of food recovery opportunities.
- Outreach to farmers, petting zoos, and similar operations will determine "food to animals" opportunities, acceptable food, collection options, and storage and processing requirements.
    - Check with the state agricultural agency for acceptable food and processing requirements.

**Who's Doing It?**

- Tripoli in Bremer County, Iowa (population 1,313) is part of a network of anti-hunger agencies and volunteers using mobile pantries to provide food to rural residents in Northeast Iowa.
- The Akron-Canton Regional Food Bank provides local charities with the tools required to meet the food needs in rural Ohio communities. To build capacity, the food bank partners with others, including Journeys End Ministries in Newcomerstown in Tuscarawas County (population 3,820).
- The Food Bank of Central and Eastern North Carolina serves 34 counties throughout North Carolina. Their Mobile Food Pantry program works with local partners to bring three million pounds of food to rural communities every year.
- The Second Harvest of South Georgia serves rural communities throughout southern Georgia. Programs include "Kid's Café," which provides needy children with evening meals. The organization effectively leverages the food recovery options of urban areas to meet the service needs of rural and small towns.
- The Food Marketing Institute (FMI) and the Grocery Manufacturers Association (GMA) are partnering on the Food Waste Reduction Alliance Project, an initiative to reduce the amount of food waste sent to landfills and increase the amount of food donated to food banks, as well as

promoting increased supermarket diversion of organics to animal feed, compost, and anaerobic digestion.

- Society of Saint Andrew national network connects volunteers with farms to glean produce that has been left unpicked after a harvest. The Society distributes the gleaned produce to food banks and other organizations serving marginalized communities, both urban and rural.
- Elementary schools in St. Francis, a town in Anoka County, Minnesota (population 7,218), along with businesses around the region participate in a recovery program that sends food scraps to Barthold Farms, located in St. Francis. The program saves the school district and businesses money by reducing garbage waste and collection fees. See the Pigs Aren't Picky video for more information.

- Mohegan Sun Casino and Resort, Uncasville, Connecticut conducted a waste stream audit and found that 37.5% of its waste stream was food scraps. The casino now collects around 1,000 tons/year of food scraps and sends them to a local pig farm. More than 50 tons a year of cooking grease is sold for biofuel and animal feed. The casino has reduced its waste by 1800 tons per year.

## Part III: Organics Recycling = Composting

Organics recycling—commonly known as composting—is a controlled, aerobic (requiring oxygen) biological process which results in the decomposition of organic materials. This decomposition process occurs naturally in nature. In composting, microorganisms (bacteria, fungi, and other living organisms) digest the organic residues for food and energy, resulting in more rapid decomposition. This "manufacturing process" converts waste material into a value-added product.

The controlled composting process is created by combining organic materials in proper ratios into containers, piles, or rows; providing adequate air flow; and, ensuring sufficient moisture to achieve accelerated decomposition. The "finished" material is then allowed to mature through a curing period, resulting in compost.

Compost is much different than the raw materials that went into the process. Compost is a stable, humus-like material, free of unpleasant odors, easy to handle, and can be stored for long periods. It is a valuable soil and potting media amendment that, when applied, improves the chemical and physical properties of soil, introducing organic matter, beneficial micro-organisms, and macro-and micro-nutrients, benefiting both soil and plants.

Compost users include homeowners and communities, nursery and greenhouse operators, landscapers, gardeners, farmers, grounds maintenance personnel, golf course managers, transportation departments, land development contractors, and others. The act of composting can be done on a small "decentralized" scale, as in home or backyard composting, neighborhood or community composting, or on a larger scale at farms, commercial, or municipal/tribal operations.

The benefits of composting and compost use are numerous, including:

- Organics management. An effective way to manage yard waste, brush, food scraps, soiled paper, and other organics to avoid landfill disposal or incineration.
- Value-added product. Composting offers home owners, schools, communities, farms, and private businesses an opportunity to make compost for use or sale.
- Soil quality. Compost is less dense than soil and thus holds more nutrients than soil. It helps to improve soil quality by adding organic matter; moderating soil pH; building cation-exchange capacity (CEC)[7]; enhancing soil porosity; increasing the microbiological ecology of soil; improving water infiltration; and more.
- Water retention. Compost adds organic matter and other qualities which improve the moisture holding capacity of soil.
- Improved soil quality. The application of compost helps to filter pollutants through soil.
- Nutrient recovery. Composting helps to retain the nutrients present in organic materials and provides these nutrients in a form for easy plant uptake, reducing the need for synthetic fertilizers.

All composting, whether at home or at a central processing facility, follows a similar process and requires five essential components. These are:

1. Feedstock and nutrient balance (Carbon: Nitrogen Ratio)**.** A proper balance of "green" organic "feedstock" materials (e.g., grass clippings, food scraps, manure), which contain large amounts of nitrogen, and "brown" organic "feedstock" materials (e.g., leaves, wood chips, ground brush), which contain large amounts of carbon (but limited nitrogen), is necessary for decomposition.

2. Particle size**.** Smaller feedstock particles allow for more surface area upon which the microorganisms can feed, helping to speed up the decomposition process. Smaller particles help to improve porosity (air flow), produce a more homogeneous compost mixture, and improve pile insulation to help maintain ideal temperatures. Particles that are too small, however, can pack down too much and inhibit air flow. Mowing, grinding, chipping, or shredding materials are effective ways to achieve appropriate particle sizing.

3. Moisture content**.** Moisture is required to keep the microorganisms in compost alive and active. Water helps to transport substances within the compost pile and makes the nutrients in organic material accessible to the microbes. Depending on the type of organic materials being composted, additional moisture may need to be added, either through rainfall or intentional watering.

[7] Soils act as storehouses for plant nutrients. Many nutrients, such as calcium and magnesium, may be supplied to plants solely from reserves held in the soil; others, including potassium and nitrogen, are added to soils through fertilizing to meet the needs of crops. The relative ability of soils to store one particular group of nutrients—the cations—is referred to as cation exchange capacity or CEC. The CEC of a soil determines the number of cations that the soil can hold. This, in turn, can have a significant effect on the fertility management of the soil.

4. Oxygen flow**.** The microorganisms in compost are "aerobic"—requiring air in order to be active. Aeration helps to speed up the decomposition process. Aeration can be achieved by turning or "mixing" the compost or placing the composting materials on a series of perforated pipes. Adding "bulking agents," such as wood chips, will also help to aerate the pile. Aeration is essential to keep the decomposition process from becoming anaerobic, which can cause odor problems.

5. Temperature**.** Decomposer microorganisms are active during a certain temperature range. Some microorganisms ("Mesophilic" bacteria) become active at lower temperatures, as these microorganisms work, their activity will cause temperatures to rise. As temperatures go above 120°F other microorganisms ("Thermophilic") will cause the temperatures to rise even higher. These high temperatures are necessary for more rapid composting and to ensure that pathogens and weed seeds are destroyed. Microbial activity can raise the temperature of the pile's core to 140° F or more.

Having the proper nutrient balance, particle size, moisture level, and aeration will ensure that the temperature rises and the compost process is working effectively.

### *Backyard and Neighborhood Composting*

Keeping materials onsite—at home—or in the community—presents a relatively low-cost, but effective, management option for virtually all organic materials. Such "decentralized" or locally-based composting programs have many benefits, including relatively low startup costs. These programs require residents to play an active part in the organics management effort and help to create a sense of personal responsibility for organics management.

Promoting both backyard composting and use of home digesters, along with effective organics reduction outreach, presents the most effective low-cost organics diversion opportunity for handling home generated organics.

A well organized and promoted backyard or neighborhood composting program can divert substantial amounts of organic materials without the need for municipal or private collection, transportation, or processing. These benefits are especially magnified when combined with organics reduction efforts such as grasscycling and leaf mulching.

Communities benefit from lower disposal costs and reduced organics management requirements. In the long-term, backyard and neighborhood composting efforts can reduce or eliminate the need for municipal organics collection and help to reduce the need for more landfill space or incinerator capacity. Residents save on trash or yard waste collection fees in areas where collection fees are applied on volume or weight of materials disposed. Backyard and neighborhood composting creates a compost product that can be used in gardens and on landscaping as a soil amendment, helping to reduce fertilizer input needs.

Decentralized or onsite composting applications are not limited to households. Commercial developments, including parks, golf courses, corporate campuses, and large multifamily residential units, as well as schools, colleges, universities and other institutions with landscaped areas and/or food waste generation can manage their own onsite composting programs.

See Attachment A for resources on home, school, and special event composting.

**Backyard Composting Promotion**

- Benefits of composting
- Set up & making it work
- Multifaceted: brochures, workshops, Facebook
- Compost demonstration sites
- Master Gardener/Composter programs

**Trench Composting**

The easiest way to compost at home, especially food scraps, is through direct soil incorporation. In trench composting, chopped food scraps are placed in a hole or trench and covered with at least eight inches of soil. For use of this method in the winter, a large trench can be dug in the fall, such as in a garden area. The trench can then be gradually filled in and covered during winter. Leaves can be placed over the trenches to add additional organic material. By spring the materials have decomposed and the area is suitable for planting.

**Backyard Composting**

Residents have a wide variety of options available for effective backyard composting. Home compost systems can be simple and "slow," where materials are layered in a pile or heap and turned occasionally or left to "rot." Decomposition will occur in a year or more using this method. A more active home composting approach requires use of bins, attention to the proper "mix" of green and brown ingredients, and more frequent turning of materials in order to speed decomposition. Finished compost from this approach would result in 6 months to a year. There are a wide range of commercially available backyard composting bins suitable for home composting; bins can also be constructed using readily available materials.

**Backyard Food "Digesters"**

Backyard "digesters" are an excellent option for home management of food scraps, vegetable grease, and pet wastes. Digesters do not produce compost, but the systems allow these foods to decompose and generate some nutrients for the soil underneath the units. The systems produce few odors if done correctly and offer a practical deterrent against unwanted vermin. Commercial versions of home digesters, including the Green Cone™, are promoted as an option for handling all types of household food organics, including meat, dairy, and eggs. Do-it-yourself digesters can be easily constructed from a metal garbage can. Digesters are designed as an effective means of handling food scrap and pet wastes, but not yard trimmings.

*Communities will gain the highest diversion benefit from promoting the use of commercially available home digesters along with home composting in order to capture all household organics.*

**Worm Composting**

Worm composting or "vermicomposting" is a process using worms (“red wigglers”) to convert organic material into a dark rich soil amendment. It presents an opportunity for low cost food scrap diversion. The worm castings or “vermicompost” created in the process can be used in gardens, outdoor landscaping, and indoor plantings. Vermicomposting can be done at home, school, institutions, businesses, as well as on a farm or commercial scale.

Worms will eat most grains, vegetables, and fruit. Worm bedding is made from cardboard or shredded paper; it can also be made from aged or composted livestock manure and bedding or straw. Worm bins can be easily made from plastic bins (7 - 14 gallon) or built from wood. Bins can be kept indoors (e.g., basement or garage) or outside, however the worms must be kept from freezing and in temperatures below 80F°.

In the classroom, worm composting is an easy, inexpensive and practical way to help students learn about science and the environment. Introducing students to worm composting is a way to help create knowledge about other forms of composting that can be done at home and the important role that composting can play in waste reduction and soil formation.

**Neighborhood Composting**

Neighborhood compost sites are more common in urban areas, often associated with community gardens. However, these decentralized systems can provide residents in rural and small communities with another low-cost composting option. Neighborhood composting can particularly benefit the elderly and others who may have difficulty managing a home composting system, as well as those with limited yard space.

As with home composting, neighborhood composting allows for effective organics management with minimal costs. Materials are still handled close to where they are generated, although residents need to transport materials to the site. Neighborhood composting sites allow residents to share the experience of composting, gain the benefits of making compost for community garden efforts, and help to foster more environmental awareness in the community.

**School Composting**


Every school day each student generates as much as two pounds or more of compostable material, such as food scraps and soiled paper. Composting these materials can help schools significantly reduce their waste while providing educational opportunities for students. Removal of organics from the school waste stream can result in up to a 95% reduction in cafeteria wastes.

Of course, organics diversion in schools presents many hurtles, especially in small towns and rural communities. Many schools do not have access to an offsite compost facility, while on-campus composting can be difficult to sustain without dedicated support and diligent maintenance.


A suitable school composting system depends on a variety of factors, including whether there are available offsite services (processing and hauling) or an onsite area suitable for composting; the amount of food waste generated; available staffing or volunteers; and, the student body size and age. Schools can collect materials for processing at an offsite composting facility or for animal feed. Alternatively, organics can be managed onsite using outside compost bins (commercially available backyard compost bins or constructed bins); with worm composting bins either in classrooms or outside; or by using an in-vessel composting unit (a commercial system).

Formation of a school "compost team" and coordinator can help to ensure composting success. The team should include representatives from administration, teachers, custodial and cafeteria staff, parents, and students. The team would be responsible for program development, ensuring that there is administrative, staff, and student support for the program, and overseeing the composting efforts.

**Special Events Composting**

As much as half (or more) of special event waste is compostable. Virtually all communities—from small towns to large cities—have special events. Whether a block party or music festival, events offer a perfect opportunity for hands-on education about composting. Special events present a microcosm of our society. People gather, they do activities together, and they generate waste.


Composting can be successful at virtually any type of special event. Events frequently offer recycling, a very laudable undertaking. However, taking that next step—to implement collection of compostables—often seems daunting. Admittedly, the tasks to implementing successful event composting are often unfamiliar and can be challenging—finding a hauler, securing volunteers, and convincing vendors to use compostable service ware. Composting at special events doesn't usually happen without extremely dedicated organizers or outside "intervention" from solid waste experts…and, often both!

Typically special event composting requires an offsite processor of food scraps and soiled paper. Some agricultural fairs may be able to integrate these organics into a well-managed onsite manure composting operation. Containers will be needed for collection, along with hauling services. Smaller events may be able to work with the processor or volunteers to provide hauling.

Materials to be diverted could include pre- and post-consumer food scraps, as well as compostable flatware, plates, packaging, and napkins. Fairs with livestock shows can partner with municipal, farm, or private compost operations to also handle manure and bedding. Events may want to consider a policy on vendors' use of compostable service ware. Integrating the compost collection with recycling and solid waste will help to ensure success.

**Opportunities and Action**

Home and neighborhood composting programs work best if someone is responsible for implementing the program, either paid staff or a volunteer, at least to initiate the program. Alternatively, working with the Agricultural Extension Service, Master Garden programs, garden clubs, environmental organizations or similar groups may be an option. As with organics reduction efforts, education is vital in order to overcome resident concerns, especially if promoting food scrap composting.

Many rural residents already compost, however, others simply pile leaves and yard waste at the edge of yards or woods just to "get rid of it." Convincing residents of the relative ease and benefits of composting, especially food scraps, may present a challenge. Provided the knowledge and training to compost, however, many residents will come to realize the benefits and important role home and neighborhood composting can play in helping their community better manage organic materials.

**Revisit Backyard Composting**

Many communities have long standing home composting programs. Revisiting these efforts, offering new outreach and training programs, compost bin and Green Cone™ sales, and other incentives can help to reinvigorate home composting. It also presents an opportunity to reach out to new residents, as well as promoting school and neighborhood compost options.

**Tips for adding Food Scraps**

- Do not compost: meat, bones, grease, dairy products, cat litter or dog manure
- Have adequate carbon (leaves, soiled paper, straw, etc.)
- Always cover food scraps with carbon & soil
- Cover with lime to deter fruit flies & vermin
- Line bottoms of compost bins with wire mesh
- Use a home digester for meats, dairy, & grease

Working with the Agricultural Extension Service or a garden club to offer a Master Gardener or Master Composter program or similar effort that incorporates a composting component presents multiple opportunities. This is a great way to recruit volunteers to promote home composting, offer workshops, and to set up a compost demonstration site. Garden clubs may be willing to host or help maintain a compost site affiliated with a community garden.

While school composting can be a challenge, the benefits are substantial—from significant reductions in waste to a wide array of educational opportunities, benefiting both the school and community. When children learn about composting they teach their parents. Municipal expertise in composting is important for assisting schools in setting up a successful and cost effective program. If an offsite composting opportunity is available, schools will need assistance in collection and setting up hauling. If composting is to be done onsite, students, teachers, and staff will need to be instructed on proper composting techniques.

Special event composting provides a valuable education tool for communities, helping residents to learn about composting, what can be composted, and overcoming the "yuck" factor. Diverting food scraps and organics from special events does present unique challenges to organizers, from attendee

and vendor education to finding a hauler and a processor. Specific planning, training, and collection logistics are necessary. Food vendors may be resistant to switching to compostable service ware. Already overstretched event organizers can be reluctant to take on new tasks. Solid waste staff or volunteers can help event organizers in setting up organics collection, including vendor education information, assistance with locating compost processors, and collection logistics.

Action Tips:

- The most effective backyard composting programs offer "truckload" compost bin sales or subsidized bin distributions.
    - Some states offer state contracts for purchasing compost bins in bulk.
- If budget constraints prevent subsidized bin sales, bulk purchases and sales are typically less expensive than retail selling rates.
- In addition to compost bin sales, consider sales of the Green Cone™ or a similar backyard digester.
- "How to" educational brochures and website information is essential to foster an understanding of composting and the options available to residents.
- Composting workshops will help to ensure success and greater community interest.
- Volunteer "Master Gardener/Master Composter" training and outreach efforts can establish a network of volunteers trained in composting who can:
    - Be available to staff composting booths at town events
    - Provide training at workshops
    - Help to maintain a backyard composting demonstration site, and
    - Possibly be responsible for a neighborhood or community compost site.
- Compost demonstration sites and displays are helpful for showing residents the compost process and the options for containing compost.
- Towns can take a lead role in the setup and maintenance of neighborhood compost sites.
- Consider sponsors or in-kind partners to subsidize backyard composting bin purchases, community composting containers, and other program components.
- See NERC's School Waste Reduction, Recycling, and Composting information available for free download.
- NERC's Special Event Food Scrap Diversion Guide provides an overview of food scrap composting and zero waste events.

**Who's Doing It?**

- Central Vermont Solid Waste Management District represents eighteen towns in three counties in Central Vermont. All of the District's communities have populations under 10,000; all but three are under 5,000. The District aims to help member town residents manage food scraps where they are produced—at home—through educational outreach and sales of compost bins and the Green Cone™.


- Ardentown, a village in New Castle County, Delaware (population 264) created a public composting site to help it reach a goal of reducing the 19% of its waste stream which is yard waste. The Ardentown Composting Site has six large composting bins for residents to deposit leaves. Residents are also encouraged to practice grasscycling.
- Annapolis Royal, located in Annapolis County, Nova Scotia (population 481) has adopted a zero waste goal. The town provides curbside collection on a biweekly basis for recyclables and garbage, and promotes home composting and neighborhood composting for organics management. Green Cones™ are sold through the Town Hall. "Neighborhood Composters," large wooden composters, are built and maintained by the town for residents to compost food scraps and yard trimmings.
- Ionia County a rural county in Michigan comprised of three towns (each with populations under 11,300), along with several townships, villages, and unincorporated areas has an excellent website promoting home composting.
- Santa Ynez Band of Chumash Indians, San Joaquin Valley, California promotes gardening, landscaping and composting aimed at increasing community self-sufficiency and reducing waste.
- Ho-Chunk Nation Black River Falls, Wisconsin started its community compost site as a health initiative to address diabetes, a major concern for tribal nations. The Nation found a way to address not only its impact on the environment, but also the health of the community by encouraging gardening and composting, healthier living, and better food choices.
- The Northeast Resource Recovery Association (NRRA), a non-profit recycling cooperative, uses cooperative purchasing to offer lower prices on purchases of backyard compost bins, rain barrels, kitchen scrap pails, and compost turners for sale. NRRA offers municipalities, community groups or service organizations around New Hampshire the opportunity to sell the items at lower than retail prices and to use the sale as a fundraising opportunity. The Maine Resource Recovery Association also provides backyard bins and similar products for sale to Maine communities.
- Vermont Master Composter program is managed by the University of Vermont Extension Master Gardener Program with financial and technical support from the Vermont Department of Environmental Conservation Waste Management Division. Students are required to complete community volunteer work in order to be certified.
- Kittitas County, a rural county in Washington (population 40,915; population density 14 people per square mile) offers a free Master Composter Workshop to groups. Master Composters receive valuable reference materials and composting tools, learn about composting methods, including composting with red worms. Once receiving the training, Master Composters are asked to volunteer at least 15 hours to share their composting skills.
- The Douglas County, Washington (population 38,431; population density 18 people per square mile), Master Composter program provides trained volunteers to present at civic and service

organizations, schools, and church groups; provide technical assistance on composting yard debris and food scraps; and, establish exhibits for classrooms and community events.

- Jefferson County Solid Waste Management provides solid waste management services for this semi-rural county in Missouri. The District promotes composting and vermicomposting through workshops at libraries and at the Byrnes Mill Recycling Center. The program also targets schools, providing presentations and assistance for outdoor composting or worm composting; schools are provided with worm bins upon request. The annual cost for the program is around $6,000 for the workshops, promotion and advertising, worms and worm bins, compost bins for demonstration sites, and staffing. Follow-up surveys of participants indicate that 75% of those who attended the workshops now compost.
- Manchester Essex Regional Middle School, in Manchester-by-the-Sea, in Essex County, Massachusetts, (population 5,136) has a very successful Green Team. The Team's multi-faceted waste reduction, recycling, and composting program resulted in a 90% reduction in the school's waste stream. The program has been expanded to all of the district's schools.
- West Side School in Healdsburg, Sonoma County, California (population of 11,254) diverts its food scraps through a worm composting program. The K-6 school, with approximately 130 students, sells its sifted and bagged compost at a local farmers' market. The program teaches the children sustainable practices and has raised $1000 a year consistently for the school.
- The Compost Club works with schools around Sonoma County to worm compost. Nine schools participate, resulting in more than 185,000 pounds of food scraps and soiled paper being diverted from the landfill. Vegan food scraps are fed to the worms; remaining food scraps are collected by a pig farmer. Parents and students participate in the harvest, bagging, and labeling of the finished soil amendment for sale.
- Boston Harbor Elementary located in a rural area of Thurston County, Washington, participates in the County's "Food to Flowers" Food Waste Composting Program. The school uses an onsite (in-vessel) Earth Tub for composting.
- Mt. Baker School District, located in Deming, a small town in Whatcom County, Washington (population 353), collects food scraps in an old cement mixer converted into a tumbling composter – known by the students as "Gertie the Regurgitator."
- The Fond du Lac Tribe, Cloquet, Minnesota started several vermicomposting and household composting programs, including the Ojibwe School Vermiculture Program, Head Start Vermicomposting, a Household Vermiculture Project, and a Household Yard Composting Bin Project.

