Organic Wastes Management in the Most Densely Populated State

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Introduction

In 2012 Americans generated over 250m tons of trash; that means nearly every American produced about 4.38 lbs of solid waste each day (US EPA, 2012). Of the total volume of waste generated, some 12% (30m tons) was incinerated using waste-to-energy technology and about 35% (87m tons) was either recycled or composted (ibid.). That means the remainder – still about 54% of all waste – was sent to a landfill. While the ecological, economic, geographic, and social impacts of landfills are the subject of considerable debate among policymakers, citizen groups, and scientists alike, one thing that is certainly clear is that a huge amount of recyclable and compostable materials are sent to landfills every day. The US Environmental Protection Agency (or US EPA, 2012) estimates that of the 135m tons of material sent to landfills across the US each year, 21% (28m tons) is food waste, 15% (20m tons) is paper products, 8% (11m tons) is yard waste, and another 8% is wood. If recovered in a properly designed system, each of these materials could have significant economic and ecological value.

In addition to ecology and economy, there are important spatial benefits to preventing useful materials from entering the landfill. In New Jersey, the most densely populated state in the US, officials have long reported that dwindling landfill capacity is a mounting concern (NJDEP, 2001). As existing landfills in New Jersey approach their designed capacity and new landfills become virtually impossible to cite, preventing usable materials like organics from entering the state's landfills becomes more important with each passing year. In 2010, New Jersey generated 22 million tons of waste, 5,000 pounds per capita. While about 61% (13m tons) of New Jersey's solid waste is recycled each year (NJDEP, 2012); 10% (2.1m tons) is incinerated and 30% (6.5m tons) is landfilled. If the US EPA estimate regarding the composition of landfilled materials can be applied to figures for New Jersey, then 52% of the material sent to New Jersey landfills (3.4m tons) should be organic – and thus rather than landfilled, be composted or treated using other technologies.

In this white paper, we argue that the State of New Jersey and its various municipalities should implement aggressive tactics to reduce, capture and process the organic materials currently being sent to landfills. Proper management of organic wastes can reduce pressures on existing landfill capacity, reduce greenhouse gasses (Thompson et al, 2005), and even create jobs (Platt, 2014). While organics management technologies and processes already exist at multiple scales, ranging from the household, to large institutions like universities, to entire municipalities, we focus on the applications of composting to solving the state's problems with organics disposal. At the moment, there is only limited collection and processing infrastructure for organic materials in New Jersey. We argue that historically, many factors have come together to limit the collection and processing of organic materials, including state policies, waste management economics, and public perception problems, but also offer some examples of successful organics management programs whose lessons could be implemented in New Jersey.

What's the Deal with Composting Technology?

Compost is the result of various organic materials such as yard waste, manure, and food scraps breaking down into a useable form of fertilizer. In a typical composting process, microorganisms, moisture, and oxygen are the key to breaking down organic materials. Dry and anaerobic composting is possible, but is more difficult and less widely used, therefor will not be discussed in this paper.

The composting process can be either static or dynamic. Static composting is a very slow process that can take months to complete. Basically, a compost pile is built and then left alone until it is finished. Dynamic, or hot composting, takes a much more hands on approach. The compost pile is monitored and turned, which increases heat and speeds up breakdown of feedstocks. The result is a more uniform compost that is produced in a relatively short period of time. According to Haug (1993), a good finished compost turns biologically putrescible organics into a stabilized form and destroys organisms pathogenic to humans. It is also capable of destroying plant diseases, weed seeds, insects, and insect eggs. (p.2)

Each type of organic material, or feedstock, contains a carbon to nitrogen ratio; in a finished compost, the ideal ratio of carbon to nitrogen should be about 30:1. This ratio is important because too much carbon may slow the process and too much nitrogen will produce odor, both of which can deter people or communities from composting at all. As Haug (1993) explains, engineering of compost is often conducted using a “handbook” approach with little knowledge of how to control the forces that achieve the end product. Fortunately, several technologies that can be applied to successful composting at multiple scales, from the individual home to institutions like universities and hospitals.

