FOOD SCRAPS COMPOSTING ON COLLEGE/UNIVERSITY CAMPUSES:

A Step-by-Step Guide

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During the next 50 years, composting will in its own way be of greater total benefit to mankind than has the automobile….It is firmly believed that conservation of these wastes should become part of our way of life, or eventually our nations will suffer.

- Dr. John Snell (1964)

Former Head, Department of Civil Engineering, Michigan State University

INTRODUCTION

Despite nearly 150 years of repeated calls for recovering nutrients in discarded organic materials, composting has still not found its way adequately into the common practice of higher education institutions. With remarkably few exceptions, on-campus recovery and composting of discarded, uneaten food remains embryonic in its development. According to the Association for the Advancement of Sustainability in Higher Education, only 15% of its member institutions (institutions more likely to embrace sustainability initiatives) report having a campus composting program of any kind, let alone a food scraps composting program specifically.

Several have described the recovery and composting of discarded uneaten food as the final frontier in recycling, but clearly leadership in this particular initiative is sorely needed. Citizens turn to higher education to be the vanguard of that change.

This eBook is intended to serve as a guide for campuses that want to embrace reforms that will contribute to a more benign relationship between humans and the planet. It will allow higher education to practice what it teaches and lead by example with the recovery of discarded, uneaten food, on-campus composting of the food scraps, and the actual use of the compost to restore the fertility and vitality of campus soils so that they are capable of producing farm-to-table food that will be served on campus. That is reconciliation, resilience, and sustainability in action!

STEP 1: CONDUCT A FOOD SCRAPS RECOVERY AUDIT

The first step in a food scraps recovery and composting project is to determine the amount of discarded uneaten food that is generated on campus. This includes both prep waste (pre-consumer) as well as plate scrapings (post-consumer). There are highly experienced professionals available either to conduct such an audit or to provide guidance about how to conduct one. The U.S. Environmental Protection Agency also offers guidance on how to conduct an audit.

The protocol to conduct an audit is also ideal for student involvement. The data collected during the audit are essential to assure that whatever technology is used to transform the food scraps into compost is sized appropriately and to determine the amount of additional components, if any, that will be needed. The audit is also critical to determine the economic benefits of on-campus composting. Knowing the hauling and tipping fees associated with removing the discarded uneaten food from campus will allow for a comparison with the cost to operate a composting system on campus.

STEP 2: SELECT TECHNOLOGY TO PROCESS THE FOOD SCRAPS

There are several technologies available for addressing discarded uneaten food on campuses. Some are clearly consistent with the concepts of reconciliation, resilience, and sustainability while others treat discarded uneaten food as a waste product simply to be disposed of as easily as possible.

OFF-CAMPUS FOOD SCRAPS COMPOSTING OPTIONS

The first question to be answered is if the composting is to take place on or off campus. If the answer is off campus, then the primarily considerations will be the hauling and tipping fees. The hauling fee is the fee a waste hauler charges for transporting the discarded uneaten food from the campus to a management facility. This fee is associated with the distance to the management facility. The tipping fee is the fee the management facility charges to accept the discarded uneaten food and is associated with the type of management facility.

The three most common off campus options are:

