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Spring 2016

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Recommended Citation

Berg, Zoe; Dessauer, Leyana; and Fuentes, Jesse, "Composting at Sarah Lawrence College" (2016).

Campus Environmental Sustainability Project. 6.

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COMPOSTING AT SARAH LAWRENCE COLLEGE



By: Zoe Berg, Leyana Dessauer, and Jesse Fuentes

THE COMPOSTING PROCESS

- Composting is a biological method of transforming organic matter into nutrient-rich soil.
- Mesophilic bacteria, bacteria which are present in most organic matter and thrive at temperatures between 68 and 113 °F, begin the composting process by breaking down organic materials. This decomposition process results in the release of carbon dioxide and heat.
- As mesophilic bacteria break down compost, they cause the temperature within the pile to increase. This increase in temperature creates ideal living conditions for heat-loving thermophilic bacteria, which complete the decomposition process.
- Larger organisms, such as worms, also participate in the decomposition of the organic materials.
- As the temperature within the pile increases, many common strains of pathogenic bacteria are exterminated.
- Optimal decomposition occurs when the carbon to nitrogen ratio within the pile is 30:1.
- Compost piles should maintain a core temperature of between 140°F and 160°F in order for the microorganisms living within the pile to function optimally. If the temperature of the pile exceeds 160°F, the microorganisms responsible for breaking down the compost will die and the organic material will not evolve into compost.
- Excessive heat can be prevented through aeration of the compost via regular turning of the pile.