Technologies for Households

The simplest form of composting is backyard composting, in which individuals create a small compost using household organic wastes such as kitchen scraps, newspaper, and yard wastes. According to Colon et al. (2010), backyard composting presents potential benefits in comparison to industrial composting because it avoids the collection of these wastes reducing economic and energy investments as well as requiring less land use and more control of the process and the feedstocks being treated. Backyard composting is exempt from most regulations because adverse impact potential is minimal (Haug, 1993), although improperly conducted, Colon et al. (2010) also noted that problems with slow decomposition, flies, rodents, and odors can result.

At the same time, studies by Anderson et al. (2011) and Colon et al. (2010) have found that backyard composting performed better than incinerating or landfilling for most categories of potentially negative environmental impacts with the exception of the releases of greenhouse gases that contribute to global warming. There are many paths to successful backyard composting, with the simplest being a static pile of virtually any size in which feedstocks are layered on the ground or in a trench and left to microorganisms to be broken down. A dynamic pile can also be utilized simply by monitoring and turning the compost at regular intervals. While static and dynamic piles are ideal for those living on large lots in which an open air compost will not become a nuisance, even on small lots, if managed properly, an open pile is a viable option.

In other, more dense, living situations, a compost bin or barrel can be utilized. These can contain odors, deter rodents, speed up the composting process, and allow for portability. Bins and barrels can be purchased or built out of a variety of materials including wood, plastic, bricks, or even bales of hay; Ermolaev et al. (2013) has found that the type of bin on this scale does not significantly influence the composting process. Container composting in this fashion can be complemented by the addition of red worms, a technique called vermicomposting, and which can produce a potting soil type substance (EPA, 2015).

Technologies for Municipalities and Institutions

Composting at scales larger than the individual household faces significant compliance challenges at the municipal, state, and sometimes federal levels. These issues can be especially discouraging for more densely populated areas that do not have the open space suitable for composting operations. However, new technologies may help to solve this problem and make composting in small, densely populated areas a viable option. Several in-vessel composting systems have come on the market in the past decade, such as the Green Mountain Technologies Earth Tub, an in-vessel composting system that can be used for small facilities such as schools, restaurants and hospitals and can process up to 100lbs of organic materials per day on site. The unit contains a motorized auger to shred materials, a lever on the lid to turn the pile, and a floor air filtration system which draws air through the compost and removes odors. In two to three weeks, the volume is reduced by 50% and the finished compost is ready for curing, or drying (Green Mountain Technologies, 2012).

In-vessel options for larger scale composting that also include automation, portability, and expansion features are already being deployed around the country. For example, the Earth Flow is currently used by Colorado State University housing dining services and is monitored by student interns. Kitchen waste from two of the dining halls is composted and the finished product is used for campus landscaping projects. Though the initial investment for something like the Earth Flow system is close to $200,000, only one hour of labor for operation is needed per day and the long term costs compared to paying waste hauling fees would be lower (Bogardus, 2013). A similar project at Kean University, in New Jersey, produces appoximately one cubic yard of finished compost per day, which is utilized on campus. According to Nicholas Smith-Sebasto, Ph.D., Executive Director of the Center for Sustainability Studies at Kean University and supervisor of the program, the project is estimated to have avoided the emissions of nearly 13.5 metric cons of carbon dioxide equivalent and saved approximately 38 million BTUs of energy (Goldstein, 2013).

For even larger, municipal systems, several composting technology companies offer custom designs featuring concrete floors with pipes below the surface allowing a compost turner to efficiently water and move compost through temperature controlled aeration zones. Odors are controlled using bio-filters and bio-covers to meet air quality regulations. Water runoff is collected, treated, and re-used, greatly reducing leachate. Many designs use less than the surface area of a windrow system and cut the required composting time in half by maintaining temperature and oxygen control. But overall, the choice to keep compost production confined to small areas may not only be logistically practical, but economically practical as well. New Jersey's composting rules require any facility handling more than 10,000 cubic yards annually of materials secure a Class C permit from the New Jersey Department of Environmental Protection; costing some $30,000 for the first year and $16,000 per year thereafter. The state also requires permanent monitoring wells and does not allow outdoor windrows (Sullivan, 2012). These regulations have virtually precluded the successful operation of any large scale facilities in the state. Accordingly, we argue that setting up multiple on-site in-vessel systems would be the best way to implement composting on a city size scale, and would avoid many of the hassles and costs of Class C permitting.