- Landfill
- Incinerator
- Composting Facility

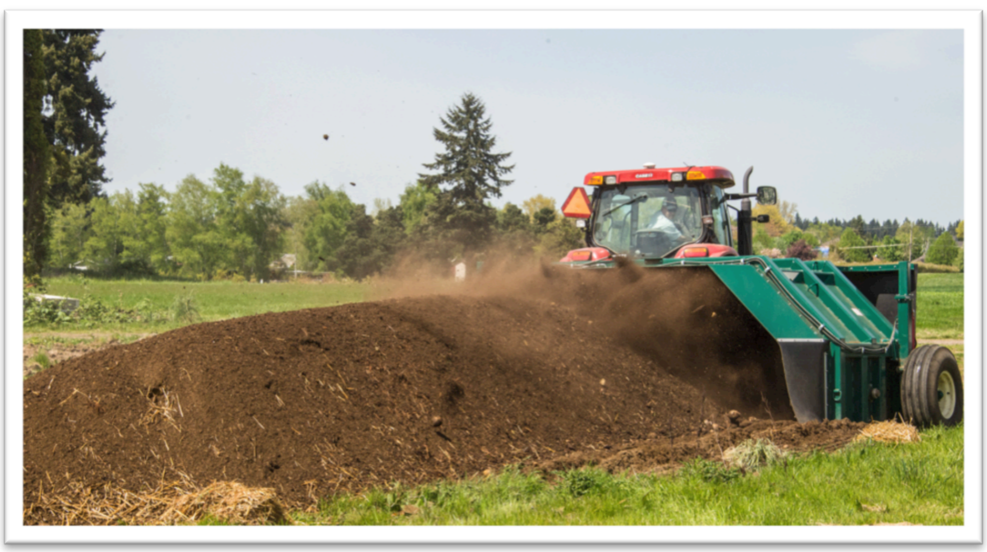
The first two have serious negative environmental consequences. When discarded uneaten food and other organics are landfilled, they are the primary source of methane emissions from the landfill. They also contribute to the formation of leachate because of their high water content. When discarded uneaten food is burned in an incinerator, its high water content reduces the efficiency of the facility often forcing it to burn fossil fuels to maintain the required combustion temperature for maximum efficiency.

ON-CAMPUS FOOD SCRAPS COMPOSTING OPTIONS

STATIC PILES & WINDROWS

These can be both aerated and non-aerated. Static piles must be turned regularly to mix the material to assure appropriate decomposition. Static piles require several months to transform discarded uneaten food into compost. Since they are open to the environment, they may attract undesirable pests and produce unpleasant odors and leachate. If not aerated properly, they will also produce methane emissions.

A windrow is an elongated pyramidal shaped row. If the campus is large enough to permit one, it also must be turned regularly, and is subject to the same detractors as static piles, only on a much larger scale. If either the static pile or the windrow is aerated, then energy demands increase substantially. If either is covered by appropriate material, the cost also increases. If heavy or specialized equipment is needed or required to turn the pile (especially in the case of a windrow), cost of equipment and skilled labor increases substantially.



BIODIGESTERS/DEHYDRATORS

These composting options use either enzymes or proprietary bacteria to liquefy organic matter so that it may be discharged into the sanitary waste water system, or dehydrate the food scraps to produce a dried material that may be added to soil as an amendment.

Biodigesters and dehydrators, while relatively simple to operate, tend to use much more energy than aerobic in-vessel rotary drum digesters and there are serious questions about the potential harm the effluent from biodigesters causes to pipes and wastewater treatment facilities.

Technologies that simply liquefy uneaten food and flush the effluent into the waste water line are not consistent with the concepts of reconciliation, resilience, and/or sustainability. It is true that they reduce the amount of discarded uneaten food that needs to be transported off the campus; however, they neglect the potential role of the nutrients in discarded uneaten food in restoring soil vitality.