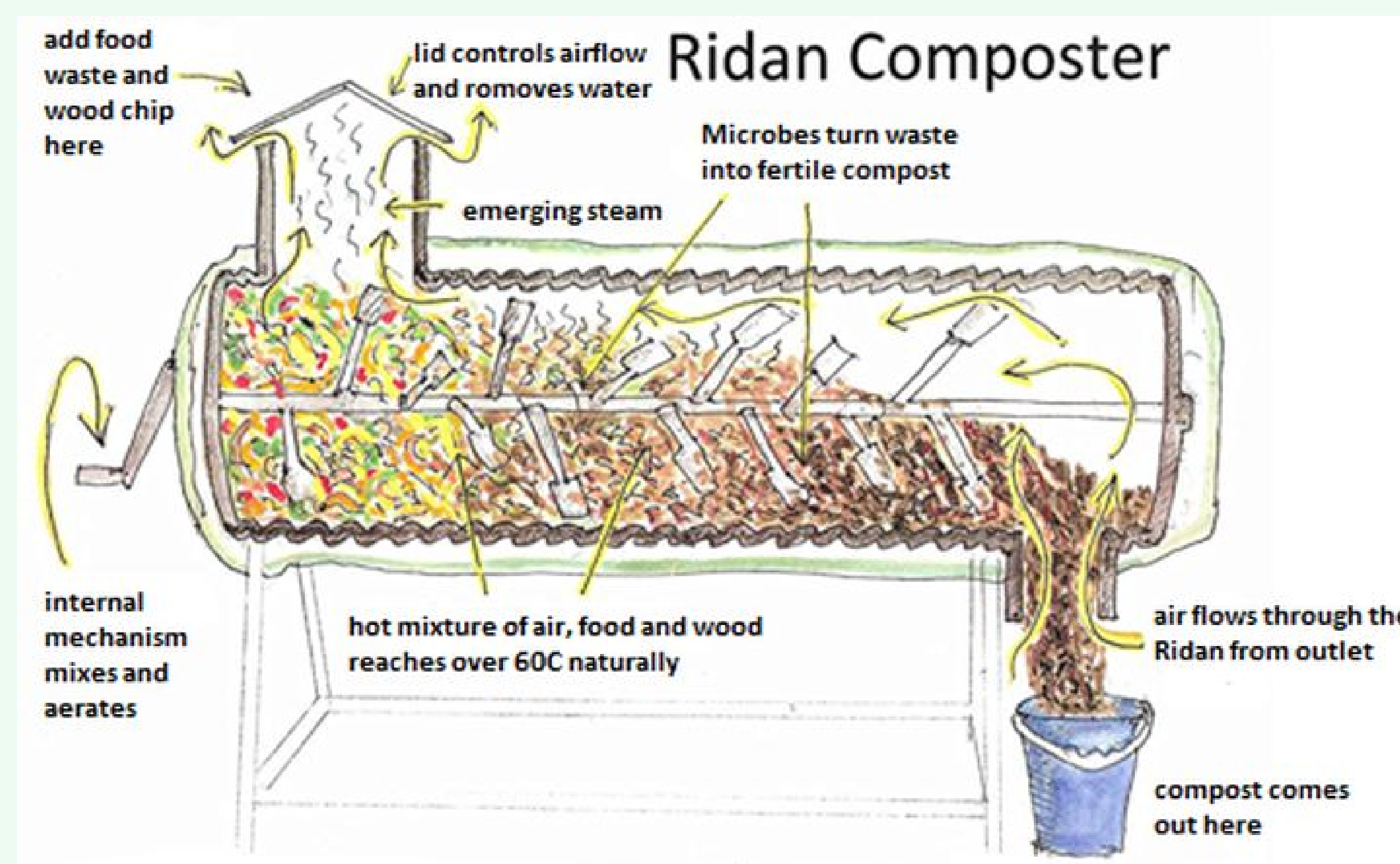
KEY BENEFITS OF COMPOSTING AT SARAH LAWRENCE COLLEGE

- Promote environmental sustainability among students and administrators.
- Reduce garbage collection fees.
- Reduce landscaping fees in that compost would substitute for the need for mulch and/or toxic, synthetic fertilizers.
- Foster a sense of unity on campus.
- Serve as an educational component for science-oriented classes for Sarah Lawrence students, students attending surrounding educational institutions, and children at the Early Childhood Center.
- Provide a sustainability model for surrounding communities to execute a successful composting program.



PLAN A: IN-VESSEL COMPOSTING SYSTEM IN BATES DINING HALL

We propose that Sarah Lawrence College invest in one large-sized in-vessel composting bin, called the Ridan Composter, for Bates Dining Hall kitchen. Bates Dining Hall produces between 35 and 50 pounds of pre and post-consumer food waste everyday. However, the Ridan Composter, an \$8500 investment, would reduce food waste production dramatically. The Ridan, a closed system, is able to store up to 105 pounds of pre and post consumer food waste and produces compost in 14-21 days. We have pinpointed this particular composting technology as the most appropriate for our College's needs because it is simple to operate and is an inexpensive way to maintain an efficient and successful composting system.



The Ridan Composter by NATH Sustainable Solutions

PLAN B: VERMICOMPOSTING (WORM COMPOSTING)