- Approximately 9,000 people attend SolarFest, in Tinmouth, Rutland County, Vermont (population 613). This three-day event features workshops, exhibitors, children's activities, and entertainment. SolarFest has been composting since 2009. Organizers require food vendors to use compostable service ware. Volunteers monitor "zero waste" stations that are set up around the event. Trash cans are limited to the portable toilet areas.

- Santa Ynex Band of Chumash Indians, California has a Zero Waste initiative at tribal events, including Elder's Day & Intertribal Pow Wow. Since 2010, 38 events have used the Zero Waste model and diverted more than half the waste typically created.
- Garlic and Arts Festival in Orange, in Franklin County Massachusetts (population 7,839) is a zero waste event. More than 10,000 people attend this two-day event to enjoy entertainment, exhibits, and workshops. The Festival began composting in 2004 and became a zero waste event two years later. Vendors are required to only use compostable service ware. Volunteers staff five zero waste stations throughout the event.
- Pleasantville Music Festival, in Pleasantville, Westchester County New York (population 7,019) is a zero waste event. PleasantvilleRecycles, a Village committee, has volunteer-staffed zero-waste stations. In 2012, the first year of initiating zero-waste the festival reduced waste by 65%, down from 5.5 tons in 2011 to 1.85 tons.

### *Commercial Organics Recycling*

Commercial organics waste includes food manufacturing processing residues; grocery discards (unsalable fruits, vegetables, and bakery goods, produce trim, soiled paper, and wax coated cardboard); and café/restaurant organics ("pre-consumer" food preparation scraps, "post-consumer" table scraps, and soiled and non-recyclable paper). Up to 90% of waste thrown out by supermarkets and restaurants is food or other organic scraps suitable for donation or composting.[8] The potential for reduced disposal fees and public recognition are primary incentives for participating in food scrap composting.

In order to implement commercial organics recycling, a local or regional compost operation, whether operated by a private, farm, or municipal entity, will need to be willing to accept food scraps into their process, if they are not doing so already. Many compost operators are reluctant to accept food scraps, as composting these materials adds a new dynamic to the process and requires adherence to best management practices to avoid potential problems. Well-managed compost operations can, however, effectively incorporate food scraps.

Starting with a pilot program incorporating food processor wastes, supermarket produce trimmings, or pre-consumer restaurant scraps, allows for easier integration into the compost process, monitoring, and troubleshooting. Food scraps from restaurants can have higher levels of contamination such as plastics; starting with pre-consumer scraps only (preparation discards) can help to limit this. Acceptable materials will need to be determined through discussions with the compost operation,

[8] Ohio Environmental Protection Agency, Ohio Food Scraps Recovery Initiative.

including, whether the operation be willing to accept paper products and compostable plastics, along with food scraps.

Getting haulers onboard for collecting organics is the next step. Commercial businesses are most effectively served by curbside collection (door-to-door), typically provided by private haulers. Rural areas can also consider working directly with farmers to collect food scraps for on-farm composting. To promote commercial organics recycling, small business generators can benefit from being allowed to use municipal drop-off food scrap collection options (if available). Collection of food scraps by non-profit organizations using bikes[9] has also been implemented on a small scale.

A variety of commercial organic collection options are utilized, including automated trucks with mechanized cart lifters; front loaders and dumpsters; pickup, flatbed, or box trucks equipped with a Tommy Lift Gate; or manual collection using carts, buckets, or compostable bags. Typically multiple collection carts or a dumpster are provided for onsite collection. Food scraps tend to be heavy, so carts larger than 64-gallons are seldom used. If carts are used, haulers often provide cart cleaning services or replacement services to minimize odors and the "yuck" factor; alternatively cart liners can be inserted to keep the carts clean. In most instances weekly collection is recommended at a minimum; daily or every other day in the summer to prevent odor issues.

Businesses can also be successfully serviced through cooperative arrangements, typically through shared containers and hauling costs. Sharing a collection dumpster or cart storage area is useful for businesses in a commercial area where space is limited, as well as for businesses that may not generate sufficient quantities to justify the costs of a cart or dumpster service.

In these instances, businesses benefit from decreased hauling costs and haulers benefit from reduced collection stops. The collection dumpster can be placed at a business that has sufficient space or in a shared parking lot or other nearby location. Businesses work with the hauler to prorate the bill equitably amongst participating businesses.


[9] Pedal People.

Some businesses, including office complexes and resorts, have implemented onsite composting for food scraps and brush. These systems may prove more economical than hauling offsite, if staffing and space is available. In such settings, a commercially available in-vessel composting system or bins or shed systems are common solutions. Onsite staffing and training are required to ensure that systems are properly managed and maintained. In commercial areas onsite composting using a shared small scale in-vessel container presents a possible model. Commercially available worm composting units or "homemade" worm composting bins can also be used.

**Opportunities and Action**

Commercial organics diversion offers many communities an initial opportunity to focus on diversion of food scraps. Working with haulers to realize that route densities for hauling organics are more easily achieved with commercial entities due to the concentrated location of generators and higher waste volumes can help gain hauler cooperation and support. This can potentially lead to expanding the services to residents in the future. Similarly, commercial organics tend to be less contaminated, especially if pilot projects are initiated with just pre-consumer wastes collected, thus presenting a more appealing option for compost operations to "experiment" with processing food scraps.

Education and training are required for success. A wide range of Internet resources on how to promote commercial organics recycling are available for municipal staff or volunteers to assist in training commercial generators.

Pilot projects focusing on supermarkets and restaurant "pre-consumer" food preparation scraps can be initiated to allow for staff training and troubleshooting prior to collection of "post-consumer" food waste. Focusing on the collection of pre-consumer materials in a pilot allows for more concentrated employee training, without having to also educate customers. Pre-consumer contamination is usually minimal and easier to eliminate through employee training (such as not putting disposable gloves in the compost bins).

Assistance to commercial generators, including conducting a waste audit to show businesses what they generate; how much waste can be diverted (through reduction, recovery, and composting); the potential dollar savings that can be achieved through composting; as well as working with businesses to "right size" their trash collection, may require additional training for solid waste staff. Cooperative programs with county, regional, or state solid waste agencies, or nonprofit organizations may prove most effective; Master Gardener programs can potentially provide trained volunteers as well. See Attachment A for a list of recommended resources.

Serviceware and other products that display the Biodegradable Products Institute's (BPI) Compostable Logo meet either ASTM D6400 "Specifications for Compostable Plastics" (bioplastics) or ASTM D6868 "Specification for Biodegradable Plastic Coatings on Paper and other Compostable Substrates" (fiber-based applications) standards. ASTM D6400 or D6868 are the only certified standards for compostability. Products certified through ASTM or BPI are intended to compost effectively in large-scale composting operations. Promotion of BPI certified products will not only benefit compost operations, but also companies that get their products certified. And, it will help consumers to more easily know what products they purchase can be composted.

Action Tips:

- Identify potential compost operations willing to accept food scraps and potentially wet cardboard and soiled paper.
- Work with the compost operator and hauler(s) to initiate a pilot program for food composting.
- Start by targeting businesses that are the largest generators and those that have the most potential to divert a significant amount of food scraps (and thus realize reduced trash costs).
- Consider hosting a meeting for food processors and large food scrap generators (supermarkets, large restaurants, institutions) to discuss options and to see what they need to start a program.
- Work with haulers to design cooperative business collection arrangements (shared collection containers) and/or route densities that allow for cost-effective hauling.
- Online "how to guides" or fact sheets are useful for businesses to be introduced to the program.
- Hands-on technical assistance that includes free waste audits, hauling and container advice, "right-sizing" trash contracts, and staff training will foster program success.
- Work with businesses to include training in new hire orientation and ongoing staff meetings; setup employee feedback mechanism and provide feedback (amount of food scraps diverted, etc.) on regular basis; and, consider bilingual trainings and signage, as needed.
- Providing small grants to commercial and institutional entities are helpful for the purchase of inside bins, training materials, and signage to encourage food scrap diversion.
- Business recognition programs are also a powerful incentive.
- Permitting small businesses to use a residential organics recycling program with no fee will promote greater participation and benefit small businesses.
- Communities with larger office complexes, institutions, or resorts may want to work with these businesses to establish onsite composting systems.

**Who's Doing It?**

- A demonstration project of EDEN Delmarva promotes the recovery of organic materials from restaurants in Rehoboth Beach in Sussex County, Delaware (population 1,327). REPLENISH collaborates with haulers and composters to compost pre- and post-consumer scraps from restaurants. The resulting compost is used as a soil amendment by local farmers to grow produce that is purchased by participating restaurants.
- Close the Loop Lamoille Valley! in Morristown, the largest town in Lamoille County, Vermont (population 5,139) is a partnership between the Highfields Center for Composting, the Lamoille Regional Solid Waste Management District, local composters, and area businesses to compost food scraps.
- The Town of Carrabassett Valley (population 761) and Sugarloaf Ski and Golf Resort, in Franklin County, Maine, implemented a comprehensive composting program that captures both pre- and post-consumer food waste from the resort and area restaurants. The resort uses the in-vessel Earth Tub system for composting. The resulting compost is used on the Sugarloaf Golf Course and in public gardens.

- Chittenden Solid Waste District serves 18 towns in Chittenden County, Vermont (population 156,545; population density 272 people per square mile). The District provides hands-on technical assistance and free tools to help schools, businesses, and institutions to separate food scraps for composting. Assistance is provided to set-up composting onsite or to have organics transported by a local hauler to the District's Green Mountain Compost facility.
- Central Vermont Solid Waste Management District provides free training, instructional signs, advertising and promotion, hauling of food scraps for the first month, and free 48-gallon totes for food scrap collection as an incentive to promote organics composting.


- Tompkins County, New York, comprised of numerous towns and one city Ithaca (population 30,014) partners with Cayuga Compost, a private company in Trumansburg (population 1,797) to provide food scrap collection and composting services to area businesses and institutions. Through funding from the county, Cayuga Compost was able to expand its collection program around the county. The County sees the food scrap recycling program as playing a significant role in helping to reach its 2016 75% waste diversion goal.
- Ulster County in New York State has three villages, 20 towns, and one city (population 23,893). The Ulster County Resource Recovery Agency (UCRRA) is a public benefit corporation formed to develop, finance, and implement a comprehensive countywide solid waste management program. UCRRA opened a composting facility in 2012 using an aerated static pile method to manage yard waste, food scraps, and other organics. Private haulers collect and deliver the organics to the facility, which charges $50/ton for separated organics compared to the $100/ton charged for landfilling. The facility accepts food waste from supermarkets, grocers, and restaurants. UCRRA works with private haulers to establish effective route densities to meet the needs of its communities.

**Ulster County Compost Facility**

## Part IV: Residential Drop-off Organics Collection

Options for organics collection include: drop-off (transfer stations, recycling centers, farmers markets, etc.); door-to-door service ("curbside"); and "modified" curbside or neighborhood collections. These alternatives may be used as standalone options or in combination.

Drop-off systems are the primary method for waste management in rural, small, and tribal communities. Organics, including food scraps, can easily be managed through drop-off collection systems. Collection works effectively in areas where residents already deliver their household discards to landfills or transfer stations, but can also be established as standalone collection points, such as transit centers or farmers markets. Drop-off systems often result in lower community participation when compared with curbside collection systems. However, if properly incentivized and promoted, high diversion rates from drop-off organics programs can be achieved.

Organics collection containers can be placed at transfer stations, public works yards, or other location(s) in a community for residents to unload their organic materials. A container system is typical if materials are to be stored and transferred to an offsite organics processor. Container and transportation technologies can impact the overall costs of drop-off compost collection/transfer systems. Some systems rely on contractors to provide rental containers (e.g., 20 - 40 cubic yard roll-off dumpsters or carts) and transportation of materials to a processing site. Others employ homemade containers, existing trucks, and municipal employees to collect and transport materials.

Food scraps can be collected with yard debris or separately in smaller dumpsters or carts. If a container system is used, the containers must be monitored and emptied regularly to prevent odors. Alternatively, residents can drop-off "loose" materials at a designated location for grinding, mulching, or composting onsite or for later transfer to a container for offsite processing. If materials are to be managed onsite, it is preferable that the drop-off location be next to or near the processing area to minimize the amount of material handling. The area needs to be safe for residents to access and conveniently leave materials.

Mobile or temporary yard debris drop-off sites can also be established during seasonal periods, such as for leaves in the fall and brush in the spring. Mobile sites can allow communities to provide collection where space is limited and/or as a supplementary service during seasonal peaks in organics material generation. Temporary containers can be set on a site once a week or once a month for collection of wood waste, yard debris and/or other organics. At the end of the day or designated period, the container would be hauled to a processing facility. Appropriate sites could include transfer stations, recycling centers, retail centers, or other convenient, public locations.

Permanent drop-off programs tend to capture more material than a mobile system because permanent sites are often more convenient (located where residents normally dispose of waste). Additionally, the ongoing presence of a permanent collection location serves to remind residents of the opportunity to recycle their organics.

Permanent drop-off locations are generally more costly to operate than mobile sites, as permanent sites require more maintenance and higher operation costs. However, residents are better served, more organics diversion occurs, and the cost per ton collected is typically lower due to the larger volumes collected. Drop-off centers can also accommodate school, institutional, and small commercial generators.

An issue with drop-off sites is the potential problem of contamination which can occur if trash or other materials are discarded with the organics (such as materials placed in plastic bags). Staffing reduces this concern and staff can help to answer resident questions about acceptable materials. Collection at farmers markets can be managed by local not-for-profits, garden club members, or other volunteers.

Training is necessary to ensure that attendants/volunteers know what's acceptable and how materials can be contained—for example, if materials are acceptable in paper or compostable plastic bags. Attendants will also need to know the acceptable dimensions of brush if this material is collected.

**Opportunities and Action**

A drop-off program is an appropriate management system in virtually any community as costs are significantly lower than curbside collection. A range of container options and systems allow for a wide variety of transport possibilities to offsite community, farm, commercial, or regional composting facilities. Onsite mulching or composting at the point of collection (such as a transfer station) can also be implemented. Food scraps can be effectively handled through drop-off collection. Drop-off programs can also serve to supplement residential curbside collection of organics to allow multi-family residents, schools, and small business generators to participate.

Regionally operated landfill facilities and similar operations may present drop-off siting opportunities when municipal space or funding is limited. Exploring partnerships with a local garden center, landscaping company, farm, or other business for mulching or composting may present a viable drop-off collection option for

**Adding Food Scraps to Yard Waste Collection**

Starting a yard waste composting program and then adding food scraps and soiled paper to the collection at a later date allows for more extensive diversion with relatively minimal additional costs (*Freeman & Skumatz, Best Management Practices in Food Waste Programs*).

If food scraps and yard waste are collected separately, additional carts, collection routes, and staffing are required. However, if food scraps are added to a drop-off or curbside collection program, the volume does not increase substantially and collection is more efficient.

Adding food scraps and soiled paper in the compost stream will help achieve a higher rate of organics diversion. Of course, education and outreach have to be effective in convincing residents to overcome the "yuck" factor in combining their food scraps with yard waste.

Creative outreach targeting pizza boxes and paper towels as "new additions" to their yard waste collection can help residents adjust to adding food scraps to their collection.

residents and small businesses. The cooperating business can benefit by charging tipping fees and selling the resulting compost, as well as increased foot traffic.

Educating participants is important in order to foster awareness about the benefits of composting and to help alleviate confusion over what is and what is not acceptable. Participants need to know if materials can be bagged and what type of bag can be used; if there is a size limit on tree limbs; and if brush and limbs can be bundled with twine. Acceptable food scraps, soiled paper, and compostable service ware will also need to be described if these materials are included.

There may be concerns about drop-off programs—ranging from wildlife to odors. Keeping bears and other vermin away from food scrap collection bins can be a concern. Unattended bins (such as at night) should remain locked and secure. When food is deposited in the bins, covering with a thin layer of sawdust and even lime will reduce odors and fly larval. A bucket or cart of sawdust can be kept next to the collection containers, with a sign asking residents to cover the food scraps. Meat, dairy, and grease should not be collected if there is a concern. Odor issues should be addressed through regular and timely removal (or processing) of stored materials. Containers holding grass clippings will need to be painted regularly due to the corrosive qualities of grass.

**Animal "Resistant" Bins**

Action Tips:

- Controlled access and an onsite attendant (or volunteers) are important to allow for monitoring of materials to prevent contaminants from being placed in the containers or collection area.
- Simple, concisely worded fliers should be distributed to participants at least at the start of the collection program, and if additional organics (such as food scraps) are added to the program.
- Signage at the point of collection serves to reduce the potential for contamination and provides an additional educational opportunity.
- Website postings and social media outreach work well for ongoing education and are low cost.
- If partnering with a business for drop-off opportunities, or if residents have access to a regional drop-off option, promote the specifics and location on websites and social media. Work closely with the end user to establish exactly what is acceptable.
- Use of plastic bags adds an unnecessary expense in operating costs to remove organics from the bag and screen the end product. If acceptable in the compost operation, participants can use certified compostable bags. If materials are transported in plastic bags, request participants to dump materials from bags into the containers; have a container or garbage bag nearby for disposal of the bags.

- In designing the drop-off area it is important to consider the needs of residents with heavy loads. The design should work with gravity so that brush can be pushed out of vehicles or dumped from a higher point into a designated container or area located below.

**Who's Doing It?**

- The Franklin County Solid Waste District in western Massachusetts, manages four municipal organics drop-off programs at transfer stations in New Salem (population 990), Northfield (population was 3,032), Orange (population 7,839), and Whately (population 1,496). Food scraps and soiled paper are collected in the four communities. The District also provides technical assistance for food scrap composting at schools and special events.
- Windham Solid Waste Management District's Converting Organic Waste composting program ("Project COW") allows residents to drop-off food scraps at its transfer station. Vernon (population 2,141) and Dover (population 1,410) residents can drop-off food scraps in the "COW container" at their public garages. Materials are composted at the District's compost operation.
- The Chittenden Solid Waste District collects food scraps at its seven drop-off centers, including: Hinesburg (population 4,340), Milton (population 10,352), Richmond (population 4,090), and Williston (population 8,698). There is no charge to drop off food scraps and residents are provided with a free 4-gallon bucket with a lid to use in their kitchen.


- Mount Joy is a borough in Lancaster County, Pennsylvania (population 6,765). The Mount Joy Compost Site accepts brush and leaves for composting at no charge to town residents. Finished mulch products (leaf and woody) are available for $10 per pick-up truck/small trailer load if loaded by the resident or $20 per front end loader scoop, if loaded by the town; residents may also bring buckets to fill for $10.
- In Pennsylvania, North Londonderry Township (population 6,771) and North Cornwall Township (population 6,403) in Lebanon County and West Earl Township in Lancaster County (population 6,766), use a key card access system to allow access to their yard waste drop-off facilities. Access cards are issued to residents for an annual fee. The key cards are easy to use and allow the communities to control access times, monitor who enters the site, and have helped to minimize dumping of unwanted materials.
- Henniker, a town in Merrimack County, New Hampshire (population 4,836) encourages town residents to drop their yard waste at StoneFalls Gardens, a local garden center which uses the organics to make compost.

## Part V: Curbside Organics Collection

In a curbside collection system, residents place their organic materials at the curb separated from other household waste and recyclables. Organics may be collected the same day as trash, alternate weeks, or special days may be set aside for organics collection (especially for seasonal collections). Weekly pickup is the most effective for the collection of food scraps. One of the benefits of curbside collection is a relatively higher participation rate due to the convenience for residents. Also, the materials arrive regularly at the processing site, benefiting the processor.

However, the system is costly, especially in areas where low population density makes providing door-to-door collection more inefficient and expensive. Proximity to processing facilities may also pose a challenge, with long haul distances proving costly. Haulers may be able to use an existing truck to collect organics, helping to reduce expenses. Alternating collection of organics with every other week trash pick-up is a way to control costs. Modified split-body trucks for collection of both recyclables and food scraps/soiled paper have proved to work effectively in a number of communities. A modified curbside collection or neighborhood collection, where bins or placed in close proximity to residential clusters may also present an option.

Many towns, especially in the Northeast, collect leaves in the fall using a curbside system. Leaves can be collected loose with a specialized vehicle, bagged, or a cart. Vacuum trucks and “claw vehicles” are specially designed vehicles for the collection of both leaves and brush. Bagging yard waste is a familiar undertaking to residents; however, the use of plastic bags presents a contamination issue at composting facilities, requiring an extra step for debagging. The debagging equipment and labor adds considerable costs to processing. Typically the use of large paper “leaf/yard waste collection” bags (available at retail outlets) offers a better alternative to plastic bags.

Carts, while expensive to purchase and requiring an initial distribution system, are easily loaded and maneuvered by residents. Food scraps can readily be added to the carts if added to the collection program. Another option is to provide residents with an “organics bin” sticker to place on a regular trash can for pickup. Compostable plastic bags also work well for food scraps collection.

Curbside collection can be contracted to a local hauler or processor. The contract should state where and/or how the material is to be processed, for example, mulching or composting. Container type, collection vehicle requirements, and route allocation and frequency must be determined with the contractor.

**Opportunities and Action**

Source-separated curbside collection programs require effective public education campaigns for proper compliance and participation. Sufficient planning is necessary to determine the most cost effective model that will meet program goals. Materials to be collected, seasonal generation considerations, existing equipment, and contract opportunities will need to be weighed. Container and collection vehicle requirements, route allocation and frequency must also be determined.

Yard debris collection offered weekly or biweekly encourages participation by reducing the need for extended storage by residents. Curbside collection of leaves (fall) and brush (spring) tends to be seasonal. To reduce collection expenses, some communities may collect only on designated days during the season. Food scrap collection will require weekly pickup. Towns can control expenses by providing trash collection on alternate weeks, with weekly organics collection. Hauling recyclables and organics in a split-body truck presents cost savings as well as reducing neighborhood truck traffic.

In communities where curbside collection services are provided by one or more private haulers, it is essential that a positive relationship with the hauler(s) be established in order to gain support for the collection of source separated organics. Local jurisdictions and regional planning districts may want to consider issuing an exclusive contract for the collection of organics. This will allow for a hauler to more easily realize route densities required for more efficient and cost effective collection of organics.

Alternatively, a community can be divided into geographical services areas with a small number of haulers providing services, with little to no overlap. This system can support existing haulers servicing a community, while limiting the number of vehicles in residential neighborhoods. Route densities can be achieved, thus benefiting haulers, while cost control through competition between haulers is also left in place.