Factors Limiting Composting Technologies

While composting organic waste presents many benefits, the actual use of composting systems in New Jersey is quite limited. The business of composting, however, is much more complex, especially at larger scales, and there are several limiting factors, including political, economic, and especially, perceptual issues. Composting and other forms of organic waste recycling are different than the recycling of other materials such as aluminum and glass in that they may become a putrescible nuisance if not handled properly. Therefore, while political and economic hurdles may be more easily overcome, winning the hearts and minds of the general public can be a more significant challenge.

Policy Factors

The New Jersey Solid Waste Management Act (NJSWMA) has provided the framework for the collection, transportation and disposal of solid waste in the state of New Jersey for almost forty years. The act has been amended many times, most recently in 2006, in order to stay current with trends and demands of the federal government, state agencies, and New Jersey municipalities. In New Jersey, counties are responsible for siting and maintaining landfills as well as developing comprehensive waste plans; municipalities are responsible for the collection and disposal of solid waste in accordance with those county plans. In addition, municipalities are also responsible for recycling programs and making them available to commercial, institutional and residential generators (NJ DEP, 2006).

Since 2000, several organic waste recycling initiatives began to take form in New Jersey. While at times they seemed to be gaining momentum, all eventually fizzled in part due to challenging regulations. Many of these regulations are meant to protect the environment and the community, but they can also be prohibitive to organic waste recycling. Previously, Class C permitting was discussed: in addition to the high costs and being difficult to acquire and maintain, the Class C permit grants only conditional use to composting facilities. Even though NJDEP preempts municipal zoning and planning authority, in other words, allowing zoning variances, for these types of composting facilities, many roadblocks to composting can be implemented by municipalities and counties, for example by failing to discuss composting facilities in comprehensive plans (and thus precluding their operation). Furthermore other state regulations can limit the implementation of composting, for instance by requiring facility buffer distances from other land uses or classifying food waste as a hazardous material (cf. Hayes, 2005).

Economic Factors

As mentioned previously, the costs of implementing any large scale composting operations have been extremely prohibitive, with permitting fees ranging in the tens of thousands of dollars. In addition to these fees, there can be significant expenses associated with the installation of equipment necessary for regulatory compliance.

Even at a smaller, institutional or municipal level, the costs for implementing and maintaining composting can high, although the opportunity to recover those costs is probably greater in the long run. For example, in a study conducted by Cornell University, an Earth Tub was installed at an urban hospital in New York was able to produce finished compost with no notable odor or pest problems. The hospital saved an average of $1,500 a year in disposal costs and a potential for revenue up to $2,000. These figures, however, did not include extra labor required to prepare the feedstock or operate the Earth Tub. Once those numbers were factored in, the Earth Tub was not found to be an economically viable option for the hospital. These types of systems have however, been successful at many universities, institutions, and municipalities who may use volunteers or interns for labor and maintenance. With the initial investment in an in-vessel composting system ranging from ten to two hundred thousand dollars, careful selection of appropriate methods and technology is vital to economic benefit.

Perceptual Issues

Composting facilities, both large and small, are often faced with opposition from communities in which they are sited. While many may agree that composting represents a useful and even desirable service, many residents do not want it in their community due to both real and perceived threats such as odor nuisances and pests. Essentially, the practice of composting must win public favor in order to be successful. In order to change public perception, several things must happen. According to Janet Pellichero, the coordinator for Princeton, NJ's recycling program and the leader of the only curbside community organic waste recycling program in the state, education is the key. Education must be paramount in all organic recycling programs, public or private. Much of the reason for failure of prior organics programs is contamination, something that can be prevented at the source through education.

But potentially more harmful to composting's reputation as both health hazard and public nuisance are the several failed attempts of large scale composting operations in New Jersey and surrounding states. The shut down of Peninsula Composting Group in Wilmington, DE is the most recent example of how the trust of a community can be lost by mismanagement of facilities. The closure of the facility, one of the largest on the US East Coast, in 2014 was due to overwhelming complaints of odor from surrounding residents in Wilmington and New Castle, as well as numerous regulatory violations. Since 2009, this facility had been accepting organic material from several surrounding states and many organics recycling programs in the region had relied on it, including New York City. While the long-term impacts of the facility's operation and subsequent closure on public perception remain to be seen, the incident has most likely damaged the image of composting into the foreseeable future.