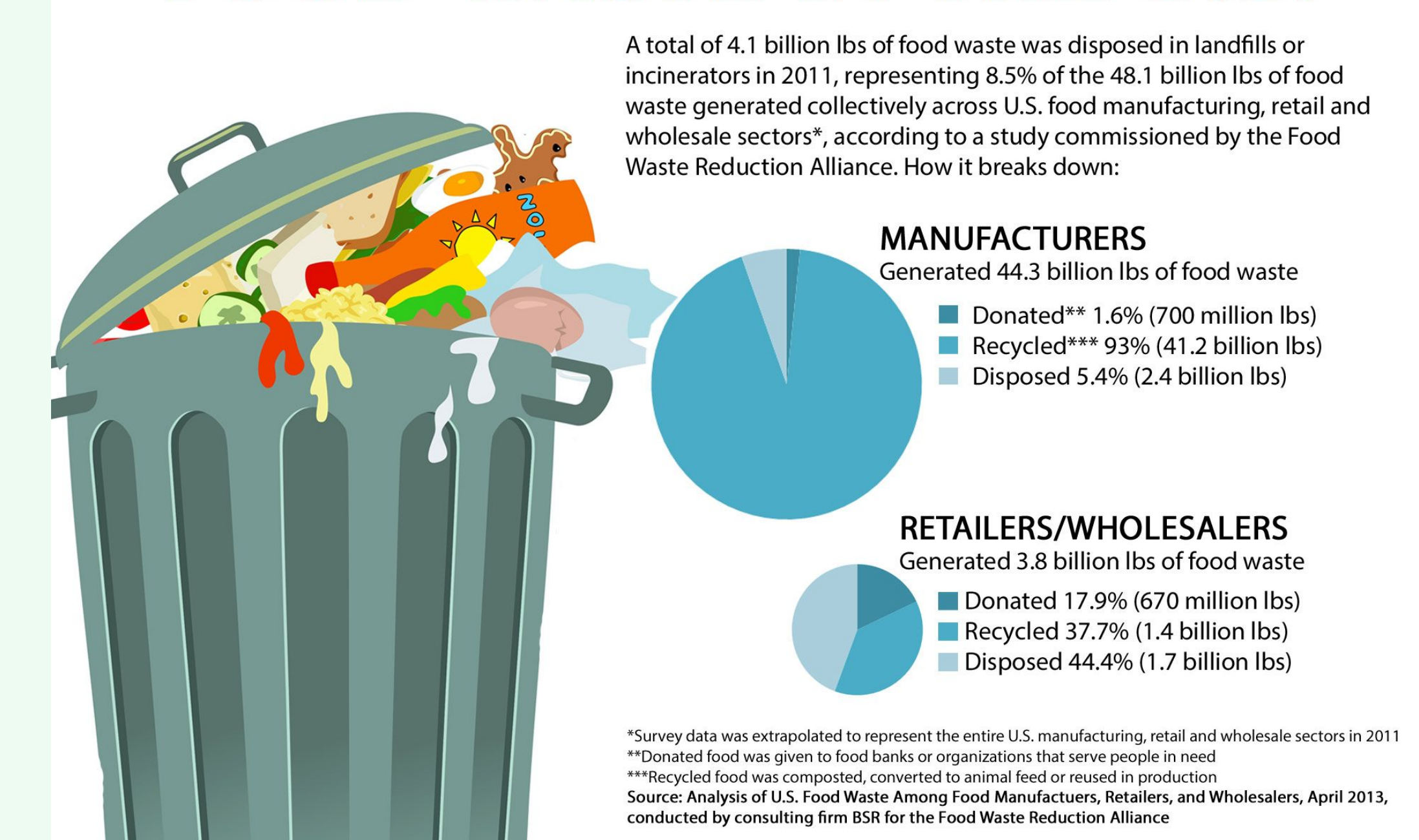
Vermicomposting, the use of worms to convert organic material into compost, is a composting program already in existence at the Early Childhood Center. We propose that our current vermicomposting program be expanded via the placement of vermicomposting bins outside of the entrance to the Pub. Vermicomposting stacking bins are inexpensive and can be found for as low as \$80 from online vendors. The bins are designed to stay damp and dark, with proper ventilation and the temperature between 70°F to 80°F degrees in order for the worms to thrive. The worms will consume food scraps and convert the organic waste in the tray into worm castings. Once this process has been completed, the worms will move to other stacking trays to continue the same process. The finished product is nutrient rich and can be used instead of chemical fertilizer. Red Wiggler worms and vermicomposting training programs are available for a low cost or, in some cases, are free of charge.



HOW DOES FOOD WASTE CONTRIBUTE TO ENVIRONMENTAL PROBLEMS?

- The average person generates 4.3 pounds of waste per day.
- The majority of pre and post-consumer waste finds its way into landfills (Center for Sustainability and Commerce).
- Organic material in landfills releases methane as it decomposes. Methane, a heat-trapping gas twenty times more potent than carbon dioxide, exacerbates the effects of global warming.
- Organic material in landfills also causes leachate formation. Leachate is produced when water filters downward through a landfill, picking up dissolved materials from decomposing waste. The leachate moves through open spaces in soil and rock, contaminating groundwater supplies.