**Overcoming the "Yuck Factor" – Tips to Provide to Residents**

- Use a plastic, metal or ceramic container with a tight fitting lid for kitchen collection.
- Contain food scraps in an uncoated (no shine) paper bag, approved compostable bag, or line container with newspaper.
- Wrap food scraps in newspaper or paper towels before placing in the collection bucket.
- Place leftovers in a container or wrap them in paper and store them in the refrigerator or freezer until collection day.
- Carry leftovers to the collection cart in cardboard pizza boxes and cereal boxes (with inner bag lining removed).
- To avoid smells in the kitchen, dump food scraps into the curbside cart or outside storage bin every few days.
- Sprinkle baking soda in the compost bucket container and the outside collection cart.
- Wash the collection bucket with vinegar after dumping it; rub vinegar around the rim to deter fruit flies.
- Remove fruit flies with a vacuum.
- Put melon scraps directly into the outside collection cart (not in the kitchen bucket).
- After dumping the food scraps in the collection cart, cover with yard trimmings, shredded paper, or damp newspaper.

Action Tips:

- Determine program goals: diversion and participation rates.
- Conduct a needs assessment to itemize available and needed equipment, containers, and labor.
- Communities will need to ascertain if they will undertake the initial investment in hauling vehicles or if hauling services will be contracted through an arrangement with a private hauler, or arranged through regional cooperation.
- Container choice can impact staffing and equipment requirements, costs, and resident participation rates.
- Designing of collection routes to meet the needs of residents, address the seasonal nature of leaf and yard waste generation, and minimize costs through route efficiencies is important for program success.
- Improper sorting of materials, contaminant materials (plastics, trash), and use of plastic bags to contain the materials can greatly impact the quality of the resulting product (mulch or compost) and the expense of processing. Effective outreach and education is crucial to limit contamination.
- The higher costs of curbside collection programs can be offset by reduced disposal needs and costs, increased landfill life realized through increased diversion.
- In communities where hauler services are contracted, the hauling of organics can be included as a part of the service agreement.
- Communities may consider requiring rate incentives that serve to promote organics diversion, such as mandating the use of volume based rates for trash collection and/or the hauling of organics at free or reduced rates. Alternatively, local, regional or state jurisdictions can mandate that all haulers provide curbside collection of organics.
- While not widely practiced in the U.S., alternating (every other week) garbage collection with recycling and offering weekly organics collection is a way for communities to control costs while meeting residents' need for adequate service.

**Who's Doing It?**

- Hamilton (population 7,764) and Wenham (population 4,875) are rural-suburban towns in Essex County in eastern Massachusetts. The towns are in close proximity to each other and have implemented joint solid waste management programs. Curbside collection of food scraps in both Hamilton and Wenham was an outgrowth of Hamilton's "Waste Reduction Program," a volunteer citizen-led project. Hiltz Disposal provides weekly collection of organics and recyclables in a split body truck; Bricks End Farm processes the organics. Hamilton has switched trash collection to every other week.
- Ipswich, a coastal town in Essex County, Massachusetts (13,175 population) started a 'Food Waste Plus' Curbside Collection Pilot. Residents pay less than $2 per week for weekly collection of food scraps (including meat and bones), kitty litter, soiled paper, and yard trimmings.
- Watervliet, in Albany County, New York (population 10,254), completed on 6-month pilot to collect source separated organics (SSO) from 50 residences. Through the Watervliet Organic Waste (WOW) program, residents were provided a kitchen collection bucket, an outside collection cart, and compostable bags. The program is continuing and food scraps are collected by the city and composted at a passive aeration facility. Watervliet pays $51 a ton for landfill tipping fees; according to the pilot project's report, it would save $28,000 a year if 75% of the residences participated in the food scraps collection.


- Brattleboro, in Windham County, Vermont (population 12,049) offers weekly collection of food scraps and soiled paper. Triple T Trucking uses a split-body truck to collect recyclables and organics.
- Earthgirl Composting provides curbside collection of food scraps and soiled paper for households, small businesses, and special events in Chittenden (population 156,545; population density 272 people per square mile) and Washington counties (population 59,534; 84 people per square mile) in Vermont. Collected materials are delivered to Grow Compost and/or Green Mountain Compost. Participants are charged based on collection frequency.
- Huron, located in Erie County, Ohio (population 7,149) runs one of the few curbside compost programs in the state. The program offers year-round collection of food scraps; yard waste is collected nine months of the year. Residents are charged $220 per year for waste, recycling, and compost collection; more than half of the households are participating. Huron contracts the service to FSI Disposal which provides the collection. Materials are hauled to Barnes Nursery and Compost Facility located in Erie County. Organics can also be dropped off at Barnes Nursery ($5 per car load; $10 per pickup; $26/ton). The company processes about 20,000 tons of food scraps, yard trimmings, and wood chips each year. Food scraps are shredded and mixed upon arrival and then formed into windrows. The windrows are covered with a biofilter of shredded yard trimmings.
- The Compost Queen is a residential and commercial compost pickup service based out of Erving in Franklin County, Massachusetts (population 1,800). Food scraps and compostables are collected for a fee and transported to Clear View Composting, a private operation in Orange, Massachusetts.
- N.A.T. Transportation, a hauler in Bradner, Ohio (population 991), collects yard trimmings, food scraps, and paper for composting. Residents are provided with orange-lidded collection carts for containing organics. About 50 percent of the 420 homes in the village were participating after one year of program operation; the set out rate is about 80% weekly. The village pays an extra $2.50 per household for the service regardless of the participation rate. Frost and odor issues are minimized by encouraging participants to include compostable paper-based products and to wrap organics in newspaper. The wastes are then composted at Hirzel Farms and used for organic farming. N.A.T. also provides organics collection in the nearby village of Luckey. The organics collection replaced the village's faltering recycling program. The recycling bins are now being used for collection of food waste, yard trimmings, and paper. A drop-off location for container recyclables has been set up.
- Enumclaw in King County, Washington (population 10,669) provides curbside collection of yard trimmings, food scraps, and soiled paper. Residents are charged a volume-based rate fee for garbage disposal; organics are collected at a lower rate ($9.43 per month) than the "mini-can" rate of $15.80. Residents are provided a rolling cart for collection of organics at no cost.
- Miami, in Ottawa County, Oklahoma (population 13,570) provides weekly curbside collection of yard trimmings. Residents can also drop off yard trimming at the transfer station, at no charge. At the transfer station, wood chips are available to the public free of charge and compost is available for $8 per scoop (1,600 pounds per scoop).

- In Wayzata, in Hennepin County, Minnesota (population 3,688), residents can recycle their organics through the Blue Bag Organics Composting System. Food scraps and soiled paper (e.g., pizza boxes and paper plates) are placed into a Blue Bag Organics BPI-certified (compostable) bag. Residents place the Blue Bag liner inside their regular garbage cart for pick-up. Trash and organics are transported to a transfer station where the Blue Bag is removed for hauling to a compost facility.
- Mackinac Island, an island and resort area in Michigan (population 492), started collecting source separated organics in 1992. The island is a historical community that prohibits motor vehicles, so horse-drawn trailers are used to collect wastes. There are just over 500 year-round residents, but during peak tourist season, about 15,000 visitors come to the island. Organics are collected daily in the summer; once a week in the winter. Residents are charged $3/bag for garbage, but only $1.50/bag for organics. Collected organics are shredded and mixed with manure and commercial food scraps using a front-end loader, and then composted in aerated concrete bays. The finished compost is sold.

## Part VI: Grinding and Mulching

Land clearing, utility line maintenance, and seasonal or storm-related cleanup generate stumps, brush, vines, and other organic debris. Often woody land clearing wastes are landfilled, left to rot onsite or in woods, or burned. However, wood, brush, stumps. tree branches, along with Christmas trees, whether generated commercially or residentially, can be ground or shredded and distributed as mulch onsite or transported to wood waste processors to be ground and marketed as mulch, boiler fuel, wood pellets, or bulking material for composting.

If sufficient funding is available, grinding or shredding equipment can be purchased. Regional opportunities for sharing grinding equipment can help to reduce costs for mulching. Once the equipment is secured, handling organic material is relatively cost efficient. Onsite grinding, mulching, or composting services can also be contracted out.

The technology and staffing requirements involved with producing mulch and boiler fuel makes it a low cost organics management option. Alternatively, ground wood can be used as a bulking agent for composting to create a higher value compost product and as an ingredient for food scrap composting.

**Opportunities and Action**

A wide variety of grinding and mulching options present communities with an opportunity to reduce disposal needs and potentially generate revenues through the sale of mulch or boiler fuel, or for use as compost feedstock. If towns do not handle the material directly, promotion of onsite grinding to developers and landscapers will encourage better management.

It is beneficial for all communities to have an arrangement for grinding services, either through owning equipment directly, contracting for grinding services, or through mutual aid agreements, in order to be prepared for debris management resulting from a natural disaster (see Part XII, below).

Action Tips:

- Towns without grinding equipment can consider contracting for these services. Develop an up-to-date list of available service providers or establish contracts that provide ongoing access to grinding services.
- Regional cooperative purchasing and shared use of grinding equipment presents an opportunity. Also consider lease-to-own options and purchasing used equipment.
- Operation, personnel training, and ongoing equipment maintenance must be factored into the program.
- Potential markets for ground materials should also be determined.

**Who's Doing It?**

- The Northeast Resource Recovery Association (NRRA) provides wood grinding services to communities around New Hampshire. Towns designate a drop-off collection area for wood/brush materials (brush, leaves, clean-unpainted wood, pallets, and stumps). NRRA contracts with private haulers to grind the materials. Towns can keep the mulch or sell the wood chips (used as bark mulch or biomass fuel) to the vendor to offset the grinding charges.

- Lewis County Solid Waste Utility, in rural Lewis County, Washington (population 75,455; 28 people per square mile), owns a chipper which is lent to municipalities within the county for scheduled chipping events. Transfer stations in the county were redesigned to foster diversion of brush and yard trimmings by making it easier for landscapers and residents to drop-off material. The chipped material is processed at a private compost operation.
- Waitsburg in Walla Walla County, Washington (population 1,200) purchased a wood chipper through Washington State's Coordinated Prevention Grant (CPG) Program. The town holds no-cost chipping events in the spring and fall to provide residents an alternative to outdoor burning of organic waste. The program removes organic material from the municipal solid waste stream and provides a source of wood chips for landscaping purposes.
- Fort Independence Indian Reservation in Owens Valley, California keeps green waste out of the landfill by chipping and shredding for mulch to use on the Tribe's community garden.
- Berkeley County, West Virginia (population 105,750) is located in the Eastern Panhandle region of West Virginia. The Berkeley County Organics Recycling Program accepts brush, Christmas trees, leaves, grass clippings, and garden waste. Residents are asked to drop-off brush at a designated area at the recycling center. Typically, the brush is ground bi-annually into mulch by county staff. The ground mulch is left onsite and sold to the public at $12 per bucket load.

Berkeley County Organics Recycling Program

## Part VII: Centralized Composting

Community, municipal, or tribal managed compost operations present an environmentally sound and beneficial means of recycling organic materials. A well-planned and effectively managed facility will pose few operational hurdles, be maintained within projected budgets, produce a quality compost product, and have community support.

Successful onsite organics composting requires:

- A plan of action
- Available land
- Appropriate equipment
- Proper management, and
- Community support

> This section is designed to present a basic overview of the compost process, site considerations, methods, and other components for onsite composting.
>
> *It is not an operators training guide.* Additional guidance and formal training is recommended and may be required by state regulation.
>
> A list of compost operator guides and other training information is contained in Attachment A.

Rural and small communities have a variety of organics processing options available—ranging from small to large-scale operations, using a range of processing technologies. These processes each has its advantages and can be combined to better serve the community and for cost efficiencies. Communities can start out with one facility using low level composting or mulching technologies, and later add additional facilities and/or higher level technologies for more rapid composting and to handle new materials, such as food scraps.

Small-scale operations can be designed to work in concert with larger, regional facilities or as standalone operations. At a small-scale facility, such as at a transfer station, materials could be stockpiled and later put through a grinder for size reduction for transport to a centralized facility or use as mulch or boiler fuel. If sufficient space and staffing allow, onsite composting could be done. Leaves, yard trimmings, and even food scraps could be appropriately composted by applying a low-level technology using a front-end loader for mixing and materials turning.

A regional facility (possibly operated by a regional government, solid waste district, or by a private company) could provide advantages in terms of economies of scale (thus lowering the per-ton cost) and in handling a variety of materials from multiple communities. The facility would need to be designed with storage areas to hold feedstocks until needed for mixing. The processing technology used at a regional facility can range from low/intermediate technology (such as windrows or static piles mixed by a windrow turner) to a high level of technology (enclosed systems of various types). A grinder may be required for size reduction of brush.

Regional processing facilities require a larger amount of land and may be less conveniently located for some residents. The capital investment and operating costs of larger processing facilities are usually out of reach of rural communities acting alone, however, regional cooperation lends itself to the development and management of these larger scale operations.

Small-scale operations may not capture the economies of scale presented by more central processing options (i.e., spreading fixed costs for equipment, land, and labor over a greater amount of handled material), they nonetheless provide cost effective solutions for communities where regional or private sector opportunities are limited.

A composting program should be a component in an organics management program, focusing on the "hierarchy" of organics reduction, recovery, and composting. An integrated program will reduce the amount of organics to be managed and help to control costs.

Smaller sites can be equipped to meet the processing needs of the community and not incur the costs of transporting materials to a central facility. Locally managed composting operations can be conveniently located where residents are dropping off wastes (e.g., a transfer station). The resulting compost product is also easily available to residents. Food scraps can be phased-in to the compost operation for additional diversion.

**Community-Based Composting**

Community composting presents a scalable organics diversion option that is applicable in virtually any community. Community compost programs can be established at community gardens, farms, schools, or other locations. They can be operated by not-for-profit organizations, governments, private sector, schools, housing associations, cooperatives, or through other arrangements.

According to the Institute for Local Self-Reliance's Growing Local Fertility: A Guide to Community Composting, there are ten basic types of community composting:

- Community Gardens
- Farms (Rural and Urban)
- Schools
- Drop-Off Networks
- Collection Entrepreneurs
- On-site Composters
- Off-site Composters
- Demonstration & Community Leader Training Sites
- Worker-Owned Cooperatives
- Home-based or Homesteader Hubs

Governments and community organizations can successfully implement community compost sites for handling yard trimmings and food scraps. Locally-based compost sites can be established at multiple locations in communities, providing a low-cost option for collecting and composting food scraps. Not-for-profit agencies and volunteers can be enlisted to manage the sites. Local and regional jurisdictions can provide loans and contracts to not-for-profit agencies for implementing community composting sites.

*Management of community compost sites will require adoption of best management practices contained in this section. Depending on the type of composting technology employed and location, community composting operations may not want to collect meat, bones, or dairy due to concerns with odor and vermin.*

**Planning a Compost Operation**

State or regional agencies may be able to provide assistance in planning and implementing a municipal composting operation. The planning process will be more or less complicated depending on the size of the operation, the types of materials to be processed, facility location, and the processing technology to be used. An operations plan is important to have in place no matter what size facility is planned.

Larger and regional operations should consider consulting with an engineering or technical firm to determine an appropriate compost site design and operation plan, if appropriately trained personnel are not on staff.

It is helpful to put in place a basic public relations campaign and to set up a citizens committee to be involved with the siting process from the beginning of the operation planning stages. Informing the public will help gain support for the project and help to educate residents about what's acceptable at the compost site. The committee can act as a feedback mechanism once the operation is running and can assist in troubleshooting as issues arise. This step is especially important if food scraps are to be accepted.

Planning for a compost operation involves:

- Estimating the volume of organics expected to be handled.
- Conducting a needs assessment to determine available land, staffing, and equipment that can be applied to the operation.
- Determining additional operating space required, as well as additional capital, staffing, and equipment requirements necessary for start-up, ongoing operations, and potential expansions.
- The feasibility of the composting operation planned.
- Siting specifics to be included in the plan – a schematic layout of the compost site, materials flow, leachate and storm water management, a listing of equipment and personnel (with their qualifications and/or training to be received), an overview of the composting method to be used, safety and fire emergency plan, monitoring techniques and record keeping, provisions for controlling odors, and a description of a contingency plan if the compost operation ceases.
- Include estimates on how composting could create cost savings and other benefits to the community and how costs and benefits of the operation will be tracked. Benefits could include: avoided landfill or incineration fees, the volume of landfill space conserved, avoided transportation costs, benefits of using compost on public property (and reduced expenditures on fertilizer and compost), and potential revenues received from tip fees and compost sales.

Locally based, small scale operations can measure approximate volumes by surveying residents to determine how they currently manage organics. Visual inspections of a sampling of waste brought in for disposal can also be conducted to estimate expected organics volumes. A survey can be conducted at a transfer station or farmers market. Communities that already collect leaves, Christmas trees, and/or seasonal yard waste will have a sense of the amount of material available for composting. Planning for regional operations may require a more formally conducted waste audit, taking into account the communities that will "feed" into the system.

**Financing and Economics**

Program costs will vary widely, depending on the size of the operation, existing equipment and personnel available, and other factors. Financing needs for smaller scale operations will be minimal if existing land and equipment are available for use in the operation. Site preparation can potentially be handled by municipal staff, depending on the requirements. If equipment is needed and more extensive site preparation required, financing professionals should be consulted. Regional facilities will need to more extensively plan capital investment requirements and determine effective financing options.

**Funding Options & Cost Savings**

- Tip Fees
  - Residents
  - Landscapers & other small commercial generators
  - Haulers
  - Keep fees lower than solid waste tip fees
- Sales of compost & mulch
- Cost Savings
  - Sharing equipment & labor
  - Used equipment
  - Calculating avoided disposal costs
  - Reduced soil & fertilizer purchase costs achieved through the use of finished compost

Program economics will involve:

- Evaluating program capital and operating needs and costs
  - Taking into account existing land, equipment, and personnel
- Determining tip fees (for residents, landscapers, and other small commercial generators)
- Calculating avoided disposal costs
- Estimating reduced soil and fertilizer purchase costs achieved through the use of finished compost
- Estimating potential revenue from compost sales
- Assessing the overall costs and benefits

Inclusion of a contingency plan in upfront financial planning is recommended, especially for larger operations. Planning for potential system modifications or expansions will allow issues to be managed without operation disruptions. Once the operation is running, efficiencies may also be created to improve the operation and reduce costs.

Community compost operations may involve contractual arrangements that factor in the economics outlined above.

**Regulatory Compliance**

Compost operation regulatory and permit requirements vary by state depending on the type and volume of materials accepted for composting. It is important that officials and compost operators understand the specifics of their state permitting requirements prior to planning and developing a compost site. Composting food waste typically triggers a higher level of permitting and more stringent regulatory requirements (monitoring records, etc.), although requirements for community and small-scale operations are usually less than for larger scale facilities. Small operations, such as yard waste composting at transfer stations, typically require little in the way of permit requirements other than a potential modification in the transfer station operating permit. Specific operation and site parameters are likely to be required for larger facilities. Operator training may also be required.

It is up to public officials and compost operators to know and understand the following:

- Key terms and definitions associated with the various types of permit requirements and classifications for handling and processing yard waste, source-separated food scraps, manure, etc.
- State compost operation classifications and operation requirements for each classification level.
- Types, sources, and volumes of materials that can be handled under the operating permit.
- Monitoring and reporting requirements.
- Any other regulatory and permitting requirements.
- Any restrictions on compost distribution, use, and sales.

Work with local boards of health and environmental commissions to determine if there are local ordinances, zoning or siting restrictions, or other compliance requirements that may apply. Obtain local approval of a site plan. Keep local agencies informed of operation plans and developments.

**Best Management Practices Goal**

Ultimately the management goal for any compost operation is to create the optimum conditions to promote the proper microbial decomposition of collected organic materials. It is essential that the process fosters sufficient microbial activity to create enough heat for the required amount of time to destroy pathogens and weed seeds. Best management practices dictate that the operation practice effective process control and operational efficiency to be able to handle problems (such as odor issues) as they arise, while manufacturing a usable, quality compost product.

**Best Management Practices Goal**

Results in quality compost in the shortest time possible with:

- Minimum odors
- Minimum environmental impacts
- Minimum process-related problems

**The Composting Process**

Successful composting depends on the promotion of optimum composting conditions—the appropriate mix of organic materials or feedstocks, appropriate particle sizing, sufficient moisture content, appropriate oxygen levels to support aerobic organism activity, and temperature.

Feedstock ("Ingredients"). Feedstocks are the raw materials used in the compost process. It is important to know and understand the characteristics of the feedstocks to be used in the operation. Feedstocks are characterized by their carbon to nitrogen ratio (see below). Depending on the type of feedstock, it can also serve as a "bulking agent" to provide porosity in the pile. Bulking agents are needed to help with pile stabilization and in aiding air flow through the pile. Wood shavings are a good bulking agent; wood chips can also be used but will need to be screened in the final process.

*Healthy biological activity is essential to successful composting. Setting up the right environmental and conditions is fundamental to the process.*

Feedstock characteristics also include the texture of the ingredient, the moisture content, and its pH (measure of acidity and alkalinity). A material's "bulk density" plays a role in how easy materials are to handle and mix, as well as contributing to the ease of air flow through the pile. The odor potential for the feedstock should also be considered; grass and food scraps, for example, have a greater potential for causing odors in a compost pile. The nutrient level of the ingredients will factor into the compost

end product results. Compost made from just leaves and yard waste will have lower nutrient value than compost made from manure or food scraps.

Nutrient Balance (Carbon to Nitrogen Ratio)**.** The carbon to nitrogen ratio represents the total amount of carbon in a material versus the total amount of nitrogen. A proper carbon to nitrogen (C:N) ratio is required to optimize composting conditions. A C:N of 30:1 to 40:1 is optimum for composting. If the C:N ratio goes below 20:1, odors are likely to occur and nutrients may be lost. If the C:N ratio rises above 40:1, the composting process slows down and temperatures will not rise to necessary levels. In developing a "compost recipe" operators must find a proper balance mixing available high nitrogen materials, including grass clippings, food scraps, and/or manure and available high carbon materials, such as dry leaves, wood chips, saw dust, straw or livestock bedding, and brush.