Examples of Regional Composting Efforts

However, one way to reverse this negative perception is to establish successful composting programs at household, institutional, and municipal scales. When the public sees only failed attempts, the public will believe that composting is predisposed to failure. However, if several small programs are implemented with successful results, they will gain trust. Many of the communities and businesses who are the most supportive of organic waste recycling programs and are willing to pay for them, do not actually compost the material locally, but rather send it out of state or to large facilities to be processed. If these communities were willing to set the example by composting locally and showing positive results, more businesses and communities would be willing to take the risk. From our perspective, public perception will be improved via smaller facilities and on-site, in-vessel systems. As the following examples from Philadelphia's Compost Co-op illustrates, successful composting can happen without the public even being aware of its presence.

The Compost Co-op

Though the city has not taken on the actual execution of organic waste diversion programs, they do encourage them, and furthermore ordinances that require organic waste diversion by restaurants either through food processors installed in kitchens or alternatives such as paying for a separate organic waste pick up. Located in the Fishtown neighborhood of Philadelphia, the Compost Co-op is a service that picks up and processes both residential and business post consumer organics.

According to Jennifer Mastalerz, one of the founders of Compost Co-op, her business, as well as other successful private composters in the Philadelphia area do not have to contend with the regulations and prohibitive laws that exists in New Jersey. Mastalerz did not have to get any permits or licenses for her facility and the local government in Philadelphia and the Fishtown neighborhood have been cooperative, leasing her the lot at a very low cost. The composting operation, located in the middle of a densely populated urban area, has had no complaints about odor or pests and residents often do not even know that it is there or that composting is taking place.

When asked if she thinks that community composting on a small scale with support from local government is the most efficient way to implement the process, she replies that small scale composting avoids many of the problems that emerge from centralized facilities (Mastalerz, 2014). She has a relationship with community neighbors and residents adjacent to the facility and can quickly correct any issues that might arise.

We feel that a small-scale, neighborhood based composting program would be highly effective in mitigating many of the problems associated with organic wastes management, and offer a suite of policy suggestions to implement such a program.

Policy Suggestions

The demand in New Jersey for organic waste regulations has been relatively limited in the past, however interest in the sector of organic waste diversion has been rapidly increasing for the past several years. Many cities nationwide now have mandatory organic waste diversion programs, including many large cities surrounding New Jersey. Research suggests that it is only a matter of time before similar regulations are enacted in the state. Two bills were recently introduced to state Senate which would require organic diversion by large scale generators. In addition to the legislation that is being pushed for within the state, pressure from surrounding states has also generated much discussion among governing bodies on the subject of current waste management practices.

In light of the challenges facing management of organic wastes in New Jersey, we propose the following policy suggestions. In contrast to the typical impulse among policymakers and some segments of the solid waste industry to provide new types of 'centralized' service for new classes of waste (as has been the case historically, with, for example, curbside collection of recyclable materials), we propose a suite of policy interventions that emphasize decentralization, and, properly implemented, spur economic growth in the state while also protecting the natural environment and especially agricultural practices.

The first step would be for the State of New Jersey to prohibit the disposal of organic wastes in landfills in the state. Subsequently, this would necessitate action amongst either original waste generators (households and businesses) or commercial and/or municipal waste collectors to separate organic materials from the waste stream. Since we are advocating a decentralized organic waste management system, in conjunction with this landfilling ban on organic materials, we propose several ways of supporting organic separation and management at the household and business scale. The first of these would be for the State of New Jersey to empower county and municipal governments to impose fines or other punishments for non-compliance, in the same vein as rules related to recycling.

But, rather than rely simply on a 'negative' system of enforcement, we emphasize in our proposals a cost-sharing and incentive-based model for improving organic wastes management in the state. The first aspect of these policy supports would be to subsidize the purchase of in-vessel composting systems for homeowners and businesses. We suggest that homeowners be reimbursed 50% of the cost of an in-vessel system, including in-vessel systems that people construct themselves, wherein homeowners would be reimbursed 50% of the costs of the materials. For rental units, apartment buildings, and other multifamily dwellings, we propose that the owner of the property be reimbursed in the same fashion but also be obligated to provide an in-vessel composting system to tenants, of an appropriate size based on the number of residents and the average per capita volume of organic materials produced in the state, as determined by the NJ DEP.