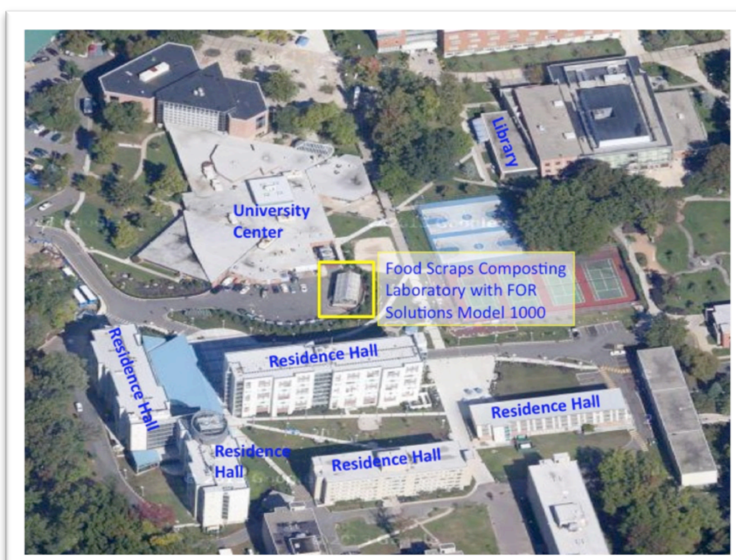
AEROBIC IN-VESSEL ROTARY DRUM SYSTEMS

These systems are sealed cylindrical drums where food is digested by bacteria already present in the food. Aerobic in-vessel rotary drum technology transforms discarded uneaten food into nutrient-dense compost that may be used as a soil amendment in landscaping as well as in food growing applications. Food and dining services on college and university campuses that recover discarded uneaten food, compost it on campus, and use the compost to grow food that is served on campus are quite possibly the most fertile ground for the creation of a vision for reconciliation, resilience, and sustainability in practice.

Aerobic in-vessel rotary drum technology also requires a very small footprint compared to the amount of discarded uneaten food being processed; therefore, it may be possible to situate the system very close to where the discarded uneaten food is actually generated. This will reduce transportation concerns and costs as well as reduce greenhouse gas emissions associated with transporting the discarded uneaten food to the site where it is processed.

Other advantages of aerobic in-vessel rotary drum composting include:

- No offensive odor
- Low energy consumption
- No undesirable pests attracted
- No leachate or greenhouse gas emissions
- Very fast processing time



STEP 3. ESTABLISH THE FOOD RECOVERY PROTOCOL

Regardless of the technology selected to manage the discarded uneaten food that is generated on campus, a workable protocol to collect this food must be carefully developed.

PREP WASTE

Collecting discarded uneaten food from the kitchen areas is relatively simple. Collection buckets are placed at all of the prep areas. Chances are, the food service workers are already placing their discards into garbage buckets, so the transition to placing them in recovery buckets should be uncomplicated. A covered 10-gallon bucket is ideal because when full of a mixture of foods, it will weigh about 38 lbs., which is an amount that an average person is able to lift.

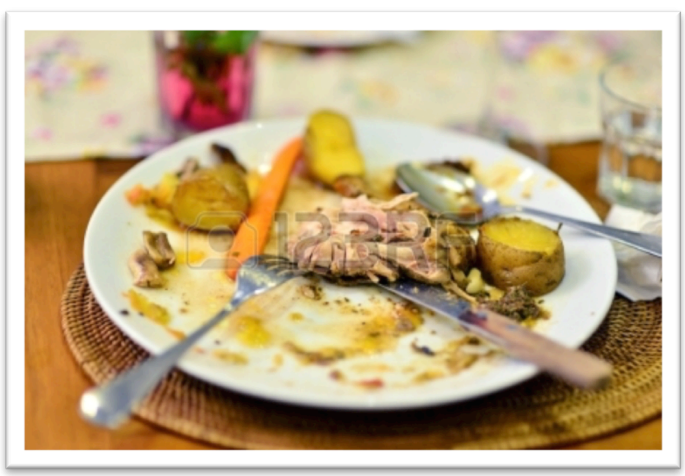
The type of technology selected will determine the type of prep discards that may be recovered. For example, with an aerobic in-vessel rotary drum system, all discards including bones, shells, raw and cooked meat, and dairy may be recovered. Other technologies may not accept these items.

PLATE SCRAPINGS

Collecting food that diners do not eat is possible by several different protocols. One option involves them placing their trays or plates on a carousel that delivers them to the dishwashing areas where a food service worker scrapes the uneaten food into a 10-gallon collection bucket. The type of technology selected will determine if napkins or compostable flatware and/or serviceware may be placed in the buckets. Aerobic In-vessel rotary drum systems accept both provided the Biodegradable Products Institute certifies them as compostable.

Another option is to have students, faculty, and staff take an active and participatory role in the recovery of the discarded uneaten food. With this protocol, collection buckets are strategically placed in the actual dining area(s) so that the diners may themselves scrape their plates. An advantage of this protocol is that it has the potential to raise the awareness of the diners of the amount of food they waste. A possible disadvantage is that they may not be as conscientious as the food service worker in making certain that no contaminants are placed in the collection bucket. Contaminants may include single serve condiments (Which should be eliminated regardless of whether or not a food recovery program is in place!), flatware or serviceware, and personal belongings. Another option is that food service staff collect plates or trays and either deliver them to the dishwashing area or scrape them.