**Table 1: Sample Carbon and Nitrogen Ratios of Various Organics** [10]

| ***Carbon Sources*** | ***Carbon: Nitrogen Ratio*** |
|---|---|
| Yard wastes | 50 - 90:1 |
| Straw/hay | 50 - 80:1 |
| Wood chips/sawdust | 250 - 500:1 |
| ***Nitrogen*** *Sources* | |
| Vegetable scraps | 10 – 30:1 |
| Fruit scraps | 10 – 30:1 |
| Grass & garden gleanings | 10 – 20:1 |
| Chicken manure | 10 – 25:1 |
| Cow manure | 20 – 30:1 |
| Horse manure | 25 – 30:1 |

Proper particle size**.** Smaller feedstock particles allow for more surface area upon which the microorganisms feed helping to speed up the decomposition process. Smaller particles help to improve porosity (air flow), produce a more homogeneous compost mixture, and improve pile insulation to help maintain ideal temperatures. Particles that are too small, however, can pack down and inhibit air flow. Coarse materials, such a brush may require grinding prior to use in a compost operation. Large scale operations typically grind or chip materials to achieve particle sizes ranging between ¼-2 inches. A mix of particle sizes in the optimum range will feed the decomposer organisms, while allowing for adequate air flow and providing structure to the pile.

Moisture content**.** Water helps to transport substances within the compost pile and makes the nutrients in organic material accessible to the microbes to ensure healthy microbial activity. Depending on the type of organic materials being composted, additional moisture may need to be added, either through rainfall or intentional watering. If the pile is too wet, however, the organisms can drown due to lack of oxygen. An optimum "moisture content" (MC) of 40 - 60% is recommended. If the materials become too wet, dry feedstocks can be added.

[10] Adapted from Robert Rynk, "*On-Farm Composting Handbook*," Natural Resource, Agriculture, and Engineering Service, 1992.

Oxygen flow**.** The microorganisms in compost are "aerobic"—requiring air in order to thrive. Mixing the carbon and nitrogen materials together helps to provide the homogenous mix necessary for decomposition and promotes air flow. It is important that as materials are added that they do not become compacted. Aeration can be achieved by turning or "mixing" the compost or placing the composting materials on a series of perforated pipes ("forced air") to promote air flow. Adding "bulking agents" such as wood chips and will also help to aerate the pile. Aeration helps to speed up the decomposition process and is essential to keep the decomposition process from becoming anaerobic, which can cause odor problems.

Operations that accept grass clippings and/or manure should consider testing these feedstocks and finished compost for persistent herbicides. If contained in finished compost, these herbicides may harm plants.

Temperature**.** There are three stages of the composting process. Decomposer microorganisms are active during a certain temperature range. "Mesophilic composting" occurs as temperatures rise above freezing. As bacteria, actinomycetes, fungi, earthworms, and insects begin their decomposing activity, temperatures rise. As temperatures go above 110° F, Thermophilic microorganisms become active, increasing the rate of decomposition, and causing temperatures to rise. If properly maintained, a compost pile will generate its own heat though the microbial action involved in decomposition. Within two days a pile should reach temperatures between 120°F and 150°F.

These high temperatures are necessary for more rapid composting. To ensure that pathogens, parasites, and weed seeds are destroyed, the temperature needs to be at least 131°F (55°C) for 15 days with five turnings for turned windrow operations. For in-vessel or aerated pile systems, this temperature must be maintained a minimum of three days. Once temperatures stabilize, a "curing phase" is important to allow for additional stabilization and maturation.

**Table 2: Optimum Conditions for Successful Composting**[11]

| Factor | Range | Ideal |
|---|---|---|
| Carbon to Nitrogen (C:N) ratio | 20:1 - 60:1 | 25:1 - 40:1 |
| Moisture content | 40-65% | 50 - 60% |
| Oxygen concentration | Greater than 5% | Much greater than 5% |
| Particle size | 0.5 - 2" (1.5 – 5 cm) | Varies, depending on end market |
| pH | 5.0 - 9.0 | 6.5 - 8.5 |
| Temperature (F) | 110 - 150°F | 130 - 145°F |
| Bulk density (pounds per cubic yard) | Less than 1,100 (35 - 40 pounds per cubic foot) | Less than 1,100 |
| Porosity | 30% - 80% | 50% - 80% |
| *Conditions are those recommended for rapid composting; variations outside of these ranges can also result in successful composting.* | | |

**Recipe Development**

It is important that compost operators understand the basic physical, chemical, and biological characteristics of organic feedstocks. It is also essential for any compost operator to know and understand the basic compost process. Recipe development will help operators better understand the process and to ensure the proper conditions for decomposition, given the materials available to the operation.

Step 1: What's the primary ingredient—what must be managed? What feedstock(s) are readily available? What are the characteristics of the primary ingredient—nutrient content, C:N ratio, moisture content, bulk density, pH, and potential for odors.

For many small operations the primary ingredient will be leaves and/or yard trimmings or brush. However, community compost sites may be specifically established to process food scraps.

Step 2: What are the complementary or secondary ingredients available? What are the characteristics of these? How can they be mixed together to properly compost with the primary ingredient? A proper balance of carbon and nitrogen, moisture, bulk density, etc. should be the goal. Strive to develop a recipe that creates an optimum mix using the appropriate ranges for the feedstock characteristics (refer to Tables 1 and 2).

For small scale operations, the diversity of material inputs may be limited. Rural and small communities might consider accepting manure and livestock bedding from local farms to mix with the leaves and brush collected from residents. If grass clippings and other vegetative matter (higher nitrogen) are accepted, these can be mixed with leaves (higher carbon material) for a relatively balanced compost recipe. Mixing one part grass or food scraps (by volume) with three parts partially decomposed leaves will promote increased composting of leaves and help to reduce odor issues with grass and food scraps.

Recipe development resources are contained in Attachment A.

[11] Adapted from Rynk.

**Composting Technology**

Processing technologies can range from "minimum-level" to "high-level." The site requirements, labor and equipment needs, length of processing time, and costs are different for each technology level, but the end product—finished compost—is essentially the same, although quality will vary. The amount of time necessary for processing depends on the materials to be composted and the technology and process applied.

A "minimum level" technology is a low cost option primarily suitable for managing leaves and sometimes other brush. Materials are collected and piled in windrows (long rows) or piles, typically using available municipal space. This operation requires a front loader or other equipment, such as a backhoe or manure spreader to mix materials, form and turn the windrows, land for the operation, and minimum staffing. A well-constructed pile or windrow, with well blended materials and proper moisture can be minimally turned (as little as once per year). It can take up to three years to complete the composting process.

"Low level" technology is applicable for managing leaves, grass clippings, and brush. Brush is shredded and materials are piled in windrows approximately 6' high and 12' wide. Water is added to achieve and maintain a moisture content near 50%. Temperatures of 140°F to 160°F for optimal composting conditions should be reached within a week. Materials in the windrow are then turned once every 3 – 4 months, resulting in the process being complete within 9 – 12 months. A front loader, tractor, or bobcat is required for making and turning the windrows and a thermometer for monitoring the compost. If brush is accepted, a grinder (owned, contracted, or rented) will be needed to process brush and limbs into a consistent particle size. The process serves to divert organics from the waste stream and create a compost product at a relatively low cost and with minimal staff requirements.

Depending on the space availability, material types and volumes, and staffing, a more "intermediate-level" or moderate technology could employ more aeration for faster decomposition. Turning the materials more regularly and temperature monitoring are required for more rapid composting. Alternatively, equipment for a static pile, including a blower system and piping ("aerated static pile"), can be used for aeration. Compost covers (or systems such as GORE® Cover or *Ag*-Bag) can also be employed to speed decomposition and control odors. Composting can also be done indoors to control odors. More attention

**Food Scrap Composting**

Introducing food scraps into the composting process should be phased-in to allow for proper recipe development and management.

Greater attention to the proper carbon: nitrogen balance will be required to compost food scraps and prevent odor issues from developing.

Carbon sources and pre-processed bulking agents should be stockpiled to ensure sufficient carbon sources for mixing. Once food residuals are delivered to the site they must be immediately mixed with the carbon materials.

Community compost and smaller operations may want to collect just vegetable scraps and no meat or dairy to reduce odor & vermin concerns.

Whether to include soiled paper products & compostable plastics must also be decided. These too add concerns, such as litter control and potentially longer processing times required for full decomposition.

to recipe development and proper mixing of materials will be needed. More active composting can result in finished product within six months. These systems are scalable for uses in community composting to larger operations and are appropriate for handling food scraps.

"Higher-level" technologies using windrow turning equipment, large scale aeration systems, or in-vessel systems can be beneficial for processing yard waste and brush with biosolids (sewage sludge) and/or food waste. These systems are designed to control odors and complete the composting process more rapidly, often within four months. Windrow turners are effective more mixing food scraps and aerating windrows to reduce odors. Less expensive windrow turners can be tractor driven. In-vessel systems usually consist of a rotating drum or tank with a mixing system. These systems can be costly; however, they may be appropriate for regional operations. Smaller-scale and specially designed in-vessel systems can be cost-effective for handling food scraps at institutions, commercial establishments, and community composting operations.

**Compost Methods**

A range of composting methods can be adopted, although piles and windrows are most commonly practiced with smaller operations. Each method can employ varying levels of technologies discussed above.

*Compost pile*

A "static pile" can be managed "passively" where the piles are turned infrequently. Materials are stacked into a pile and left to decompose with minimal maintenance. This is the least labor intensive method, with piles being turned one-to-four times a year. It is also the least expensive option, requiring minimal equipment. A tractor, front loader, or even a manure spreader can be used to stack and turn materials. A passive leaf pile can take three to five years to turn into compost. Odor issues can arise when piles are turned due to anaerobic conditions that develop.

A "passively aerated pile" can be achieved by piling materials on perforated piping or on top of bulking agents (such as wood chips). This method is effective for composting leaves, yard trimmings, and manure, but not recommended for food scraps.

Materials must be thoroughly mixed before building the pile in order to ensure aerobic composting. The process will take a year or more for finished compost, depending on feedstocks. Alternatively, piles can be turned more frequently, about once per week, using a bucket loader or front loader in order to create more rapid decomposition. Passively managed piles are successfully used in rural composting operations, where equipment and staffing is limited. Low technology is required, along with minimal management. Dry and large-particle size feedstocks can be mixed in to give the compost pile adequate porosity for aeration.

*Aerated Static Pile*

An "aerated static pile" involves building a compost pile on top of a "forced air" system. A perforated pipe (ten inch diameter) is connected to a blower system to blow air through the decomposing materials. The system may be a positive (pressure) aeration or negative (suction) aeration. Materials must be well mixed before piling in order to create a homogeneous mixture with good porosity. A layer of peat, wood chips, or finished compost can be used to cover the materials to add an insulation covering and help to control odors.

This method helps speed up the composting process by ensuring proper air flow. It does require a higher level of technology, with moderate capital and operating costs, due to the initial purchase and installation of pipes and blowers. It also requires a site with utilities. After two to ten weeks of composting in the aerated static pile, the material can be turned into another aerated system or windrowed to finish the compost process. This system presents an excellent, scalable process for managing food scraps.

The advantages of the aerated static pile include less use of front end loaders for turning and less labor once the piles are built. The initial construction of the pile does require substantial labor to mix and build the pile. Also, the monitoring and maintenance of blowers will require trained personnel. Moisture loss can be considerable, so should be closely monitored. Odor control can be maintained through covering the pile with chips or finished compost. The pile should sufficiently reach temperatures of 131°F for a minimum of three days. The process takes up to 6 months to produce compost ready for curing.

Aerated static piles can also be constructed in "compost sheds or bins," using wood or cement walls. Aerated piping is laid down on the floor of the bin. Concrete floors can be installed for easier long-term maintenance with the aeration piping running through grooves formed into the cement. The walls of each bay within the shed should be wide enough to allow for maneuverability by a front loader for stacking materials. Sheds can be covered to reduce run-off and drainage.

Tips:

- Materials should be mixed thoroughly into the pile to form a "haystack" type pile 4' – 6' high.
- Piles should be no more than 6' high and 12' wide in order to ensure sufficient air movement through the pile.
- Aerated piles should start with a higher initial moisture content and include a bulking agent or carbon source with higher percent of larger particles to promote greater aeration.
- Use a porous, well-aged capping layer (such as wood chips or finished compost) to cover the pile in order to better promote decomposition and to reduce odor potential.

- Sufficient space should be available for additional piles, depending on the volume of organics collected.
- It is beneficial to place a layer of woodchips over aeration pipes to help protect the pipes and assist in air flow through the pile.

*Windrow*

A windrow is a long, narrow pile of mixed compost feedstocks. Windrows are typically 10' – 16' wide by 3' – 8' high, depending on equipment used to build the windrow. Windrows can be built and turned using a manure spreader or front loader. Windrows can be affectively managed using low to intermediate technology and moderate management intensity.

A "*passively aerated windrow*" system can also be designed using perforated piping. Materials are stacked into windrows over a series of perforated pipes, laid out on a grid with 12-19 inches between the pipes. The piping should be 10-12 inches in diameter with holes at 12-inch intervals. Wood chips laid over the pipes will aid in air circulation and help to protect the pipes from breakage. Air moves through the windrows through a "chimney effect," drawing air from the sides and bottom of the windrow. Initial upfront labor is intensive, requiring sufficient mixing and stacking of materials to form a homogenous mixture with good porosity. The method is relatively low in overall maintenance and equipment needs, however, requiring a front loader or bobcat for mixing and stacking, and the piping for aeration. The method works well for retaining moisture in the composting material and has a relatively low potential for odor.

Passively aerated windrows do require a longer time for composting, typically 6 –10 months to produce finished compost, and a relatively large area for the composting materials. Because materials are not turned, the ability to adjust the composting mixture is limited. Temperatures may not reach the suggested 131°F for pathogen reduction, so this system is not recommended for processing food scraps or manure.

"*Aerated or turned windrows*" are maintained by regular turning of the organic materials using a front loader or windrow turner. Aerated windrows can be used to decompose large volumes of diverse organic wastes, including food scraps. Regular turning provides aeration, helps to rebuild porosity through the windrow, and also promotes the breakdown of feedstocks through active remixing of materials. Windrow management is more intensive, requiring regular monitoring of temperatures in order to determine compost activity and turning frequency. When windrow temperatures fall below 120°F, the windrow requires turning. Turned windrows are common in many operations as they allow for a good balance of flexibility, process control, and affordable economics for most composting facilities.

Turned windrows have the advantage of being able to be maintained with commonly available equipment (such as a front loader) and windrows are flexible enough to handle wide range of materials. Turned windrows allow for the adjustment of the feedstock mixture during composting.

With the right feedstocks and proper turning, the windrows will reach the suggested 131°F for parasite elimination. Community compost operations can even turn windrows using shovels or a small loader.

Turned windrows require sufficient space to allow for anticipated volumes to be managed during the active compost phase; substantial amounts of water, depending on the materials composted and the weather may also be needed. Windrow turning can also generate odors, so precautions should be taken to turn materials primarily in the early morning hours and on weekdays if odors are a concern. Turned windrow compost operations have relatively low capital and moderate operating costs. Up to 6 months are required to produce compost ready for curing.

A "*modified static pile*" allows for a hybrid system where an aerated static pile is used in the initial phase of composting, followed by turned windrow during later phase of active composting. This system effectively combines the advantages of both technologies.

A more "high technology" windrow system would employ specialized windrow turners. A windrow turner uses an auger to turn and grind and mix materials within a windrow. Self-propelled windrow turners require a higher level of capital investment, plus specially trained staff to operate and maintain the equipment.

Tips:

- Keep windrow piles as straight and uniform as possible. Thoroughly blend materials without compacting them. Check and adjust moisture level by adding water or dry bulking agent. Move materials from surface to center of windrow and vice versa.
- When turning with a frontend loader, lift material and let it cascade down to maximize aeration and porosity. Re-shape the windrow for consistent dimensions and smooth sides.
- If building more than one windrow, leave sufficient space between them for drainage and to allow for turning. For low technology operations, using a front loader, a 15 to 20 foot aisle should allow for adequate maneuverability when turning the piles.
- Composting time varies depending on how often the pile is turned or how efficiently it is aerated. Minimal turning of windrows will require three to five years for piles to decompose and cure; low-level technology, with increased windrow turning, would take six to eight months, followed by curing. Once composted, organics can be moved to the curing area to allow for composting of new materials in the windrow area.
- Temperatures should be monitored daily during the active compost phases and after turning the windrow. Measurements should be taken at various depths (e.g., at one foot and three feet into the pile) and at least every 75 feet along the windrow. Always turn and aerate a pile or windrow if temperatures reach above 160°F.
- Once the active composting phase for pathogen reduction is met, materials can be turned weekly or as needed until ready for curing. Curing time can range from 30 to 60 days.
- Moisture management is important. If the windrow is too dry, add water when turning and rebuilding the windrow. Start by watering the outside of the pile before mixing materials into the

**Regimes for Pathogen Reduction**

- Turned Windrow: 15 consecutive days with temperatures ≥131°F (55°C) with 5 turnings
- Aerated Static Pile: 3 days with temperatures ≥131°F (insulated pile)
- In-vessel: 3 days with temperatures ≥131°F

center. Shape the windrow to increase rain infiltration. If the windrow is too wet, turn it to release excess water vapor or mix more dry carbon material into the pile. Allow compost to dry somewhat but maintain adequate moisture (35%-45%).

- Windrows typically reduce 60% in volume during active composting; two windrows can then be combined into one to free up space. Be sure to track when windrows were formed.
- If using a passive aeration system, pre-mixing of feedstocks is crucial to ensure proper composting. Materials can then be laid out over perforated piping.
- The size of the windrow must be sufficient to achieve desired temperatures, but within the size necessary to build and turn using available equipment. Large windrow dimensions are appropriate up to 8 feet high. Oversized piles often are the cause of odor because they can compact and limit air flow. Undersized piles may lack the thermal mass necessary to sustain high temperature.

*In-Vessel*

An "in-vessel" compost option involves mixing and making compost in a fully "environmentally controlled" enclosed operation, such as a drum or container with an agitating mechanism. These systems can handle large volumes of any type of organic material and can operate in any climate year around. In-vessel systems vary widely, from rotary drum composters ("Earth Tub™") to composting "chambers" and "box or tunnel" systems. These systems create compost more rapidly compared to other methods. Finished compost is usually achieved in 2–4 months.

In-vessel systems work well for operations that will be handling significant amounts of food scraps or biosolids, particularly if the operation is located where odor issues are likely to be a concern. In-vessel systems reduce moisture loss and water needs and require a smaller footprint for composting. Odors are easily controlled and the method is effective in eliminating pathogen concerns.

A higher degree of expertise and training in operating in-vessel systems is required. In addition to the relatively high capital investment, a front loader or similar equipment is required for loading the materials into the containment vessel. A site with utilities is also needed. Smaller in-vessel units, including systems adapted with forced air systems, can be used by community compost operations.

**Siting Parameters**

Check with state and local regulatory agencies prior to siting a compost operation in order to ensure that the operation is in complete compliance with permitting requirements. "Set-backs" or distances from waterways and structures may vary depending on the materials and volume to be composted. There may be little in the way of distance requirements for composting smaller volumes of leaves and yard trimmings.

The following provides general guidance for siting compost piles or windrows:

- From 100' – 500' from wells and potable water sources
- Adequate distance from wetlands, surface water bodies (streams, ponds), and flood plains; recommended at 200'
- Minimally 200' away from residences and 50' from property lines
- A low water table to reduce flooding risk on the site
- A high soil percolation rate, but not excessively permeable soils in order to avoid standing water.
- Gently sloped surface (1-3% grade)

**Site Selection and Design**

In general, the space needed for composting depends on the amount and type of material to be composted and the type of composting system. A lower technology system may require more space because of the slower decomposition time involved in the composting process. Two to twenty acres should be adequate for most rural/small town composting operations. Consideration needs to be given to high generation periods—the fall for leaves and early spring for brush and yard trimmings. Community compost operations will vary in size, depending on volume and the system used.

A turned windrow composting operation can typically handle 4,000 to 6,000 cubic yards per acre of materials, depending on the equipment used to turn the materials, the windrow height & width, and the width of the aisles.

If a separate curing area is used, it can accommodate 6,000 –7,000 cubic yards per acre.

A diagram or plan of the compost area is essential to determine prevailing wind direction, traffic flow patterns, land slope, runoff patterns, surrounding land uses, and the location of wetlands or water bodies. The Natural Resources Conservation Services (NRCS)[12] or state environmental agency may be able to provide assistance with site planning, soil information, and drainage control. Ideally the compost area should be located on an evenly graded gently sloped surface (1% - 3%). This will help to prevent ponding and move runoff to the drainage filter area or storm water system. Windrows should be parallel to the slope.

In siting the operation it is important to consider the size of the facility, the volume of materials to be processed, and the types of materials to be accepted. Larger operations and those that accept significant amounts of food scraps will want to be sited away from residential areas. A "buffer zone" around the site is crucial to alleviate any nuisance issues, including noise, blowing material, dust, potential traffic concerns, and odor. Operations may want to consider using shrubbery or fencing to screen the area from view.

The site plan should include, at a minimum, a material receiving area (where organics are dropped off), an active composting area (where materials are layered into a pile or windrow), and a curing area (where finished compost is allowed to cure). The design should consider adequate space for equipment movement and be laid out in a logical manner for effective process flow that allows for material drop-off, mixing, composting, and curing with minimal movement of materials.

[12] http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

A mixing area should be designed into the operation, depending on the volumes and types of materials accepted. Mixing and chipping or shredding can be done in or near the material receiving area. If leaves will be mixed with manure it will be beneficial to thoroughly mix the materials; a mixing area is essential if food scraps are to be handled. If food scraps are composted, additional carbon and bulking materials should be stored onsite. Food scraps will need to be covered and mixed immediately upon being delivered to the site in order to reduce odor problems. Many facilities lay down a bed of bulking materials, such as ground yard trimmings, to absorb liquid associated with food residuals.

Handling brush may require a pre-processing area for grinding the material to proper particle size. Consider whether a grinding operation is necessary and affordable. Larger operations will want to have an area for stockpiling bulking agents. Larger facilities and those accepting post-consumer food scraps or materials containing a significant amount of contaminants, may need a post-processing area for screening compost. Post-consumer food scraps composting will bring in additional issues with plastics and other potential contaminants that will need to be screened to be effectively removed. Consider seasonal increases in population (and thus materials generated) when planning the site. Be prepared to load finished compost into customer vehicles.

Being a good neighbor is essential in the siting process. When planning the siting and operation of a compost facility, it is important to keep in mind the various ways an operation may impact residents and nearby businesses. Potential problems at compost facilities relate to air quality (dust and odor), water management issues, traffic, noise, visual aesthetics, and vectors. In most rural areas these issues should present minimal concern due to lower population densities. Planning for potential impacts will help alleviate any future concerns, however. Traffic flow should be considered in order to minimize both noise and dust impacts on neighbors. All compost operations need to address drainage issues and ensure that any runoff is properly managed. An effective good neighbor strategy involves getting to know the neighbors and keeping them happy. Respond appropriately to all complaints.