We would reimburse businesses as individual firms, but also allow for businesses to pool resources to allow for economies of scale in organic waste management. For example, a group of restaurants in a town's CBD could pool funds to purchase a larger in-vessel system that would manage the organic wastes of firms involved in the agreement. Similar agreements might also be reached for multiple tenants in a single commercial building or complex, so long as the volume of organic material produced does not exceed the capacity of in-vessel systems.

If municipalities are unable to enforce a requirement that property owners and businesses engage in separation and on-site processing of organic wastes, due to contractual arrangements with a private hauler, for example, then we propose legislation that would superimpose 'organic waste management' districts onto the territory of the town. These districts would be based on a combination of population and estimated organic waste production. Districts would be centered on an appropriately sized in-vessel compost system intended to manage the organics produced by that district, and housed on municipal property.

In-vessel systems are available in a wide variety of sizes and have the ability to meet the demands of a variety of population sizes technology needs. Many of these systems may be expanded on as populations grow. Instead of building one large facility, smaller in-vessels systems may be expanded upon as needed, resulting in less initial investment. Managing organics on a small scale helps to avoid problems associated with current regulations and the nuisances and economic problems of large facilities. As problems occur, they can be addressed in a more timely and efficient manor.

While fines and/or other penalties would be used to enforce organic separation rules in the short term, we proposed a series of incentives for property owners and businesses to encourage long-term compliance. First, we propose that property owners receive a 0.25% property tax rebate for every year that they can demonstrate diversion of organic materials. Second, we propose a similar tax rebate for businesses that can demonstrate diversion of organic materials, and also, while the property tax rebate would be a flat percentage, that business rebate should increase over time and alongside the volume of material diverted. In other words, the longer a business (for example, a restaurant) complies with the organics regulations, the greater rebate that business should receive each year. We also propose that the rebate be proportional to the amount of material diverted – since greater producers of organic material would have higher costs in separating and managing that waste, their rebate should reflect those additional costs.

Third, in recognition that many private citizens and business owners alike know very little about how to compost or what to do with finished compost, we propose a public education campaign consisting of printed and, especially, electronic/web materials on the benefits and science of composting, instructions for effective, safe, and non-nuisance composting operations, and perhaps most significantly, recommendations on what users should do with finished compost.

While homeowners and many residential properties will be able to utilize the compost they produce on site – in yards, gardens, or other landscaping functions – we realize that businesses will most likely find themselves in a situation where they have more compost on hand than they could ever utilize. To this end, we propose a mechanism for the sale of compost, which, if implemented properly, would offset the costs of the equipment subsidy and tax rebates while also contributing to protection of the natural environment. Specifically, at sites which produce compost over the volume they can reasonably utilize on site, we propose that compost producers (including households and other dwellings) be allowed to sell their compost at a price set by the NJ DEP. The sale price should be set according to an index linked to the prices of topsoil, clean/screened fill dirt, and most importantly, the market price of synthetic fertilizers that properly produced compost could replace. We propose that this index seek a target price of approximately 50% the price of major synthetic fertilizers. Parties interested in selling surplus compost would first have to secure an annual license from the NJ DEP which reflect compliance with established quality and safety standards for compost production.

The compost sales program would directly benefit both farmers and the natural environment in the State of New Jersey. Farmers would be able to purchase a high quality soil amendment at a much lower price than they currently pay for synthetic additives. Compost utilized in place of synthetic fertilizers and other agrochemicals would contribute to organic farming practices, and their associated ecological and economic benefits. These include diminished air and water pollution, reduced worker exposure to toxins, reduced reliance on petroleum products, and the marketplace premium currently enjoyed by organic produce over ‘conventional’ produce. By extension this composting program would support sustainable farming techniques, as well as ongoing state and private efforts to protect and preserve agricultural lands and open space. Money collected from the sale of compost would be divided between the seller and the specific parts of State, county, and local government associated with the enforcement of fines/penalties, issuing of licenses, and especially the equipment subsidy, tax rebates, and education program.

Conclusions

In order to be ahead of any future regulations that may be imposed on them, businesses and institutions in New Jersey would benefit from taking the initiative to move towards organic waste diversion. In addition to the logistical benefits of being proactive, composting has been shown to benefit the environment, reduce costs associated with traditional waste removal and in some cases, generate income through sales of the finished product.

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