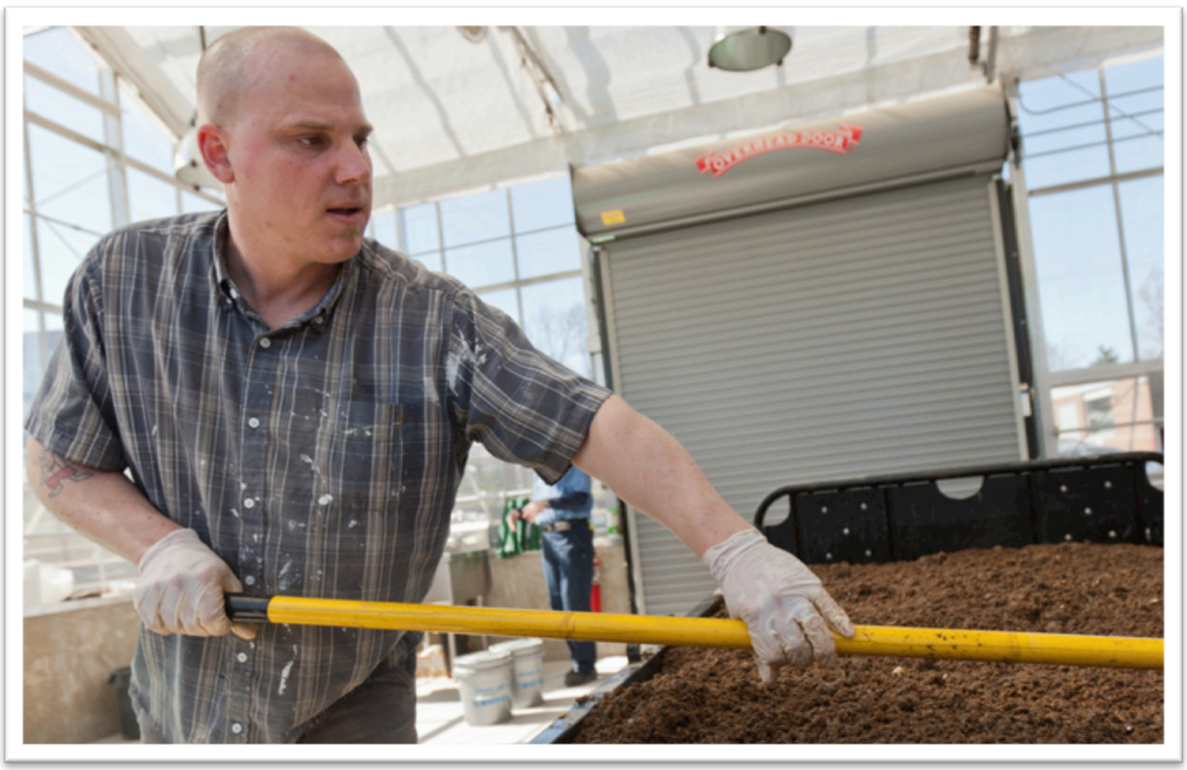
Regardless of the protocol selected, training of both the food service staff and diners is necessary. An aggressive communication/ education campaign designed to elicit the desired behaviors of all participants should be developed and implemented.



STEP 4. IMPLEMENT THE TECHNOLOGY AND TRANSFORM THE FOOD SCRAPS INTO COMPOST

TRAIN PERSONNEL

The first step in implementing the technology is to train the personnel that will be collecting the discarded uneaten food as well as those that will be processing it. An important part of that training is to provide them with a tour and explanation of the composting facility so that they would be able to identify with what was being accomplished and so that they develop a sense of ownership of the project. They need to be made to believe that they are an important part of the success of the project.



CONSOLIDATE FOOD SCRAPS

If on-site, aerobic in-vessel rotary drum digestion is the technology selected, then the following procedures are recommended. The process begins by consolidating buckets of discarded uneaten food into as few as possible. It is highly probable that some buckets delivered to the composting facility will not be full. It actually saves time by consolidating the buckets so that they are as full as possible rather than processing buckets that are not.