Communities will also benefit from considering the handling of disaster debris at the compost operation. The ability to process disaster debris will substantially improve recovery time in impacted communities and offer a more cost efficient disposal option for organic debris (see Part XII, below).

Tips:

- Year-round accessibility will be necessary unless the site will only operate seasonally.
- Depending on the types of organics generators or collection vehicles anticipated, the site will need to be accessible for large vehicles.
    - Sufficient space for future expansion should be planned, if space allows.
- Access to a water source is necessary.
- Gate and a perimeter fence (or other barrier) is recommended to control access to the site and prevent illegal dumping.
- Signage is needed to control incoming traffic and public access to areas where equipment will be operating.
- An area to store finished compost should be established. It will need to be accessible to the public if materials are to be sold or given away.
- If possible, plan the site so that customers see the end product…not the feedstock unloading and mixing area.
- Set up the site so that the oldest finished product can be moved first.

- To the extent possible, sit up the site so that material movement is in as linear a fashion as site constraints allow and that nothing should move more than twice in its same physical condition.
- A neat site appearance is important. Product image and community approval reflects your operation. Don't let weeds grow on the finished product. Deal effectively with leachate/ponding. Consider the view from the road.
- Larger facilities (for example central processing facilities) may want to consider installing weather monitoring equipment.
- A truck scale may also be needed at central facilities that will be charging tipping fees based upon weight.
- An equipment garage will help secure and protect equipment.
- Office/employee facilities may be necessary, depending on the size of the operation and permit.

**Siting Opportunities**

A composting operation can be located as a "stand-alone" site or co-located with another facility. Operations can be located at transfer stations, public works yard, a landfill, recycling center, or wastewater treatment plant. There are many possibilities for siting community compost operations—including community gardens, vacant lots, and schools.

The amount of land required for the composting site depends on the volume and type of material accepted, the composting system, and the amount of time required for the process to complete.

- Typically 2 - 20 acres is adequate for most rural & small communities.

Co-locating the operation allows for sharing of existing infrastructure, including fencing, employee amenities (shelter, restroom access, etc.), water supply, electricity, etc. Co-locating can allow for better use of available space. Existing equipment located at the site may be usable for the compost operation. Co-location also allows for use of existing traffic patterns and impacts. The facility may be able to take advantage of existing permits; new impacts at a second site are avoided, including any potential citizen opposition.

**Drainage System**

Check with state and local agencies regarding drainage requirements for the type of composting operation planned. Larger facilities will most likely require specialized drainage structures, such as a retention pond. Plan drainage needs by first observing how water flows through the site.

The site should be graded to divert water from running onto the site. A gentle slope will help to drain leachate from the pile or windrows and runoff into drainage structures. Drainage structures include filter or buffer areas and diversion channels (grass, gravel, crushed glass, or geotextile-lined). Rain gardens and marsh areas work well in smaller sites. Filter sizing and design or run-off management may require professional assistance, depending on permitting requirements, the size of the compost area, or if leachate is a problem. Leachate retaining ponds or lagoons, as well as piping systems may be required. Contact the Extension Service, NRCS, or Conservation District or state environmental or agricultural agencies for assistance.

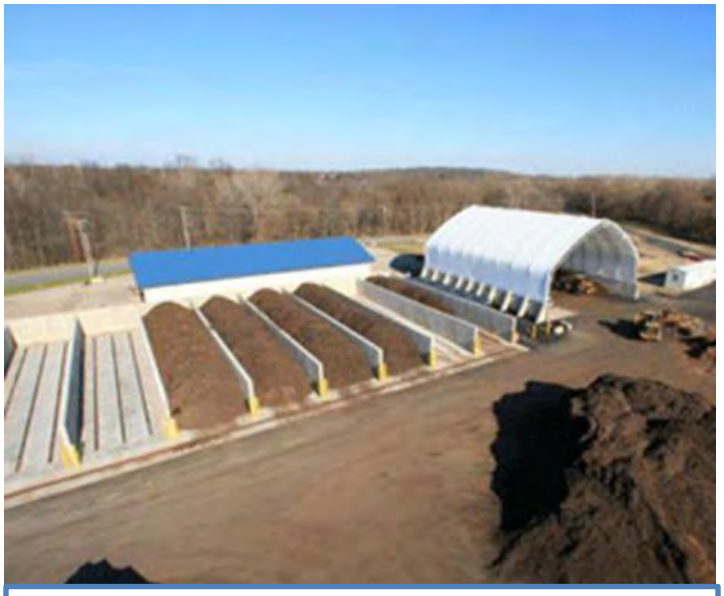
Tips:

- A grassy or vegetated filter/buffer serves as a relatively low cost drainage field. Crushed glass or other filtration material, covered with grass or vegetation provides a cost effective system.
  - Check with state and local agencies to determine if this drainage system is adequate—a more extensive drainage system may be required.
- Site grading to divert surface runoff from the up-slope side of piles will reduce leachate issues and help to control soil erosion around the site.
- Trenching can be used to capture or divert leachate.
- Install piping around larger piles or windrows or where seepage becomes an issue, to capture the wastewater and divert it to the filer area, drainage pond, or holding tank. Reusing the water to spray back onto composting materials may be a cost effective investment, depending on water needs.

**Compost Pad**

A firm and stable surface to support heavy equipment under varying weather conditions is necessary for the compost operation. Compacted soil is adequate as a pad for composting, as long as other precautions for siting the compost area are met (distance from water sources, filter area, etc.). When locating a pile on unimproved soil, soil types should be considered. Native soil with moderate permeability (not excessively or poorly drained) is best. Sand or silt soils may allow too much drainage, while clay soils will rut in wet weather making access and turning difficult.

As an alternative, six inches of compacted and graded sand or gravel should be installed if soil conditions are not sufficient for drainage. Small diameter dark gravel is recommended. Keep in mind, however, that gravel can present problems when mixing materials as it can become mixed in with the composting materials. A hard packed or cement mixing area is recommended. An impermeable paved surface or concrete pad provides an area that will limit mud problems and provides a good foundation for equipment. However, these options can be expensive.



Onondaga County Resource Recovery Agency (OCRRA) Aerated Static Pile Operation

**Staffing**

Staffing of a locally-operated compost operation will vary depending on the amount of material to be managed and the type and size of operation undertaken. For many rural operations staffing requirements will be minimal since pile or windrow management requirements will be infrequent. For operations handling a larger volume of materials, handling food scraps, or using more rapid composting techniques staffing requirements will increase.

Operations accepting just leaves or brush will have seasonal variations in staffing requirements. Requirements in the fall for handling leaves will necessitate more staff, as will the handling of grass and brush in the spring, if accepted. Incorporating food scrap collection into the operation will require year-around staffing.

For most rural, small community operations one or two employees will be sufficient. Typically, if the operation is co-located with a transfer station or other facility, staff at smaller compost operations can be shared to reduce overall employee needs. However, one person should have the role of compost operator or manager. This will ensure that one person knows the overall operation of the facility and is charge of ensuring that the facility is run effectively. All employees should, however, understand and know all aspects of the operation and how to deal effectively with issues that arise. Personnel duties will include monitoring materials as they come into the operation, ensuring best management practices, and monitoring and maintaining records.

Community composting operations may be managed by not-for-profit organizations or volunteer groups, such as garden clubs. Volunteers may be solicited to assist in maintaining the site. Operations which use a loader or which maintain vermicompost systems will need to ensure that staff or volunteers are properly trained.

**Employee Training, Health, and Safety**

Employee education, both ongoing and upfront, is important. Operator training requires at a minimum a basic understanding of the compost process. More rapid composting and handling food scraps requires that temperatures be monitored and moisture levels be assessed on a regular basis. Operators should be familiar with general troubleshooting guidelines to manage issues as they arise. If food scraps are introduced into the composting process, it is recommended that operators attend a formal compost training course. All employees or volunteers must understand the importance of proper monitoring of the compost process and record keeping. The operation will benefit from staff knowing how to use compost as well. Proper training and enforcement of all safety measures must also be observed.

See Attachment A for a list of operator training programs and resources. Check with state regulators for state specific compost operator training and certification requirements, as well as training opportunities.

Equipment operators of front loaders or other heavy equipment used in the composting process must be trained and properly certified. Whatever procedures that municipalities or other entities have in place for training and certifying employees for operating trucks and heavy equipment should also apply in the compost operation.

Equipment maintenance will also be a requirement. Employees will need to know how to run daily equipment maintenance checks. Additional maintenance and repairs will need to be scheduled and handled as a part of the overall operation requirements. A trained mechanic is a valuable asset to any operation, particularly larger facilities.

Proper sanitary measures must also be included in the training of compost staff. Hand washing equipment and sanitizing solutions should be provided in the compost area, along with instructions about proper hand washing before touching food, eyes, etc.

Personal protective gear should be provided, including hard hats and steel-toe boots, safety vests, eye and hearing protection, and dust masks or properly fitted respirators to wear when turning the compost. Individuals with allergies, asthma or other respiratory problems, weakened immune systems, and other conditions should not work in a composting operation.

Employee health and safety training should be included in staff meetings and ongoing training efforts; safety procedures should be posted. Records should be maintained on employee safety training, compliance of safety procedures, and any incidents or violations of proper procedures.

Public safety must also be paramount in employee training. The public should not be allowed in areas where equipment is operating.

**Equipment and Tools**

In many communities, existing public works, highway, or sanitation department equipment, including front-end loaders, shredders, chippers, and similar equipment may be available for sharing, especially in seasonal operations handling just leaves and brush.

Materials handling equipment such as a front-end loader or tractor with a bucket for loading, moving, and turning materials is essential for virtually any size composting operation. A large bucket size is best for efficient materials handling. Small community compost operations may be able to use shovels and pitch forks for turning materials, although a small tractor or loader will be beneficial.

If equipment is not already available for the operation, consult with other, similar operations, prior to purchasing a front loader or other piece of equipment. Learning from other operations about the necessary equipment to best meet the needs of your operation's parameters will help control costs and help to ensure operational efficiency. Ask equipment dealers to demonstrate or allow testing of equipment at your site. Consider renting equipment to meet seasonal needs or to experiment to see what works best for operational requirements.

Equipment considerations should also take into account potential expansion of the operation to include food residuals or other organics and handling disaster debris materials. Used equipment may

be available for purchase; check with regional equipment suppliers or consult Internet used equipment sites and government surplus. Consider lease to own options as well.

Pre-processing equipment may include a tub grinder or horizontal grinder used for grinding and size reduction of brush and yard trimmings. Both types of grinders are versatile for handling materials ranging from brush to stumps. Tub grinders work well for large diameter material (such as stumps and root balls) and brushy material. Horizontal grinders perform better for long material (such as trees and limbs) due to the long feed table on the grinder. Horizontal grinders also have heavier rotors better suited for contamination (such as plastic bags). Shredders are less frequently used and are typically not able to sufficiently process yard trimmings.

Pre-processing serves as a way to achieve size reduction in yard trimmings to produce consistent particle size and structure to serve as a bulking agent. Regional composting facilities and operations that handle large amounts of brush may want to invest in a grinder. Pre-processing also works well for facilities handling food scraps containing a high percentage of compostable service ware, as well as large volumes of materials bagged in paper or compostable plastic bags. Again, contact other operations to see what equipment has worked best for them. Initial contracting for these services allows for experience in seeing what equipment best meets the needs of the operation, before investing in purchasing the equipment.

Specialized composting equipment can include "turning machines" such as a windrow turner. Windrow turners are recommended for larger operations where the capital and operating costs of using the equipment can be offset by their higher throughput as compared with using front end loaders for turning. Windrow turners can be expensive, however, and not necessary at smaller scale operations. Smaller, tractor-pulled turners can be more affordable and beneficial, especially for handling food scraps.

A frontend loader works well for operations handling roughly 500 cubic yards per year of material or less. Larger operations and operations that will handle food scraps may want to consider a windrow turner. A windrow turner will more effectively mix and grind materials. It also handles larger volumes in a quicker amount of time than turning windrows with a front loader. A windrow turner is also effective in helping to provide better mixing and size-reduction and for mixing organics, such as food scraps or sludge and yard trimmings. Turners also work well for operations handling a large amounts of grass and also mixing materials brought in paper or compostable plastic bags.

Additional composting equipment could include a water truck for moving water around a site and spraying water onto piles or windrows; also useful for dust control and fire protection.

Post-processing equipment, such as a trammel screen, is the most effective equipment for separating finished fine-textured compost ("unders") from larger pieces ("overs"). Screens can also be used for separating plastic bags from compost and removing contaminants. Operations which use wood chips will need to screen material to remove the chips (these can be added again to new materials). Screening equipment is an optional addition to operations, but particularly beneficial for larger facilities and operations that accept post-consumer food scraps, as well as those which will be selling premium compost products.

Monitoring equipment includes a long-stem, non-mercury compost thermometer at least 2' -3' long. A thermometer is essential to ensure optimal composting conditions. Use of a thermometer will aid site operators in monitoring the pile/windrow temperature and determining the optimum time to turn the composting material.

Moisture meters and oxygen probes are helpful for obtaining additional diagnostic information. Compost thermometers, moisture meters, and oxygen probes are available at garden or hardware stores or on the Internet. A windsock is a simple tool that can be used to monitor wind direction.

Safety equipment for workers includes: hard hats and steel-toe boots; safety vests; dust masks; and eye and hearing protection.

**Monitoring the Process**

It is essential that all of the primary components be monitored in order to ensure proper composting. If the carbon:nitrogen ratio is proper, moisture levels adequate, and air flow sufficient, temperatures in the pile will rise to appropriate levels and be sustained for the required amount of time for pathogen and weed seed destruction. This will indicate that the biological process of organics decomposition is working. Temperature is the primary indicator of other factors, including moisture and oxygen levels.

Monitoring temperature, oxygen, moisture, and porosity serves as a "feedback" mechanism allowing compost operators to turn and manage piles or windrows to insure optimum composting conditions and avoid unnecessary turning. Observing, monitoring, and recordkeeping should be the foundation for decisions and activities at the compost operation, whether it's turning the materials and adding water because temperatures are below 120°F and moisture content is low or adding carbon or bulking agents because the materials are too wet. Observing, monitoring, and recordkeeping can help to determine the source of odors as they arise and will also indicate when the composting process is complete and ready for curing.

**Field Measurement of Bulk Density**

Bulk Density is weight per volume, (e.g., pounds per cubic yard, lbs/cy). A lower bulk density typically means greater porosity and better air flow.

Field Measurement:

- Weigh 5 gallons of feedstock in a bucket (net weight)
- Drop the bucket from 1 ft. height
- Adjust volume back to 5 gallons
- Measure net weight
- Multiply by 40.4

**Field Measurement of Moisture Content**

Pick up a handful of material, it should feel like a moist sponge.

- If water trickles out, then it's too wet
- If you can squeeze out some water then it's okay
- If you can't squeeze out any water then it's too dry

Weather monitoring is important, especially if odor issues are a concern. Wind direction and speed can be monitored in order to determine the best time to turn materials. If the breeze is blowing toward site neighbors, avoid turning materials until the direction has changed. Monitoring rain forecasts can be utilized for moisture management of the pile, utilizing the rain for adding moisture to the pile just before turning. Freezing temperatures will slow down the composting process. Windrows and piles can be built taller and wider, if space and equipment allow, in order to better insulate materials. Food scraps may freeze, so collection and processing methods should be adapted to the climate conditions.

To help prevent vectors and pests, immediately mix wet putrescible materials (such as wet grass, wet manures, or food scraps) with carbon sources or bulking agents to the proper proportions and form into a pile or windrow. If vectors or odors are a persistent problem, cover windrows with at least six inches of well-aged mulch, wood chips, or coarse compost.

For most small-to-medium sized operations, compost operators can successfully manage and monitor the compost process through some basic practices:

*Observation*—Daily observation of the composting materials will help to ensure that the process is occurring, odors are not an issue, and that there are no other concerns. Are the windrows or piles steaming (indicating proper heating and temperature rise)? Are materials looking different – is decomposition occurring, materials starting to slowing look like soil and less like leaves or brush. Is the pile uniformly composting? Are strong odors present? Are there persistent puddles of leachate or water?

*Compost feel*—Does the squeeze test indicate that there is moisture in the material—does it feel like a damp sponge so that when a handful is squeezed, the material sticks together and your hand is moist (about 50% moisture content). If the material is soggy and dripping when squeezed it is too wet and the pile should be turned; excessive moisture indicates that additional carbon materials should be added when turning. If crumbly and doesn't stick together the pile is too dry and water needs to be added. Piles should have their moisture content measured two or more times during active composting.

*Temperature*—Is the temperature rising appropriately for rapid compost? Does the temperature rise to at least 131°F in windrows, maintain this temperature for 15 days through 5 turnings (or 3 days for aerated static piles)?

*Oxygen*—Smell is the best measure of properly aerated composting for small-to-medium sized operations. If there is an unpleasant odor, chances are there are anaerobic conditions in the pile. This is an indication that the pile needs to be turned. Oxygen probes are also available to measure oxygen levels.

Odor problems are inevitable at some point in most compost operations. It is important that operators plan for this and be aware of the potential causes of odors and how to deal with specific occurrences.

Compost is "finished" and ready for curing (see below) once the organic ingredients in the pile or windrow are digested and bacterial activity declines. When decomposition is complete, or nearly completed, the compost pile heats up very little, even after turning or aerating the pile. Finished compost will have a uniform, crumbly appearance, and an earthy smell. Little if any of the original ingredients—leaves, twigs, etc. will be visible, although wood chips, if used, are likely to still be visible.

A quick and easy test to see if compost is "done" is to put a few inches of material in a small bag. Close the bag and set it in the sun for a few hours. Open it up; if there is a strong smell the compost is not done.

**Track and Keep Accurate Compost Records**

Monitoring incoming materials, whether from residents, landscapers, haulers, or other sources, should be done in order to limit contamination problems. If materials from businesses are accepted, such as processing wastes or food scraps, it is vital that a record of feedstock sources be kept and maintained. If the incoming material has a high level of trash or other contaminants in it, properly maintained records will help to determine the source of the contamination. If odor issues arise, records will help to indicate if the issues arise from the intake of certain materials. Additionally, if the finished compost tests high in herbicides or other toxics, records will help to locate the potential feedstock source.

Odor, leachate or ponding problems, and any other issues should be recorded, along with methods used to remedy the issue. For example, if odor is coming from the pile, was the pile turned to reduce any anaerobic conditions? If the pile was too wet, was additional carbon or bulking sources added? Records should also be maintained for any citizen complaints received and how the issue was resolved. It is also useful to note weather patterns—wind direction (for pile turning and in case of odor complaint) and rain occurrences and amounts (for pile watering needs).

Operations will want to monitor pile temperature and turning frequency. Operations with more than one pile or windrow will want to also note the date the pile or windrow was formed. A temperature chart should be kept to ensure that the 131°F is maintained for 15 days, noting turning dates as well for each pile. Watering times should also be noted in order to ensure proper moisture content.

**Operation Management**

Managing the composting process for appropriate C:N ratio, moisture content, free air space, and temperature is essential for maintaining a compost operation. Management activities involve material preparation, mixing, pile or windrow construction, aeration, turning, moisture control, and monitoring. Blower systems and other technologies used will also need to be monitored.

These activities are discussed above; however the following provides some additional tips:

- Before setting up the piles or windrows lay down a 6” - 8” layer of wood chips to enable airflow through the bottom of the pile. Pile premixed, “homogenous,” materials on top of the wood chips.
- In order to begin the compost process, materials need to be stacked at least 3’ – 5’ high.
- The compost temperature should be taken daily for 15 days (to ensure pathogen destruction), moisture levels accessed, and general appearance gauged during the active composting phase.
- In leaf and yard trimming piles, with proper ingredients and moisture level and where pathogens are not a concern, turning once a week during the first month or two of the process, then once or twice a month after that should be sufficient. If pile temperatures do not rise sufficiently, materials may require more frequent turning.

The University of Wisconsin-Extension Solid & Hazardous Waste Education Center conducted a survey of composting facilities licensed by the Wisconsin Department of Natural Resources (239 facilities; 97 facilities responded). An “average” composting facility in Wisconsin has two employees, is about 5.5 acres in size, and receives about 6,300 cubic yards of leaves, grass, and garden debris. Yard trimmings come from predominately residential sources; no tipping fee is charged; materials are composted in windrows; and compost is given away.

Joe Van Rossum, *Composting Trends in Wisconsin,* BioCycle, October 2012, p. 26.

- Once the temperature goes below 120°F materials should be turned until temperatures no longer rise. Materials should also be turned if temperatures rise above 140°F.
- Depending on the materials and compost management, the active composting phase will last 6 – 10 weeks.
- Sawdust can compact relatively easily, so may require the addition of straw or other material to allow sufficient airflow through the pile. Very fine sawdust, such as from carpentry or cabinetmaking (often used by horse operations), will more than likely require the addition of other bulking material.
- If possible, cover piles, especially in the winter, to retain temperature and moisture levels. Covering piles reduces pile leaching and will help the pile heat up faster on warmer days. Once the weather warms up sufficiently the pile or windrow should be turned. Covers can be removed in the rain to add moisture, if necessary.
    - Larger windrows do not need to be covered, but special windrow covers are available and help to promote more rapid decomposition.
- Bulking agents are recommended to keep on hand to be added to adjust the moisture level, texture, or the C:N ratio.
    - Common materials include: dry leaves, ground brush, wood chips, or straw.
- Shape piles with a flat or concave top to absorb as much rainfall, snowmelt, or watering as possible.
- As the compost process continues, piles will diminish in size. Contents from separate piles or windrows can be mixed together to conserve space and ensure that there is a sufficient volume of material to continue the composting process.
- If rapid composting is desired, it is important to stay within the preferred range of conditions for all factors impacting the composting process.
- Plan for annual site maintenance, to include an inspection and any necessary repair of working surfaces and drainage structures. Ruts and depressions in the composting area should be reconstructed, the slope maintained, and any needed clearing of drainage swales, channels, and retention ponds conducted.
- Practice good housekeeping at the operation. Keep litter picked up. Limit puddles of leachate. Maintain piles and windrows neatly.
- Limiting odor concerns:
    - When the pile is turned, especially with fresh materials in it, it will give off a strong odor. Try to turn it when the there is no wind and on cooler days. Consider turning it on a weekday when neighbors are less likely to be home. Mornings are usually the best time to turn materials.
    - Install a windsock to determine the wind direction and do not turn piles if the wind is blowing in the direction of neighbors.
    - If unpleasant odors persist, there is something wrong with the pile.
    - Odors can be contained by covering the composting materials with a layer of peat moss, finished compost, and/or woodchips (about a 4” layer) or using a compost cover.
    - Avoid leachate ponding as these create odors and are unsightly.
    - Become familiar with odor sources and set up process controls to deal effectively with them as they arise.

**Curing Finished Compost**

Curing is a necessary part of the compost process in order to ensure that the compost is completely done and ready for use. Cured compost is stable—biological activity in the compost is low and it is mature—the decomposition process is complete. Properly processed and cured compost is safe to apply to soil and plants without risk of binding-up soil nutrients or harming plants when applied.

Curing is essential to reduce the potential for herbicides and chemical residues contained in grass clippings and some manures to more readily decompose, as well as to ensure that the compost is mature.

The curing process allows any remaining ammonia nitrogen to convert to nitrate nitrogen. Any remaining large woody particles will also continue to break down. By the end of the curing process compost ingredients (wood shavings, etc.) should not be recognizable. Wood chips, however, may not entirely decompose, and will require screening to remove from finished product.

Compost should be cured for a minimum of 45 days. The curing area will need to be about 25 percent of the compost pad size. Curing can be done in a designated area away from the composting materials to allow additional materials to be composted. Covering the curing materials will help to prevent nutrients from leaching out of the compost. Once cured, compost samples can be sent for analysis. In addition, cured compost should be sold or given away as soon as possible to retain the nutrient value of the compost.

**Ensuring Compost Quality**

Compost quality starts with effective and ongoing public education about what is acceptable and what is not. Customer outreach using brochures, website postings, social media and other methods must emphasize the importance of keeping organics contaminant free. Signage at drop-off locations or labels on collection carts (or bags) must clearly and concisely state what is acceptable for composting.

Residents and businesses must be taught that the composting process is impacted by plastic and other contaminants. It is essential that leaves and yard trimmings not be collected in plastic bags. Food residuals and produce scraps cannot contain plastic utensils, gloves, or other contaminants.

Observation, monitoring, sampling, and testing are essential. Ongoing monitoring of temperature and moisture levels ensures that the compost process is working.

Maintaining appropriate records to demonstrate that best management practices were followed will help to ensure that the finished compost product is free of potential pathogens and weed seeds and provide a record if issues arise.

Quality control requires active monitoring at the receiving point, as well as when organics are mixed into piles or windrows. Plastics and other contaminants should be removed immediately. If loads of organics are delivered to the compost site with unacceptable levels of contaminants, the load should either be rejected or pictures taken in order to discuss the issue with the generator. The type of contamination and generator should be recorded and tracked so that measures can be taken to eliminate the contamination at the source. Work with haulers to properly train their customers.

At a minimum, a compost test to analyze the basic nutrient content—nitrogen, phosphorous, and potassium (N:P:K:) levels of the cured compost is recommended. This test will indicate the soil amendment value of the compost and is helpful in marketing the material.

Operations that collect and compost substantial volumes of grass clippings or horse manure should have their compost tested for potential herbicide residues. Operations intending to sell the compost may want to have more extensive testing (additional nutrients, soluble salts, organic matter, and maturity) and chemical analysis of finished compost. Testing and product certification determines the compost quality and helps to ensure performance consistency. Bioassay testing—growing plants in finished compost using containers or plots—is an effective way for operations to indicate the quality of their compost and to ensure that harmful herbicides are not present.

Skowhegan, Maine

| Table 3: Compost Troubleshooting | | |
|---|---|---|
| **Problem** | **Possible Causes** | **Solution** |
| Piles have a strong or putrid smell. | • Pile may be too wet.<br>• Oxygen is lacking & anaerobic conditions exist.<br>• C:N ratio (<20) is low; excess N being released as ammonia. | • Turn pile & increase turning frequency until problem subsides.<br>• Increase carbon sources, such as bedding.<br>• Cover to protect from rain. |
| Pile is too wet. | • Insufficient carbon sources.<br>• Bedding or manure is too wet.<br>• Rain water or other water is entering compost. | • Add sawdust, straw, shredded paper or other dry amendments.<br>• Turn more often.<br>• Cover pile. |
| Pile is too dry. | • Compost amendments are too dry. | • Water lightly. Expose pile to rain, if possible. Add wet ingredients (such as urine-soaked bedding). Turn after watering. |
| Pile is not heating up | • C:N ratio is too high (>60), microorganisms not active.<br>• Pile lacks oxygen.<br>• Pile is too dry (cannot squeeze water from ingredients).<br>• Weather is too cold for compost process. | • Add additional nitrogen—manure or vegetable scraps.<br>• Turn pile.<br>• Add water throughout pile & turn.<br>• When weather warms, turn pile. Add additional materials to pile. |
| Pile heated up, but only for a short time. | • Materials may be too dense & not allowing sufficient air flow.<br>• Pile is too dry.<br>• If the pile has been active for more than a month, the compost process may be complete. | • Turn piles to ensure material distribution. Add nitrogen source and/or water to pile.<br>• Turn pile again, water if necessary & continue monitoring temperature. Look for uniformity in material. |
| Decomposition process is slow. Temperature is too high. | • C:N ratio is too low (<20) causing high temperature which kills microorganisms that make compost work.<br>• Pile lacks oxygen. | • Add carbon sources, such as leaves or bedding & turn pile.<br>• Turn pile. |
| Pile is very hot >160°F). Mixture has turned gray (ash-like) & may smoke. | • Insufficient turning.<br>• Ingredients are too dry. | • Turn materials & spread pile out to let it cool down.<br>• Monitor closely. |
| Fly infestation; problems with vermin or other animals. | • Manure or food scraps are exposed to open air. | • Mix materials immediately & cover with bulking materials.<br>• Turn more often for proper aeration & increase composting activity. |
| Viable weed seeds, pest larva, & pathogens in compost | • Temperatures in pile did not reach 130°F or did not stay at this level for sufficient time. | • Turn pile more frequently & make sure C:N ratio adequate to raise temperatures to 131°F for at least 15 days. |
| Pile has gone through 2 or more heating cycles, but compost still contains recognizable bedding material. | • Contains wood shavings or wood chips. These materials are slow to degrade. | • Monitor pile moisture, add water if necessary. Give pile additional time to degrade. Use as mulch instead of compost. Screen and reuse wood chips. |

**Post-Processing**
Operations may want to consider screening; depending on the desired end use of compost and the level of contaminants in the finished compost. Operations that want to market and sell higher quality compost product will want to screen to produce more fine-textured, uniform product. Screening is also effective in removing non-decomposed woody particles, including wood chips and contaminants, such as plastic. A typical screen size varies from ¼ to ½ inch particle size depending on desired end-market specifications.

**Compost Marketing**
Primary compost markets for most municipal or community operations will include residents and municipal users, such public works and road departments, parks, and schools. Operations that make a quality compost product and plan on selling it to offset operational costs will want to market the compost to landscaping firms, agricultural users, nurseries, orchards, and other commercial users. Towns and regional jurisdictions may want to consider developing procurement policies to promote the use of compost products by municipal departments.

Ongoing promotion of organics management programs can incorporate the marketing of compost. Potential users could be alerted through onsite signage and social media methods to the availability of compost and the locations where it can be obtained. Compost use recommendations can be posted on local websites, social media, and on fliers. Consider developing demonstration gardens using compost. Work with Agricultural Extension, Master Gardeners, and garden clubs to promote the benefits of compost on gardens, turf, soil revitalization, erosion control, and more.

For larger operations, in addition to implementing educational programs, a comprehensive marketing strategy could include developing a product name; two or more compost products, including soil mixes; requiring communities to establish procurement policies; and developing specialized marketing campaigns that target potential compost users, including agricultural, landscapers, garden centers, and others.

**Opportunities and Action**
Composting requires good management and a high level of community cooperation and participation to be cost-effective. A poorly managed system can incur high costs, produce poor results, and negatively impact public support and participation. Proper application of best management practices and creating the optimum conditions for composting will ensure successful compost operation.

St. George, Maine

Compost presents communities with a viable end product that can be promoted for use by residents or sold to offset operational costs. Compost is visible reminder of the benefits of removing organics from the waste stream and creating a valuable soil amendment instead.

Involving the community in the initial planning of the compost operation can help to gain support. A citizen task force can be established or a public information hearing sponsored. Ongoing public involvement with the operation will help to have a proactive mechanism for dealing effectively with

any issues that evolve. Consider offering regular tours of the compost operation and be sure to respond quickly to complaints.

A feedback mechanism can help create two-way communication involving the operation—contamination issues can be dealt with more effectively if fellow citizens relay the importance of clean feedstocks. Similarly, businesses need to know when their materials arrive contaminated. A mechanism for rejecting materials that are too contaminated may need to be established. Communication should allow for input and feedback from customers. Do they have issues with the operation? Are they happy with the resulting product? Investment in upfront education to residents and businesses will pay off in cleaner feedstocks, a more efficiently operated facility, community support, and a better compost product.

Consider community composting as a means to provide low cost food scrap composting opportunities. Community compost sites can provide an invaluable educational opportunity for getting residents involved in food scrap composting. Community composting can effectively divert significant amounts of organics and offers a scalable model for any size community.

Action Tips:

- Adopt best management practices, and make a quality product. Communities, solid waste districts, and tribal nations that process their own organics provide a valuable service that goes beyond waste disposal.
- It is important that public officials and operation staff/volunteers promote organics as a valuable feedstock or ingredient in the compost process, not a waste requiring disposal.
- Consider conducting a marketing assessment to define the potential markets in the area prior to establishing a processing program.
    - An assessment can be a simple listing of municipal agencies, schools, institutions, landscapers, and others who will be willing to purchase compost.
- Promotion of local market development and implementation of purchasing specifications that foster the use of compost can assist in ensuring markets for compost products, whether manufactured at community, municipal, regional, or private compost facilities.
- Build on existing operations. Some facilities in a region may have the capacity to handle additional feedstock. Even expanding an existing site to accept more materials is usually more cost effective than starting a new facility.
- See NERC's Compost Marketing Guide and Compost Marketing Plan Template.

**Who's Doing It?**

- St. George, a town in Knox County, Maine (population 2,591) accepts yard waste, grass clippings, leaves, manure, specified food scraps (no meat or dairy), and wet and waxed cardboard from residents. The organic material is composted on a 30' x 30' composting pad at the transfer station. The Town website promotes the compost operation, along with backyard composting as a way to reduce the town's overall disposal costs. The Town also sells compost bins, food collection buckets, and compostable bags at reduced rates; a compost pamphlet is available for free download from its website.
- Buxton, Maine (population 8,034) runs a licensed composting facility at the town transfer station. Organics (including yard trimmings, manure, and wood shavings) can be dropped off at no cost. The town website promotes the program as saving the town money by reducing tipping fees. Compost is available for Buxton residents at a cost of $5 for a bucket full (a small pick-up truck load); transfer station attendants load the compost with a front-end loader.

- Skowhegan is the county seat of Somerset County, Maine (population 8,589). The town's Solid Waste Management Facility handles solid waste, recyclables, construction demolition debris, and organics. Brush, grass clippings, twigs, leaves, farm manure, and food scraps are composted. Two certified compost operators manage the facility. An impervious pad with erosion and sedimentation controls catches runoff from the compost pile with wood chips, which then are recycled back into the compost pile. Some 800 yards of compost are generated each year. Compost is offered free to Skowhegan residents; the highway department uses the compost to offset public landscaping needs.
- Growing Power, Inc. is a non-profit organization and land trust with multiple farm and community compost sites, in both urban and rural settings, located around Wisconsin and Illinois. The organization composts food scraps, farm waste, brewery waste, and coffee grounds using vermicomposting bins, static pile, and windrow composting systems. Growing Power provides collection services to restaurants in Milwaukee, collecting more than 400,000 lbs. of food scraps per week, along with 48,000-64,000 lbs. of brewery waste from Lakefront Brewery every week.
- ECO City Farms is a nonprofit organization focusing on community food issues in Prince George's County and the greater Chesapeake watershed. Its community composting model is an "urban farm," with their core operation an urban farm in the town of Edmonston, Maryland (population 1,445). Compost Cab, a private food scrap collection service for the Washington DC Metropolitan Area, provides roughly 700 pounds of food scraps each week for ECO City's compost operation.

- Nantucket, an island community in Massachusetts (10,142 population), recycles and composts nearly 90% of its waste. Nantucket has mandated composting for more than a decade. Residents divide their waste into two streams: recycling and organic waste. They can haul it away themselves for free or pay for a pickup service. At the Nantucket Solid Waste Recycling and Composting Facility wood and yard debris are processed; an enclosed in-vessel composting system is used to compost food scraps, soiled paper, yard trimmings, and biosolids.
- The Shakopee Mdewakanton Sioux Community, a federally recognized Indian Tribe in Prior Lake, Minnesota, launched its Organics Recycling Facility in 2011. The facility, operating on a 47-acre site located on land held in federal trust, accepts all organic materials including, brush, wood waste, source separated organics, manure, straw, grass, leaves, food waste, and paper waste. The facility has earned the Compost Certification Seal of Testing Assurance from the US Composting Council. Materials are composted in windrows; the operation has 100,000 ton capacity. Customers include residential, commercial, industrial, and community entities. Its proximity to the Minneapolis-St. Paul metro area has proven to be a positive business investment for the Tribe which charges tip fees for disposal and produces a range of compost and compost blends for retail and wholesale.
- The Eastern Band of Cherokee Indians runs two successful, large-scale composting operations—one for food scraps and one for biosolids—at the Qualla Boundary in North Carolina (8,092 population). The tribe credits well-trained composting operators with saving them thousands of dollars in tipping fees annually. By selling compost to tribal members at affordable prices, community members are able to successfully garden. To reduce waste disposal costs, the Cherokee began composting biosolids from its wastewater treatment plant in 1995 and expanded its operations to collect food residuals in 1997. The tribe now composts approximately 72 tons of food waste and 96 dry tons of biosolids per month. The food waste, collected from seven local restaurants, including three within Harrah's Cherokee Casino, sells for $35 per ton, while the biosolids compost is sold for $15 per ton.

## Part VIII: On-Farm Composting Opportunities

On-farm composting programs for yard trimmings and even food scraps provide a potential low cost option for handling organics. Many farms already compost agricultural wastes, manures, etc. The addition of leaves and brush from a local community can be a useful source of high carbon materials for farm composting operations.

Communities that collect leaves can benefit from having these materials managed by farm-based composting operations, without having to invest in the space, equipment, and staffing required to municipally compost materials. Farmers can benefit from having an ongoing source of organic materials to mix with their on-farm organics to manufacture a usable value added product. Farm compost operations typically have more flexibility in regulatory requirements, allowing for the addition of offsite materials, even food scraps.

**Opportunities and Action**

Partnering with farm compost operations can provide communities an opportunity to divert a significant amount of organic materials. Composting can help farms diversify their operation by manufacturing a valued added product that can be used as a soil amendment for farm fields and/or sold to bring in additional revenues.

Farm–based compost operations can cost-effectively meet rural and small community organics management needs. Communities would benefit from active outreach to local farm operations to determine interest in accepting off-farm organics for composting.

Municipal trucks can be used to haul and dump the organics at the farm operations. Alternatively, local haulers may be willing to contract to transport materials. Some farm operations may also have the necessary hauling equipment or might be willing to invest in the equipment. A drop-off collection site could be established at the farm operation.

Action Tips:

- Work with state regulators and the farm compost operation to ensure that the operation complies with all necessary regulations and permits. Farm-based compost operations should follow the best management practices presented in Part VII, above.
- As with other compost operations, quality control of feedstock inputs is crucial. Communities can help prevent contamination by educating residents and businesses about acceptable and non-acceptable materials.
- Municipalities can help to ensure a market for the farm operation's compost product by agreeing to purchase compost for public use and promoting the product to local businesses and residents.

**Who's Doing It?**


- Grow Compost of Vermont started as a small farm operation in Moretown, in Washington County, Vermont (population 1,658). The farm operators found it difficult to find high grade compost for their organic gardens. In their small community, they also were increasingly concerned with the growth of the nearby Moretown Landfill. Realizing that they could help their farm operation and their community, Grow Compost was formed. Organic material including farm waste and food scraps from restaurants, schools, and local residents from throughout Central Vermont are used to make Grow Compost products.
- Bear Path Farm in Whately, in Franklin County, Massachusetts (population 1,496) accepts food scraps from the town transfer station and a school to mix with local horse bedding, leaves, and produce waste to manufacture a premium compost product.
- Holiday Brook Farm is in Dalton, a town in Berkshire County, Massachusetts (population 6,892). Leaves are delivered to the operation by the City of Pittsfield and composted with brush delivered by landscapers, horse manure, bedding, and produce scraps and wet cardboard from a local supermarket. The highly successful operation markets several compost products.
- Corinth Compost is a farm-based operation in Vermont which accepts commercial food scraps from restaurants, grocery stores, and other commercial food scrap generators, as well as area schools in Bradford (population 2,619), Corinth (population 1,461), and Montpelier (population 7,868). Composting has allowed the farm to diversify while helping the communities in Central Vermont reduce the amount of organics that goes to the landfill.
- McEnroe Farm compost in Millerton, a village in Dutchess County, New York (population of 958) is made up of manure, food scraps, and leaves. The farm sells a wide range of compost and soil blend products, certified for use by organic growers.

- Gallins Family Farms in Mocksville, a town in Davie County, North Carolina (population 5,051), began collecting and composting food waste from businesses in the Piedmont Triad in May 2011. With the help of a North Carolina Recycling Business Development Grant, the farm purchased a bucket loader, 64- and 96-gallon carts, and a flatbed truck with a lift gate to provide collection services. The farm operation produces compost in windrows. The farm received another Recycling Business Development Grant to purchase additional carts and red wiggler worms to begin vermicomposting.

## Part IX: Private Sector Composting Opportunities

Compost operations divert organic materials from the waste stream and support the local economy by creating and sustaining new jobs and selling a valuable soil amendment commodity. Composting facilities employ four times more people on a per ton basis than landfills.[13] Hauling and collection services provide additional local jobs.

Sonoma Compost

While commercial composting facilities are often located near urban areas, nearby rural areas can attract private interest by hosting facilities that accept urban-area generated food scraps. Small landscaping, garden center, or similar businesses may also choose to venture into composting to supplement existing company services.

Communities can work with private companies to manage facilities that promote local resident and commercial participation through lower tipping fees and allowing drop-off of small loads. Private composting companies may provide hauling services to ensure a steady supply of organics for processing and/or work with municipal or private-sector haulers to deliver materials.

Communities can assist in food waste diversion by partnering with the private composting operation to provide educational outreach and training to businesses for food scrap composting.

**Opportunities and Action**

Outreach to private-sector businesses, including landscapers and garden centers that may be interested in establishing composting operations could prove beneficial to the community. Communities can support private composting operations by working with the operation to establish a drop-off collection point for organics to be transported to the facility for composting. Towns can also promote compost product sales by agreeing to purchase compost products for use on public properties.

Working to promote public-private cooperation or partnerships may benefit regional organics management efforts. Economies of scale offered by county or solid waste district jurisdictions make it more economically appealing for larger scale private composting operations. Publically owned and privately managed operations present a potential model for rural areas. Available local or regional land can be used to establish a compost facility that is operated by a private company.

Action Tips:

- As with farm-based operations, it's helpful if municipalities work with state regulators and the compost operators to ensure that the operation complies with all necessary regulations and

[13] Recycling Means Business, Institute for Local Self Reliance, Feb 1, 2002.

permits. Private-sector operations should follow the best management practices presented in Part VII, above.

- As with other compost operations, quality control of feedstock inputs is crucial. Municipalities can help prevent contamination by educating residents and businesses about acceptable and non-acceptable materials.
- Municipalities can help to ensure a market for the operation's compost product by agreeing to purchase compost for town use and promoting the product to local businesses and residents.
- Regional operations designed to accept food scraps from outside the local community can be aided by holding public hearings and establishing local citizen committees to ensure public support.

**Who's Doing It?**

- Clear View Composting in Orange, a town located in Franklin County, Massachusetts (population 7,839) collects food scraps from several town transfer stations, local schools, and community events. The company owner built special "bear resistant" enclosures to house collection carts.
- Paradise Lawn Care in Smithville, a village in Wayne County, Ohio (population 1,252) composts yard trimmings and food scraps. Wayne County residents can drop their organics off at no charge. The company also provides food scrap and brush composting options for commercial businesses. Nearby Wooster College captures organics on campus and transports them to Paradise for composting.
- With a large poultry industry in North Carolina, Brooks Contractor in Goldston, North Carolina (population 268) developed a niche business collecting and composting eggshells. In 1999, Brooks designed a truck to collect food scraps and started hauling from businesses. The company manages materials in windrows with a 600 HP Scarab turner. Brooks has a high demand for their finish compost and blends, with a customer base which includes small vegetable producers and larger row crop farmers, cattle farms, golf courses, and landscapers. To promote the agricultural market for its products, Brooks gives farmers a discount on compost and has developed an agricultural-grade compost.

- Full Circle Organics operates a composting facility in Good Thunder, located in Blue Earth County, Minnesota (population 583). The 15-acre plant site is designed as a regional facility to process food scraps (largely from restaurants and institutional settings), soiled paper products, and compostable dinnerware, with yard debris and wood chips to produce compost for commercial landscaping applications. The composting at the operation begins under a hoop-structure building (using an air-filtration system to mitigate odors); later the piles are transferred outside to a seven-acre asphalt-paved lot, taking about six-months to turn the organics into useable compost. The Good Thunder facility will ultimately be capable of receiving 110 tons of organics daily.
- Skagit Soils Composting Facility, located in Skagit County in Washington State (population 116,901; population density 59 people per square mile), composts yard trimmings and food scraps. Residents, businesses, and schools can subscribe for organics collection services through private haulers; materials can also be dropped off at the compost operation.

- Sonoma Compost operates the Organic Recycling Program on behalf of the Sonoma County Waste Management Agency. The company accepts yard trimmings and vegetative food discards collected curbside from residents of Sebastopol (population 7,379); food scraps from restaurants in Sonoma (population 10,741); along with landscaper and residential drop-off of organic materials from Cloverdale (population 8,618); Cotati (population 7,265); and other rural and agricultural unincorporated communities in Sonoma County.
- Cayuga Compost, Trumansburg, New York (population 1,797) provides collection services for businesses and special events; it also has free compost drop-off locations in Ithaca and Trumansburg.

## Part X: Regional Organics Management Opportunities

Regionalization has been a developing concept in the management of trash and recyclables for many rural, low population density areas or geographically isolated communities. Materials—whether trash, recyclables, or organics—are collected and consolidated in order to reduce transportation costs and promote waste diversion through regional program development. There are numerous examples of regional or cooperative arrangements for collecting and processing organics.