The next step involves weighing each bucket and recording the weight, preferably in an electronic spreadsheet. This serves two important functions. First, it leads to the determination of the amount of bulking agent/carbon source (to be discussed next) needed and it quantifies the amount of food scraps being diverted from a landfill or incinerator.

Second, composting discarded uneaten food may make your college eligible for an Innovation in Design credit for LEED certification. It may also be helpful in meeting the requirements of the American College and University President's Climate Commitment if the President of your institution has signed it. The Carbon Storage Due to Composting Field of the Sequestration and Carbon Storage category of the Greenhouse Gas Report provides the opportunity to report the carbon dioxide stored as a result of your composting program.

CHOOSE THE BULKING AGENT/CARBON SOURCE

Once the weight of the discarded uneaten food is determined, it is possible to determine the amount of the bulking agent/carbon source (BA/CS) that is needed. The purpose of the BA/CS is to:

- Absorb the excess moisture that will be found in the food scraps
- Adjust the carbon:nitrogen ratio of the feedstock being deposited into the digestion drum
- Maintain porosity within the feedstock once it is in the digestion drum

The best option is kiln-dried wood shavings (not saw dust). Other options are available, such as cardboard, landscape debris, etc.; however, the low-moisture wood shavings perform vastly better than the other options. Kiln-dried wood shavings are readily available from a variety of sources, often for free. According to the EPA, 6.4% of the municipal solid waste stream in 2011 was wood that might be used for this purpose. Even if it has to be purchased, the cost is often very small, often around $0.05/lb.

SHRED THE FOOD SCRAPS

Once the discarded uneaten food and the BA/CS have been weighed (now called the feedstock), they are dumped into a hopper that leads to a shredder that reduces the size of anything passing through to roughly the size of a sugar cube. This size reduction contributes to an acceleration of the digestion process in much the same way that chewing food does so for humans.

The feedstock passes into a fully enclosed screw conveyor (think cork screw) that moves the material to the digestion drum much like the esophagus moves food humans have chewed to their stomach.

LET NATURE TAKE ITS COURSE

Once the feedstock is inside of the digestion drum, nature does the rest of the work. No bacterial inoculant is necessary. The bacteria needed to digest the food are already on or in it. Humans ingest them when they eat food and they perform the same service as they do inside of the digestion drum.

No heating element is needed as the heat of metabolism of the bacteria is sufficient to raise the temperature of the feedstock being digested to between 135°F and 140°F. This is sufficient to kill any undesirable bacteria such as *E. coli*, Salmonella, and Staphylococcus.

The digestion drum rotates on a prescribed schedule. The rotation contributes to breakdown of the feedstock by a tumbling action.

Because the digestion drum is on a slight down-angle, as the drum rotates the feedstock migrates toward the discharge end of the drum much like food moves through the digestion system of a human. Fresh air is also introduced on a prescribed schedule. The fresh air keeps the odor very low to un-noticeable.

After five days, the uneaten food and BA/CS has been transformed into nutrient-dense compost that is ready to be incorporated into soil as an amendment to restore the vitality and productivity of it.

Aerobic in-vessel rotary drum digestion may be used with either a batch or through-put protocol, with through-put being the most common. Batch loading means loading the digester to its operational capacity, letting the digestion process occur over the 5-day period, and then off-loading the entire contents of the vessel. Through-put processing means loading the digester with an amount the system was designed to process on a daily basis. Once the system is filled to its operational capacity, the off loading process is ready to begin. For every day that food scraps are loading and equal amount of compost is off loaded. The flow through the digester is one-way; much like the flow through the human digestive system is one-way under normal, healthy conditions.

STEP 5: USE THE COMPOST AS A SOIL AMENDMENT

Much has been written about the importance of cradle-to-grave or, more recently, cradle-to-cradle use insofar as recycling is concerned. This is especially critical when recovery of discarded uneaten food is considered. Simply recovering discarded uneaten food and composting it does little to contribute to sustainability if the compost is not used to its fullest potential, which as a soil amendment to restore nutrients to soil that is used to grow food. A secondary fulfillment of its potential is as a soil amendment to restore nutrients to soil that is used to grow plants for landscaping or decorating purposes. There is a large and growing body of literature that documents the benefits of using compost as a soil amendment to improve soil productivity.