Regional operation of central composting facilities can allow for program efficiencies in capital investment of land and equipment. Combining the processing of yard and wood waste with biosolids and/or food scraps processing, if operationally feasible, can provide for an effective regional management option.

Begin with affordable, low-risk, small-scale solutions and then expand material types and quantities once the facility is cost-effective and successful. As noted previously, early involvement of all stakeholders, including participating communities, haulers, regulatory agencies, and residents is essential for program success.

Collecting organics from rural and small communities and transporting them to a regional municipal or private processing facility may allow for a more cost effective management opportunity, particularly for communities which do not have the space, equipment, or staff to undertake onsite processing of organics. Drop-off or curbside collection can be provided through private or municipal haulers.

Distance to regional facilities can present a transportation concern, both in terms of hauling costs and meeting the needs of local residents and businesses, however. Trade-offs between potentially lower processing costs of a regional facility but higher transportation costs will need to be considered. Communities will need to determine collection options and costs to decide if a regional option makes economic sense.

Publically owned and operated facilities, such as a regional landfill, could be used to set-up a compost processing facility. Typically land, equipment, and other necessary infrastructure would be available at such a location. If the facility charges a lower tipping fee for organics than solid waste, an incentive would be provided for private haulers to provide collection services for separated organics, as well as residents and businesses to take advantage of the reduced tipping fees.

Private composting facilities offer another regional opportunity. While many private operations locate near urban areas to take advantage of higher organics generation, the actual facilities are frequently located in more rural, agricultural areas as land is more affordable and odor and other potential issues are of less concern (due to lower population densities).

State or local permitting requirements for onsite storage of organics, as well as space needs would need to be addressed. Size reduction to reduce the amount of material being transported should be considered. Private companies could be contracted to grind materials, as well as to provide transportation to regional operations.

Another regional approach may be cooperative agreements involving collection and processing sites. Shared use of equipment could reduce operational costs, but ownership and operation challenges will need to be addressed. Shared ownership of equipment or ownership by a regional entity, such as a solid waste district, would help to address barriers such as the high cost of processing equipment and lower quantities of materials generated locally. Contracting for equipment may also present an option in cooperative agreements.

**Opportunities and Action**

New Mexico's Rural Recycling initiative introduced the "hub and spoke" model for rural collection and processing infrastructure. This model has been adapted in many rural areas for the successful collection, processing, and marketing of recyclables. The concept promotes more efficient collection and basic processing of materials by creating regional recycling processing centers within larger communities known as "hubs."

Smaller communities or "spokes" are encouraged to provide collection containers for recyclables and to arrange for transportation of the collected materials to these hubs. Rural areas benefit from not having to invest in processing equipment. The "hubs" invest in the necessary capital equipment and infrastructure to meet the processing requirements and take responsibility for marketing the materials. The hub and spoke system provides an efficient means of gathering and processing recyclables, from a capital and operational cost perspective. Increased volumes of materials allow for better marketing opportunity, bringing cost benefits to all participating partners.

The "hub and spoke" concept presents a replicable model for regional organics processing facilities. As "spokes," rural and small towns act as the collection point for organics in their community, collecting materials at reduced rates or no charge to benefit their residents. Higher volumes of organic materials transported to a central facility can help to create cost efficiencies in processing and allow for development of more compost. Higher compost volumes can lead to higher material sales to off-set processing costs. A larger facility can benefit from charging tipping fees for incoming material, thus generating a source of revenue for operating costs.

Another model is to provide community drop-off locations for brush and yard trimmings and transport a mobile shredder or grinder to each location to chip materials for mulch. A regional entity or cooperating communities could own the equipment. Composting could also be done onsite if a front loader was available at one or more of the drop-off locations. Food scraps composting could be phased in as well.

As presented in earlier sections, community composting offers a low cost option for handling organics, including food scraps. A system of community compost sites could be coordinated by municipalities or a regional entity to offer a scalable approach to managing organics. Even if the system ultimately does not meet the entire needs of a region, these sites will serve as a learning curve for residents and other stakeholders to begin source separation of food scraps, learning what works and what doesn't, and planting a seed for expansion of food scrap composting throughout the region.

**Who's Doing It?**

- Chittenden Solid Waste District (CSWD) in Vermont owns and operates Green Mountain Compost. Green Mountain Compost is open for drop-off of food scraps and yard debris at its facility in Williston (population 8,698). Food scraps and yard debris are collected at no charge at any of the CSWD Drop Off Centers located throughout Chittenden County. The materials are transported to Green Mountain Compost for processing.
- Tompkins County is a predominately rural county in New York (population 101,564; population density of 203 people per square mile). The county has a current diversion rate of 60% and has increased its efforts at organics diversion in order to meet a diversion goal of 75%. The county offers curbside and drop-off opportunities for food scrap composting. The Tompkins County Solid Waste Division is partnering with Cayuga Compost, a private composting operation located in Trumansburg (population 1,797).
- Tri-County Hazardous Waste and Recycling Program (Tri-County Recycling) hired Cascadia Consulting Group to prepare a comprehensive 'best practices' study of organics specific to the rural conditions in the Columbia Gorge region, including the Tri-County area—Wasco County (population 25,213); Sherman County (population 1,765); and Hood River County (population 22,346), plus Klickitat (population 20,318) and Skamania (population 11,066) counties on the Washington side of Columbia Gorge. The study, initiated because the region has few options available for diverting organics, involved conducting an organics inventory of the Columbia Gorge area, an assessment of the current organics management infrastructure, and interviews with local stakeholders and organics management professionals. A public "stakeholder" meeting was also held. The public outreach promoting the study helped the region focus attention on organics, particularly the role that diverting commercial organics could play in helping to reduce the region's solid waste stream. To further promote composting in the region Tri-County Recycling awarded Dirt Hugger, a private company, a $50,000 grant for equipment to focus on commercial composting. Dirt Hugger offers curbside food waste collection service for food scrap generators in Hood River and The Dalles (including supermarkets, hospitals, schools, restaurants, offices, and food processors), as well as processing yard trimmings from the Hood River Transfer Station and The Dalles Disposal.
- The Ohio Food Scrap Recovery Network is a project of the Ohio Grocer's Association and the Ohio Department of Natural Resources, to build a regional systemic approach that encourages businesses to divert organic materials. Through the Network, various stakeholders, including processors, haulers, and generators have been brought together in meetings held around the state. By focusing on the economics of route density, the Network has worked to match haulers to multiple generators, helping generators find alternatives for their food scraps and other organics. While initially focusing on more urban areas, the network has been able to viably serve many rural areas as well by capitalizing on the synergies between urban-rural areas. The collected organics are diverted to compost and soil amendments, animal feed, and to digesters for energy and fuel. The network has been successful in stimulating generators to look at food diversion as an alternative to waste disposal. The number of tons being diverted by participants in the Network continues to rise

and the organics processors are starting to market themselves better, in addition to acquiring new equipment to expand their operations. Its success comes from focusing on the economics of building route densities for haulers and processors.

- The Northeast Indiana Solid Waste District uses a system of staffed drop-off sites for yard waste. Each of the four District member counties has a yard waste composting facility operated by the District bringing economies of scale to this predominately rural area (a population density of 106 people per square mile). The program is funded through the District's general budget (from an assessment on the property tax base). The program costs approximately $25/ton. In 2011, the District diverted approximately 19,000 tons from the solid waste stream of approximately 200,000 tons/year resulting in a 9.5% diversion rate. Collected yard trimmings are composted in windrows. The compost is screened prior to sale. Brush is ground by the District for a wood mulch product.
- Food scrap composting in Summit County, Colorado (population 27,994; population density 39 people per square mile) is a regional partnership of the High Country Conservation Center (a nonprofit organization), Summit County Government (the processor) and Timberline Disposal. County residents can drop off organics (including food scraps and non-recyclable paper) at the recycling center in Frisco (population 2,683) or one in Breckenridge (population 4,564). Program charges are: $15 monthly, $35 quarterly, or $120 annually.
- The Laurens County Solid Waste Management Authority in Laurens County, Georgia (population 48,434; population density 55 people per square mile) operates a regional compost operation at its county landfill. The landfill and compost operation are financed through tipping fees. The operation, which has the benefit of sharing equipment with the landfill, began as a way to put incoming dry biosolids to better use by composting the material with yard waste and divert these materials from the landfill. The operation also accepts animal mortalities for composting (including road kill, agricultural mortalities, and renderings). Yard waste is accepted by commercial businesses and residents for a reduced tipping fee ($10 per ton). The material is sold in bulk at $10/ton to farmers, home gardeners, and others; it is provided at no charge to civic organizations. The county recently started a food scrap composting programs at area schools. The operation produces 5000 to 7000 cubic yards of compost per year.
- In Grant County, Kansas (population 7,829), before a statewide regulation prohibiting open burning of solid waste was enacted, municipal solid waste was picked up and hauled to open trenches where it was burned; farm waste was also burned. Ulysses (population 6,161), the major population center for the County, needed to find an alternative means of managing their trash. In 1994, the town built a transfer station to accept municipal solid waste and transfer it by truck to regional permitted landfills. Residents of Ulysses pay a monthly fee for trash pick-up. Farm residents may use dumpsters, which are hauled by a private company to the transfer station, or may haul their waste directly to the transfer station and pay a disposal fee. Disposal fees at the transfer station vary by type of waste material. Brush and yard trimmings, including agricultural residues, are accepted at no cost and are turned into compost to sell to offset program costs. A 60% to 70% reduction in on-farm burning has been achieved since the transfer station was built.

- Kittitas County, a rural county in Washington (population 40,915; population density 14 people per square mile), dropped its contract grinding service and decided to get into the composting business when Washington State banned backyard burning. The regional Kittitas County Solid Waste Compost Facility, located in Ellensburg (population 18,174) processes about 2,000 tons per year of brush and yard trimmings. Most of the material received at the facility is self-hauled to the site by Kittitas County residents; separated yard waste is accepted at each of the county-owned transfer stations at a reduced fee. The compost is screened and readied for sale in about a year. Compost is available in two different sizes (1/2-inch minus, ideal for plant and flower beds, and 2-inch minus, which serves well as a decorative mulch product) sells for $60 a ton.

## Part XI: Anaerobic Digestion

Anaerobic digestion is increasingly being looked at as a potential method for handling organics, particularly food scraps, manure, and biosolids as it creates relatively minimal odors if done properly and generates energy to offset costs. Anaerobic digestion ("AD") uses a series of processes in which microorganisms break down organic material in the absence of oxygen. AD is employed on a large scale throughout Europe, as well as on large farm operations and at a number of wastewater treatment facilities in this country.

AD technologies, particularly for processing food scraps, are currently somewhat limited in applications due to the high capital costs required and the material volumes necessary for operation. However, rural areas with large dairy or swine operations can potentially partner to operate a digestion system that could handle at least commercial food processing wastes.

Alternatively, regional operations may lend themselves to exploring these technologies. Communities that are in proximity to urban centers may be able to feed into a larger scale anaerobic digestion system. Costs for these systems are high, although potentially comparable to more regionally operated composting operations. Working with wastewater treatment facilities to invest in anaerobic systems for both biosolids and food scraps is one possibility, particularly if the state electricity regulatory environment is supportive of alternative energy.

Smaller scale anaerobic digestion systems more adaptable to material generation needs of rural and small communities will undoubtedly become more technologically and economically feasible in the future.

**Who's Doing It?**

- The Cayuga County Soil and Water Conservation District located in Cayuga County, New York (population 79,738; population density 118 people per square mile) established a Community Digester to address manure management issues facing dairies in Cayuga County and neighboring counties. This model uses a central digester plant; approximately 35,000 gallons of manure are trucked in daily from local dairy farms and co-mingled with 8,500 gallons of food waste, delivered from local food processing plants. The project generates income from production of electricity and heat, sale of renewable energy credits, and tipping fees to cover its operational costs.
- In late 2011, Exeter Agri-Energy (EAE) finished building an anaerobic digestion system at Stonyvale Farm in Exeter, Maine (population 1,092). The facility uses cow manure and off-farm organic waste (including food scraps) from a variety of sources to produce biogas, a combination of methane and carbon dioxide. The combustion of the biogas is used to generate electricity and heat. Related systems integral to the combustion process produce organic fertilizer, organic soil additives, and animal bedding.
- Fremont in Newaygo County, Michigan (population 4,081) is home to a Novi Energy anaerobic digester designed specifically to handle 100,000 tons of food processing wastes that previously were landfilled. Much of the processing wastes come from a Gerber Baby Food plant, as well as other area food processors, organic residues and manure from agricultural operations, and restaurant grease. The plant employs 12 workers and has a 20-year contract with Consumers Energy to sell its electricity — enough to supply about 1,200 homes. The digestate, the material left behind, is used to fertilize 5,000 acres of corn crop.
- Casella Organics operates the first anaerobic co-digester in Massachusetts at Jordan's Dairy Farm in Rutland, Massachusetts (population 7,973), co-digesting dairy manure produced by the host farm and food residuals diverted from food processors.

## Part XII: Organics Disaster Debris Management

Disasters come in many forms--weather related events, fire, earthquakes. Rural communities face unique challenges in dealing with disasters. Sparse populations, low population density, and spread out communities, make communication before and after a disaster hits difficult. Rural, small, and tribal communities are easily isolated when roads and communication lines are damaged. They also tend to have limited resources and staffing.

This section only addresses organic debris management. Additional information should be sought for including other forms of debris in disaster debris management plans.

Strategies that minimize the impact of disasters can assist in preparation and recovery. Individuals, government agencies, community groups and other organizations in rural communities and the surrounding areas must work together to plan their roles and prepare to bring their resources into action should a disaster become a reality. Management of clean wood waste, brush, and yard waste resulting from a disaster is most cost effectively handled when integrated into a community's existing organics management infrastructure.

**Pre-Disaster Planning**

Pre-disaster planning allows for more cost-effective options when a disaster hits. Planning helps communities avoid mistakes. It serves to speed recovery and assists in obtaining reimbursement from the Federal Emergency Management Agency (FEMA). Having a plan for managing debris can help communities deal effectively with debris and establish policies that support diversion efforts over disposal.

Without effective management and diversion of debris, a disaster can substantially impact disposal capacity and contribute to higher disposal costs.

**Words to the Wise**

- Long after the disaster is gone, the debris remains.
- You may not be able to reduce the amount of debris, but you can reduce the impact.
- Government and public preparedness can help!

**Disaster Debris Management Plan**

A Disaster Debris Management Plan (plan) should consider the types of disasters likely and the types and amounts of debris anticipated. Past disasters in similar communities can be examined, along with the use of formulas to provide this information. Recovery resources, including equipment and personnel, available in the community and region should be assessed and documented in the plan.

A strategy for handling debris would address the following:

- Communication– biggest component!
- Team, responders, haulers, and the public
- FEMA and state requirements
- Plan for documenting, tracking, and monitoring
- Funding

**Goals of Disaster Debris Management**

- Community recovery
- Divert materials away from disposal
- Salvage
- Recycling
- Mulch/composting

The plan should be incorporated into the emergency management plan for the community or region. Advanced selection of the recovery team should occur. The team would likely include: representatives from the regional or local solid waste office; citizen environmental committee representatives; and waste haulers and equipment operators, in addition to other emergency responders. A debris project manager should be identified.

**Resources**

Include in the plan existing staff and potential sources for additional personnel, as well as citizen committee members and other potential volunteers. An outline of the community's existing solid waste management strategy, facilities, and capacity should also be examined. Regional facilities and capacity, whether government and private sector operated, would be also included. Resources would also include a listing of available debris removal equipment.

The preparation and inclusion of mutual aid agreements will provide communities with an essential resource should a disaster occur. The plan should also include a listing of tree service providers, regional haulers, and brush processors. It is recommended that these service providers be pre-qualified for service in the community and that standby contracts be developed.

Potential markets for clean wood and brush materials, including agriculture, secondary fuel options (boiler fuel, pellet manufacturers) should be determined and specifics obtained. Temporary storage ("staging") and processing sites must be identified. Reuse and salvage options for clean wood are helpful. A public information plan would also be included.

**Multiple Solutions**

The fundamental component of a disaster debris management strategy is the collection and management of debris. One single component of materials management may not be sufficient to handle the amount of debris. Planning for multiple solutions—grinding, mulching, disposal, and combustion—to manage organic debris will provide communities with the most effective management option.

Diversion is most successful if coupled with existing construction and demolition debris handling opportunities and brush and yard waste recovery programs. The plan should focus on strategies for increasing capacity of existing programs to deal with the sudden influx of materials.

Rural and small communities can greatly benefit from regional coordination and multijurisdictional agreements to manage and divert debris. Consult with county and regional agencies about potential arrangements.

**Response and Recovery**

In many rural and small town areas, municipalities can use their own labor and equipment during the response phase. Communities that do not have these resources may supplement their response by activating mutual aid agreements. Alternatively, short-term debris removal contracts can be readied for specific work determined by the immediate needs of the community.

Response Phase – Debris Clearance

- Focus on debris removal posing an immediate threat
- Clear major arterial routes
- Move debris to the side of road
- Remove or secure unstable structures
- Clear debris from around hospitals, police and fire stations, shelter areas, and residential areas

Recovery Phase – Debris Removal

- Focus on collection of remaining debris
- Removal of material moved to the side of road during the response phase
- Debris removal from residences and businesses (placed curbside or at drop-off locations)
- Providing guidance to residents and businesses
- Removal and processing/disposal in the most cost effective and expeditious manner

Debris clearance and removal would include necessary demolition and tree and brush removal from public roads and areas. The debris removal phase can be conducted by municipal labor and equipment, if resources are adequate. Contracted services may be utilized for some or all of the requirements. Communication with residents and businesses will be the role of local government.

**Contracted Services**

Expedited contracting procedures put in place through pre-drafted contracts can expedite all phases of a community's response and recovery. These pre-existing contracts can be finalized with the appropriate scope of work once the extent of the disaster and recovery requirements are determined.

Pre-qualified contractors should meet minimum standards for insurance, bonding, and licensing. Jurisdictions may want to advertise a request for qualifications (RFQ) to determine available and qualified contractors. It is important to conduct this bid solicitation process in advance of a disaster so that pre-event contracts can be awarded and put in place.

The type of contract entered into is important. "Time-and-Material" contracts are typically used during the initial response phase. FEMA will only reimburse these contracts during the first 70 hours of contractor work. "Unit-Price" or "Lump Sum" contracts are recommended after the initial 70 hour period. The process for determining qualified contractors under the RFQ and negotiating the final scope of work for recovery phase contracts must take place early in process of disaster clean-up in order to be most effective.

General contract provisions should include:

- Basis of payment and payment process
- Verification of completed work
- Volume or weight of contractors loads
- Duration of contract
- Performance measures
- Agreement to restore collateral damage
- A "termination for convenience" clause
- A conflict resolution process
- Clearly defined scope of work and tasks

**Debris Removal Strategy**

It is essential that source separation of debris materials be planned for and implemented. Source separation of brush, tree trimmings, and yard debris from other wastes is imperative for end use marketability, as well as for burning or combustion.

Collection options include curbside collection and drop-off. For most rural, small, and tribal communities, drop-off collection centers will likely be used. If curbside collection is normally provided for organics, these services can be employed to collect disaster debris. A combination of curbside collection (for immediate response and removal of debris) and drop-off centers for recovery management can also be employed. Roll-off bins or a designated clean wood/brush drop-off area can be established for drop-off collection points.

Communities need to determine, in advance, how debris from personal property will be handled. The town can pick-up all debris moved to the town right-of-way or accept debris at designated drop-off locations. Alternatively, the town can determine that it will not accept debris from private property and that residents must pay for these services through private haulers.

**Debris Management Site**

A Debris Management Site (DMS) is a temporary, permitted site that allows for the stockpiling of debris for salvage and reuse (if applicable), volume reduction, and any additional processing. A DMS allows for operational flexibility in managing disaster debris.

A community's Debris Management Plan should identify the best site(s) for the location, which can include:

- Existing disposal or transfer facilities
- Maintenance facilities
- Other government-owned properties

Considerations when identifying the DMS include zoning restrictions, possible environmental impacts, and historic preservation concerns. Suitability of traffic patterns and safety concerns must be addressed. The distance from local impacts is also important to take into account. Ideally the DMS will contain a large paved (or impervious) area sufficient for handling the debris. The location should be separated from residences, schools, etc. in order to allow for ongoing recovery needs, traffic, etc. The site must be away from water bodies and wetland areas.

State or local agencies may require the site to be permitted. Usually this process is streamlined in the event of an emergency. Consult in advance with appropriate agencies to ensure that the site meets all environmental and other permit review requirements. Communities may need to plan for any engineering work that needs to be done to the site to handle the DMS operation. Permits, if applicable, may include: waste processing; temporary land-use permits and land-use variances; Department of Transportation curb cut permit; air and water quality permits; coastal commission land-use permits; and Fire Department permits.

Planning for material separation at the DMS is essential. For organics management separation this would include salvageable wood (if appropriate) and clean wood and vegetative debris.

**Off-Loading and Processing at the DMS**

A layout plan should be developed that allows for efficient flow of traffic and clearly identified areas for source separated materials collection. Materials must be placed in assigned areas or collection containers.

A tipping area for unloading may be appropriate, depending on the size of the operation. This would accommodate additional traffic, primarily associated with delivery of collected debris loads. Collection bins or a designated location should be established for resident (and small business) drop-off of materials. This area must be safe for residents and clear signage or directions provided.

Management of the DMS will require a site manager to oversee the day-to-day operations of the facility. Maintaining daily logs and site progress reports are essential for complying with FEMA requirements. The site manager would be responsible for enforcing safety and permitting requirements.

Onsite chipping or grinding of vegetative debris can effectively reduce the volume of collected materials by approximately 75%.

Beneficial uses for ground materials include: land spreading as mulch, bulking agent for composting, soil amendment for agricultural applications, given away as mulch to the public, or used as biomass or boiler fuel.

Materials can be ground and placed in containers for storage and transport to end uses. Depending on the volume of vegetative debris and the abilities of the community, combustion or burning in pits/air-curtain incinerators may need to be used.

Debris monitors also need to be assigned to quantify debris loads and issue load tickets. All loads must be inspected to enforce source separation requirements and ensure that hazardous materials do not end up contaminating materials. An environmental compliance person should also be assigned to monitor and track potential environmental impacts at the site.

**Public Information Strategy**

In the event of a disaster, the public's cooperation is crucial. Pre-disaster preparedness can ensure that effective and timely information about the cleanup effort is provided to citizens. The public wants to know "How will disaster debris be handled?" and "When will regular refuse/recycling service resume?"

**What the Public Needs to Know**

- Safe and effective clean-up
- What can be salvaged? How?
- How should materials be separated?
- Which materials? Where? When?

As part of a community's Disaster Debris Plan, advanced public information resources should be developed. A process for distributing the information should also be discussed. A means for updating, correcting, revising, and redistributing information as operations progress will also need to be considered. A debris information point person should be appointed to address all concerns, questions, and complaints.

Effective public information includes both pre-disaster preparedness information and post-disaster clean-up and recovery information. Communication limitations should be considered in advance. How will information be distributed if the Internet and/or telephone service is not available or if the electricity is off and copies cannot be made? Prepared handouts for emergency staff, utility workers, and clean-up crews to distribute will reassure the public and keep them informed of clean-up efforts. It is also important to provide outreach to residents in emergency shelters. Inevitably telephone service will be restored and communities must also effectively prepare their staff.

Effective communications include:

- Press releases, brochures, guides
- Newspaper, TV, and radio announcements
- Fliers, door hangers
- Internet, Twitter, Facebook, and other social media outlets

**Funding Considerations**

Local governments can benefit from advanced planning and identification of ways to ensure that a greater proportion of their revenue streams are available to cover the short-term, infrequent costs of natural disasters.

This will require local governments to employ several strategies, including:

- Increasing the flexibility associated with special purpose funds when these taxes come up for renewal.
- Advance negotiations of debris removal contracts with payment terms.
- Integration with the existing organics management program.

These strategies combined with use of general fund reserves should help to provide sufficient liquidity to local governments to deal more effectively with a natural disaster.[14]

[14] Fannin, J. Matthew and Detre, Joshua D., *Red Light Ahead: Preparing Local Governments Financially for the Next Disaster*, *Choices*, 1st Quarter 2012.

**Opportunities and Action**

Due to their unique characteristics, rural, small, and tribal communities face unique challenges in dealing with disasters. However, they also have strength in their ability to pool together as a community, help each other, and leverage available community resources.

Planning and strategizing for disaster can help to minimize the impact of disasters and can assist in preparation and recovery. Planning for debris management when developing organics management programs will benefit communities, providing the most cost-effective disaster recovery opportunity.

**Who's Doing It?**

- Schoharie County Emergency Services in Schoharie County, New York (population 32,749; 51 people per square mile) uses a Facebook page for up-to-date emergency preparation and needs for the communities in the County, including storm warnings and emergency service listings.
- In 2007, a tornado struck the town of Northwood in Grand Forks County in North Dakota (population 1,100). The town implemented an integrated waste management approach to handling the debris caused by the devastation. Trees and wood debris were ground for mulch; metals were segregated for recycling, and concrete and brick stockpiled for crushing
- NERC's After the Disaster: A Guide for Residents and Small Businesses about Managing Debris Waste is a tool for town officials, residents, and small businesses useful for dealing with debris after a natural disaster. The Guide contains practical, concise information to commonly asked questions from the public on recovery, recycling, and disposal options.

## Conclusion

Organics, including, yard and landscape trimmings, food scraps, and soiled paper, continue to be the largest component of municipal solid waste. Organics management presents communities with a significant opportunity for cost savings, economic development, and an enhanced environment. The benefits are many, from reduced disposal needs, use of compost as a soil amendment, and reduced open burning of yard waste.


Focusing on reduction and decentralized diversion offers rural, semi-rural, and small communities a cost-effective organics management solution that can result in high levels of diversion. Consideration of community composting or centralized composting, established locally or regionally through partnerships with farm, regional, or private operations, also offers rural communities a viable organics management option for increased diversion of yard trimmings and food scraps.

A public outreach and education program about the value of organics diversion and composting can be the most important organics management tool available. Communities can effectively combine program development and public education to successfully implement organics management resulting in improved integrated solid waste management and reduced waste disposal.

## Attachment A: Organics Management Resources

**Beneficial Landscapes, Grasscycling and Leaf Mulching**

US Environmental Protection Agency. *Beneficial Landscaping.*
http://www.epa.gov/greenkit/landscap.htm

US Environmental Protection Agency. *Greenscaping with Native Plants.*
http://www.epa.gov/greenacres/

US Environmental Protection Agency. *Managing Leaves and Yard Trimmings.*
http://cfpub.epa.gov/npstbx/files/wiexleaves.pdf

Westchester County (New York). *Love 'Em and Leaf 'EM Campaign Toolkit.*
http://www.leleny.org/p/lele-toolkit.html

**Food Scrap Reduction and Recovery**

US Environmental Protection Agency. *Food Recovery Challenge.*
http://www.epa.gov/smm/foodrecovery/

US Environmental Protection Agency *& US Department of Agriculture. Waste Not, Want Not - Feeding the Hungry and Reducing Solid Waste Through Food Recovery.*
www.epa.gov/wastes/conserve/pubs/wast_not.pdf

US Environmental Protection Agency/West Coast Climate and Materials Management Forum. *Food Too Good to Waste Toolkit*.
http://www.epa.gov/smm/web-academy/2012/nov12.htm

King County (Washington). *Food Too Good to Waste.*
http://your.kingcounty.gov/solidwaste/garbage-recycling/too-good-to-waste.asp

**Backyard/Home Composting**

US Environmental Protection Agency. *Backyard Composting—it's Only Natural*
http://epa.gov/waste/conserve/tools/greenscapes/pubs/compost-guide.pdf

Backyard Composting Guide
http://aces.nmsu.edu/pubs/_h/H-110.pdf

Compost Methods
http://web.extension.illinois.edu/homecompost/methods.html#5

Community Backyard Composting Programs
http://www.bae.ncsu.edu/topic/composting/pubs/backyard-composting.pdf

Seattle Tilth. *Homemade Food Scrap Digester.*
http://seattletilth.org/learn/resources-1/compost/HomemadeFoodDigester.pdf

**Organics Management and Planning**

New Hampshire Department of Environmental Services. *Municipal Composting of Yard Waste*.
http://des.nh.gov/organization/commissioner/pip/factsheets/sw/documents/sw-3.pdf

Virginia Cooperative Extension. *Closing the Loop: Public-Private Partnerships for on-Farm Composting of Yard Waste*.
http://pubs.ext.vt.edu/452/452-233/452-233_pdf.pdf

Steven Sherman and David Shakel. *Waste Age*. *Green Acres: Rural counties in Oregon seek ways to increase diversion of organics*. Aug. 1, 2010.
http://waste360.com/Recycling_And_Processing/rural-organic-waste-diversion-201008

Clark County, Washington. *Example of an Organics Section in a Solid Waste Management Plan*.
http://www.ecy.wa.gov/beyondwaste/pdf/ClarkOrganics.pdf

New Mexico Recycling Coalition. *New Mexico Recycling Organics Guide*.
http://www.recyclenewmexico.com/pdf/Organics_Guide_2010.pdf

Oklahoma Cooperative Extension Service. *Rural Community Yard Waste Composting Systems.*
http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2861/F-887web.pdf

**Commercial and Institutional Food Scrap Reduction, Recovery, and Composting**

Food Waste Reduction Alliance, Best Practices & Emerging Solutions Food Waste Reduction Toolkit
http://www.foodwastealliance.org/wp-content/uploads/2014/04/FWRA_Toolkit_FINAL_0415141.pdf

US Environmental Protection Agency. *Shopping for a Change*
http://www.epa.gov/wastes/conserve/foodwaste/success/ma-shop.pdf

Ohio Food Scrap Recovery Network. *Various Resources.*
http://www.ohiogrocers.org/foundation/green-scene/composting-diversion.php

US Environmental Protection Agency. *Food Scraps Go to the Animals*.
http://www.epa.gov/wastes/conserve/foodwaste/success/barthold.pdf

University of Minnesota. *Feeding Food Processing By-products to Livestock*.
http://www.mntap.umn.edu/food/resources/67-FeedingFood.htm

Cecil R., Jolin, J.D. & Jolin A. *Green Waste, Dark Gold…Commercial Opportunities In Organic Wastes & Soil Building (A Toolkit).* www.ceedweb.org/PDFs/CommercialOrganicRecycling.pdf

Center for a Competitive Waste Industry. *Beyond Recycling: Composting Food Scraps and Soiled Paper.* 2010.
http://beyondrecycling.org/pdf_files/FinalReport.pdf

Chittenden Solid Waste District (CSWD). *Composting at Work Guide*.
http://www.cswd.net/wp-content/uploads/2010/10/Composting-at-Work-Guide_final.pdf

Greater Portsmouth Chamber of Commerce. *Compost Quick Start Guide*.
http://www.portsmouthchamber.org/Documents/Composting_Quick_Start_Guide.pdf

Washington State Department of Ecology. *Managing Food Scraps at Institutions and Agencies*.
https://fortress.wa.gov/ecy/publications/publications/0607033.pdf

Massachusetts Department of Environmental Protection. *Supermarket Composting Book*
http://www.mass.gov/dep/recycle/reduce/smhandbk.pdf

Skumatz Economic Research Associates Inc. *Diversion Research Studies: Commercial and Organics Recycling*. 2011
http://www.swmcb.org/sites/default/files/mndiversionresearchstudies_serarevisedreport_final_v3_0.pdf

**Adding Food Scraps to Collection and Composting**

Center for a Competitive Waste Industry. *Beyond Recycling – Composting Food Scraps and Soiled Paper.* January 2010. http://beyondrecycling.org/pdf_files/FinalReport.pdf.

U.S. Composting Council. *Best Management Practices for Incorporating Food Residuals into Existing Yard Waste Composting*. http://www.epa.gov/reg3wcmd/pdf/FR2YW_BMP.pdf

Econservation Institute. *Best Management Practices in Food Scraps Programs.*2010.
http://www.foodscrapsrecovery.com/EPA_FoodWasteReport_EI_Region5_v11_Final.pdf.

Freeman, J. & Skumatz, L. "Picking up the Scraps." *Resource Recycling*. January 2012.
http://www.resource-recycling.com/images/Skumatz_0112rr.pdf

Yepsen, R. "Residential Food Waste Collection in the U.S." *BioCycle*, January 2012.
http://www.biocycle.net/wp-content/uploads/2012/02/bc120123.pdf

Shakman, A. & Sobanski, B. "Leading Systems and Methods to Manage Pre and Post-Consumer Food Waste."
http://c.ymcdn.com/sites/www.fcsi.org/resource/resmgr/americas_kc/fcsi_kc_shakman_sobanski.pdf

US Composting Council. *Adding Food Residuals to Yard Trimmings Compost Sites* (Webinar Presentations)
http://compostingcouncil.org/adding-food-residuals-to-yard-trimmings-compost-sites/

Georgia Department of Community Affairs. *Source-Separated Organics Recycling Toolkit.*
http://www.dca.state.ga.us/development/PlanningQualityGrowth/programs/SWMrecyclingAssistance.asp

**State Compost Regulations**
Summary of Compost & Compost-Related Fertilizer Regulations in the Northeast States
http://www.nerc.org/nerc-resources/search-for-resources/summary-of-compost-and-compost-related-fertilizer-regulations-in-the-northeast-states?src=1

USCC State Compost Regulations
http://compostingcouncil.org/state-compost-regulations-map/

**Compost Operators Training**
Maine Compost School
http://www.composting.org/

United States Composting Council. *A Practical Safety Manual for the Compost and Mulching Industry.*
http://compostingcouncil.org/admin/wp-content/uploads/2011/10/composting-safety-manual.pdf

United States Composting Council Operators Training
http://compostingcouncil.org/training/

DSM Environmental Services, Inc. *Yard Waste Composting Operator Training Manual.* 2004.
http://www.dnrec.delaware.gov/whs/awm/Recycling/Documents/Composting_Operator%27s_Manual.pdf

Virginia Cooperative Extension. *The Virginia Yard Waste Management Manual*. 2009
http://pubs.ext.vt.edu/452/452-055/452-055_pdf.pdf

**General Composting Resources**
United States Composting Council
http://compostingcouncil.org/resources/

US Composting Council. *Seal of Testing Assurance.*
http://compostingcouncil.org/sta-benefits/

Cornell Composting
http://compost.css.cornell.edu/index.html

Cornell Composting. *Composting Factsheets.*
http://cwmi.css.cornell.edu/factsheets.htm

Center for Environmental Economic Development. *Green Waste, Dark Gold…Commercial Opportunities in Organic Wastes & Soil Building (A Toolkit).*
www.ceedweb.org/PDFs/CommercialOrganicRecycling.pdf

Maine Compost School Resource Library
http://www.composting.org/references.htm

Maine Compost School. *Composting Terminology*
http://www.composting.org/MAINE%20COMPOST%20SCHOOL%20COMPOSTING%20TERMINOLOGY.htm

US Environmental Protection Agency. *Tribal Composting Nourishes Land and Tradition*.
http://www.epa.gov/wastes/wyl/tribal/pdftxt/twj-4.pdf

University of Wisconsin-Madison, Center for Integrated Agricultural Systems. *The Art and Science of Composting - A Resource for Farmers and Compost Producer.*
www.cias.wisc.edu/wp-content/uploads/2008/07/artofcompost.pdf

Highfields Center for Composting, Technical Materials
http://www.highfieldscomposting.org/resources.htm

New Jersey Department of Environmental Protection. *New Jersey's Manual on Composting Leaves and. Management of Other Yard Trimmings.* www.nj.gov/dep/dshw/rrtp/compost/combined_manual.pdf

Levis, J.W.; Barlaz, M.A.; Themelis, N.J.; & Ulloa, P. "Assessment of the State of Food Waste Treatment in the United States and Canada." *Waste Management*. 2010.
http://www.seas.columbia.edu/earth/wtert/sofos/Food_Waste_Web_Barlaz_Themelis.pdf

Recycled Organics Unit
http://www.recycledorganics.com/index.htm

USDA, Natural Resource Conservation Service, Soils
http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/

Institute for Local Self-Reliance, *Growing Local Fertility: A Guide to Community Composting*
http://www.ilsr.org/size-matters-report-shows-small-scale-community-based-composting/

Institute for Local Self-Reliance, *State of Composting in the U.S.*
http://www.ilsr.org/state-composting-us-what-why/

**Compost Recipe Development and Technology**

Highfields Center for Composting, *Recipe Development Worksheet.*
http://www.highfieldscomposting.org/resources.htm

**Compost Marketing**

Northeast Recycling Council. *Compost Marketing Resources*.
http://www.nerc.org/compost_marketing/

United States Composting Council. *Field Guide to Compost Use.*
http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/1330/Field_Guide_to_Compost_Use.pdf

**School Composting and Cafeteria Food Waste Reduction**
Northeast Recycling Council. *School Waste Reduction, Recycling, and Composting.*
http://nerc.org/nerc-resources/search-for-resources

Cornell Composting. Cornell Composting in Schools
http://compost.css.cornell.edu/schools.html

Connecticut Department of Energy and Environmental Protection. *School Composting…The Next Step in Recycling A Manual for Connecticut Schools.*
http://www.ct.gov/deep/cwp/view.asp?A=2718&Q=325392

**Special Event Composting**
Northeast Recycling Council. *Special Events Composting Guide and Case Studies.*
http://nerc.org/documents/guidance_for_special_event_food_waste_diversion.pdf

**Anaerobic Digestion**
California Department of Resources, Recycling, and Recovery. *Statewide Anaerobic Digester Facilities for the Treatment of Municipal Organic Solid Waste*. February 2011.
http://www.calrecycle.ca.gov/swfacilities/Compostables/AnaerobicDig/DPEIR.pdf

Humboldt Waste Management Authority. *Permitting Toolkit for Food Waste Anaerobic Digesters*. March 2013.
go.usa.gov/bfYY

**General Rural Solid Waste Management Resources**
Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources Oklahoma State University. *A Guidebook for Rural Solid Waste Management Services*.
http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2870/SW%20Guidebook%208.5x11.pdf

California Department of Resources Recycling and Recovery (CalRecycle). *Rural Jurisdiction Waste Disposal Reduction Resource*.
http://www.calrecycle.ca.gov/lgcentral/rural/

National Agricultural Library. *Alternatives to Waste Disposal*.
http://www.nal.usda.gov/ric/ricpubs/waste.html

**Compostable/BioPlastics**
California Organics Recycling Council. *Compostable Plastics 101*.
http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/8095/Compostable%20Plastics%20101%20Paper.pdf

Cedar Grove Test Results
http://www.cedar-grove.com/acceptable/Accepted%20List.asp
Cedar Grove operates several composting facilities in Washington. The company does "compostability" tests on compostable products. The results of these tests determine which products they will accept into their feedstock.

United States Composting Council. Compostable Plastics Task Force, Various Resources
http://compostingcouncil.org/compostable-plastics-task-force/

**Disaster Debris Management**
Northeast Recycling Council. After the Disaster: A Guide for Residents & Small Businesses about Managing Debris Waste
http://nerc.org/documents/debris_management_guide.pdf

North Dakota Department of Health, Division of Waste Management. Various publications.
http://www.ndhealth.gov/wm/Publications/

New Jersey Disaster Debris Management Planning Tool Kit
http://www.nj.gov/dep/dshw/toolkit.pdf

**Additional Resources**

United States Environmental Protection Agency (EPA). *Information on Backyard Burning*.
http://www.epa.gov/oaqps001/community/details/barrelburn.html

United States Environmental Protection Agency (EPA). *WasteWise*.
http://www.epa.gov/osw/partnerships/wastewise/retrac.htm

*BioCycle Magazine*.
http://www.jgpress.com/biocycle.htm

N.C. Division of Pollution Prevention and Environmental Assistance. *Contract Grinding: An Alternative to Large Equipment Purchasing.*
infohouse.p2ric.org/ref/26/25000.pdf

US Environmental Protection Agency. *Organics and Climate Change*.
http://www.epa.gov/climatechange/wycd/waste/downloads/organics-chapter10-28-10.pdf

Institute for Local Self Reliance. Summary of Select State Composting Regulations. April 2010
http://www.mwcog.org/uploads/committee-documents/Zl5ZWVla20100429093127.pdf

**Tribal Resources**

Tribes and Climate Change
http://www4.nau.edu/tribalclimatechange/tribes/greatlakes.asp

EPA Tribal Waste Journal: Tribal Composting Nourishes Land and Tradition
http://www.epa.gov/epaoswer/non-hw/tribal/pdftxt/twj-4.pdf

Yurok Tribe Environmental Program. *Reducing Backyard Burning on the Yurok Indian Reservation*.
http://www4.nau.edu/itep/waste/HazSubMap/docs/Burning/YurokBurnBrochure.pdf

## Attachment B: Organics Management Needs Assessment

Implementing or expanding an organics management system requires both an understanding of program goals and knowledge of existing solid waste management services and resources. Assessing existing solid waste collection services, equipment, and staffing helps decisionmakers and staff determine available resources for implementing or expanding organics collection and/or processing. Knowing what opportunities are available will help in assessing what is needed to meet short-term and long-term local and regional planning goals.

The questions below are meant to offer a quick look at what's available and what's potentially needed. A more in depth needs assessment or plan will require more detailed information.

Community Profile

Community Name:
Contact person: Email & Phone:
Administrative structure:

Population:
Is there a significant transitory population?
- Second home owners:
- Tourists:
- Students:

Other comments on the community:

Outline of current solid waste management system

Describe how trash and recyclables are collected:
Is collection provided curbside, transfer or drop-off centers, or combination?

Is service provided by government or private sector? If private sector, is it contracted by local government or do residents subscribe for services?

*If a drop-off system is used*:

Are drop-off or recycling centers owned by local government?

Is there space available at collection centers or some other publically owned space for drop-off organics collection?

If the drop-off system is owned by a private sector company, is there a potential to add organics collection at a site?

Is yard waste (brush, leaves, Christmas trees, etc.) already collected at a site? Describe acceptable materials and how they are collected (containers, deposited on the ground, etc.):

*If curbside residential service is offered*:

What is collected curbside?:
Trash
Recycling
Yard Trimmings (describe materials allowed – leaves, grass clippings, brush)

Is curbside offered by private hauling companies through contracts or open subscription services?:

If yard waste is collected, is it collected only seasonally? (Describe):

Are materials collected in carts, bags (paper or compostable plastic) or lose?:

Is the service provided by the municipality, private sector hauler, or other entity?

Organics management goals and opportunities

Existing organics management processing:
Describe what is processed (such as leaves), how materials are are processed (chipped for mulch, composted, landfill cover, etc.), where materials are processed (onsite, transported offsite), and who provides the services (municipality, private sector):

*Goals for new or expanding existing program*:
Include: goals to add new organics (such as food scraps); begin composting of collected organics; other

Anticipated volumes and types of organic wastes to be managed (either through a new program or expanding an existing program):

Are there existing solid waste facilities (e.g. landfills, transfer stations, recycling centers) to which organics can be directed for processing?

Is there equipment at existing solid waste facilities (or owned by the municipality or private sector operator) which can be used for collection (space or dumpsters) and/or processing organics (front loader)?

Is staffing available at existing solid waste facilities who could manage collection and/or processing of organics?

Are there local private sector companies which may be interested in processing—grinding or composting—collected organics?

Exploring Options

What are anticipated costs and benefits for implementing or expanding organics management?

Collection – how will materials be collected?

- *Consider*: hauling requirements—municipal or private sector; contracted or subscription; drop-off containers; curbside collection—hauling, containers.

Processing options – onsite vs. offsite

- *Consider*: property/space requirements; site development needs; any structures needed; equipment needs; professional services needed (site design). Also consider ongoing operating costs, including: personnel; utilities; supplies; contracted services; promotion; leases (specify); equipment maintenance; insurance

- If offsite processing – how will materials get to the processing site.

Are leasing services available locally for grinding? Compost site operation? Equipment rental or leasing?

*Funding Options and Cost Savings*

- Tip Fees
  - Residents
  - Landscapers & other small commercial generators
  - Haulers
  - Keep fees lower than solid waste tip fees
- Sales of compost & mulch
- Cost Savings
  - Sharing equipment & labor
  - Used equipment
  - Calculating avoided disposal costs
  - Reduced soil & fertilizer purchase costs achieved through the use of finished compost

<u>Regional Resources</u>

Are there additional technologies or programs not currently in operation or available in that can possibly be explored? Such as including food scraps in wastewater treatment programs, if anaerobically processed or co-composting with wastewater treatment sludge (biosolids).

How can the community incorporate disaster debris planning into organics management planning. Recyclables collection is provided through curbside services and drop-off sites.

Is there a landfill or other site owned by a regional entity (such as solid waste district or county) which may be an appropriate place for a processing operation?

Alternatively, is there a regional entity that has or may be willing to purchase equipment for hauling and/or processing of organics?

Or, perhaps there are opportunities for cooperative programs (shared equipment, labor, sites) with other local entities?