Farm-to-cafeteria opportunities are becoming more popular in higher education; however, they are far from realization of their fullest potential. There are only “150 farm-to-cafeteria programs involving colleges or universities in the U.S. and Canada.” This represents well less than 5% of all campuses! Certainly, there is room for improvement.

If there is no opportunity to use the compost for on-campus purposes, it may be sold, provided there are no local or state regulations prohibiting its sale. It may also be given away to community members.

STEP 6: ADDITIONAL OPPORTUNITIES

Composting discarded uneaten food generated on campus provides an outstanding opportunity to engage and inspire student involvement. Federal work-study students may be employed each semester to work on the project. A course about composting in general and aerobic in-vessel rotary drum technology specifically may be developed and offered. The composting project and the compost could be the focus of instructional units in a variety of courses including but not limited to biology, chemistry, microbiology, and ecology.

“Higher education institutions bear a profound moral responsibility to increase the awareness, knowledge, skills and values needed to create a just and sustainable future.”

- The Essex Report

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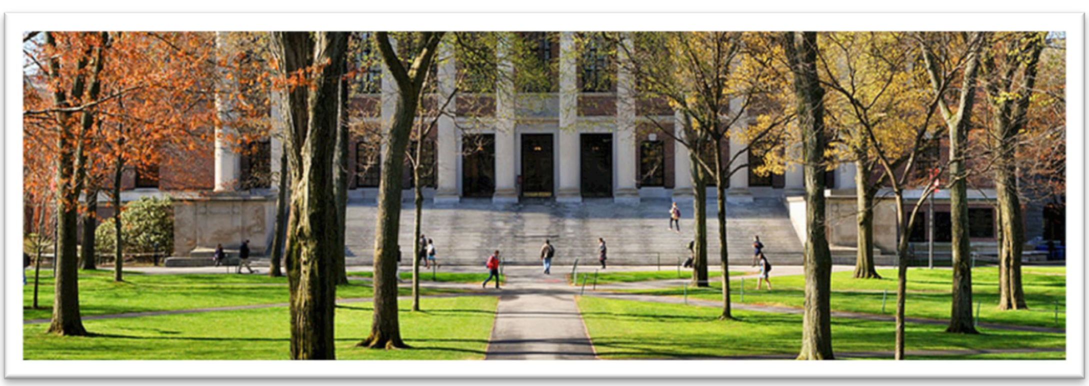
CONCLUSION

With over 4,200 college/university campuses in the nation, if each institution were to recover and compost all of the discarded, uneaten food on campus, the resultant reduction in greenhouse gas emissions, such as carbon dioxide, as a result of eliminated transportation would be roughly equivalent to removing tens of thousands of vehicles from the road. If all of the food scraps generated in the nation in just one year were composted using on-site, aerobic in-vessel rotary drum digestion that figure increases to millions.

Additionally, methane emissions would be reduced dramatically because the discarded uneaten food would not be buried in a landfill. According to the Intergovernmental Panel on Climate Change, methane has a 20-year global warming potential over 70 times that of carbon dioxide. Lastly, when the compost is used in landscaping projects, the carbon in it is sequestered in the soil and removed from the atmosphere. The nutrients in the compost also improve the biological activity of the plants growing in the area, which results in still more sequestration of carbon in the biomass of the plants.

Borrowing from Rachel Carson and a statement she made in *Silent Spring*, it is ironic to think that humanity might reconcile its relationship with its planetary home and determine the resilience and sustainability of its own future by changing its behavior to compost discarded uneaten food locally or on-site. Before society as a whole is likely to embrace this new paradigm of resource recovery and recycling, higher education must demonstrate its practicality.



OUR MISSION

The mission of FOR Solutions is to change the way people perceive discarded uneaten food from thinking of it as waste to thinking of it as a replenishable natural resource that has the power to revitalize Earth's soil.

To get more information about aerobic in-vessel rotary drum composting systems, click below to contact FOR Solutions - the only company with this patented technology.

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