FOOD WASTE IN THE U.S.



WHAT ARE THE ECOLOGICAL BENEFITS OF COMPOSTING?

- Rejuvenates soil that has been leached of nutrients.
- Supports the production of fungi and bacteria, both of which create humus, an organic matter high in nitrogen content.
- Promotes moisture retention in soil.
- Reduces waste in landfills, resulting in a decrease in methane emissions (when organic matter decomposes in a landfill, it is not exposed to oxygen, resulting in the anaerobic decomposition of organic matter, a process that produces methane).
- Acts as an organic fertilizer, reducing the need for synthetic fertilizers on campus.

SARAH LAWRENCE COLLEGE

Sustainability Proposal: Composting Initiative



Global Change Biology

Spring 2016

By: Zoe Berg, Leyana Dessauer and Jesenia Fuentes

Introduction:

Humans are avid consumers. According to Duke University's Center for Sustainability and Commerce, the average person generates an estimated 4.3 pounds of waste per day - an amount 1.6 times greater than we produced in 1960 (Center for Sustainability and Commerce). The majority of pre and post-consumer waste finds its way into landfills or incinerators, which results in leachate production and elevated methane emissions which contribute to global warming (Center for Sustainability and Commerce). Leachate is produced when water filters downward through a landfill, picking up dissolved materials from decomposing waste. Leachate moves slowly and continuously through open spaces in soil and rock, contaminating groundwater supplies. Methane, an incredibly potent heat-trapping gas, is emitted by methane-producing bacteria which decompose organic material in landfills. Therefore, we believe that the implementation of compost management programs at Sarah Lawrence would help to reduce waste in landfills and, thus, mitigate the effects of global warming.

Composting is a biological method of recycling organic matter into nutrient-rich soil. Mesophilic bacteria begin the process by breaking down organic material in the compost pile. As the bacteria use more energy to consume compost materials, they emit heat, causing the temperature of the composting pile to rise. With this increase in temperature, heat-loving thermophilic bacteria take over the decomposition process, and the temperature becomes high enough to kill many common strains of pathogenic bacteria. (Jenkins). Larger organisms such as worms also digest the decomposing matter, excreting nutrient-rich feces and helping both to improve the quality of the compost and to bind small particles into larger crumbly pieces (Compost Fundamentals).

Using compost as mulch or as a potting additive is beneficial in many ways. Compost contains macronutrients, the elements which plants require in relatively large amounts (i.e. nitrogen, phosphorous, potassium) and micronutrients (i.e. boron, iron, zinc) often absent in synthetic fertilizers (Macronutrients and Micronutrients). The release of such nutrients over a period of months or years allows for the soil to remain healthy for prolonged periods of time (Compost Fundamentals). Compost also acts as a buffer in soil in that it contributes to the neutralization of both acid and alkaline compounds, bringing pH levels to the optimum range for nutrient availability to plants, which is between 5.5-7.0 (Compost Fundamentals). In addition, compost helps to bind clusters of soil particles, called aggregates, which supports strong and healthy soil structure, altering it in a way that makes it less likely to erode. Furthermore, compost serves as a vital source of food for bacteria, fungi, insects, worms and other organisms in soil, allowing for fruitful plant growth. Lastly, healthy soil is an important factor in protecting waterways and groundwater supplies, by acting as a natural filter for toxins in surface water. Compost increases the soil's ability to retain water, thus decreasing runoff, which pollutes water via the transportation of soil, fertilizers, and pesticides to nearby water supplies (Compost Fundamentals).

Large-scale sustainability initiatives, such as composting programs, have been implemented at college and university campuses across the United States, helping to spread environmental awareness and offset the detrimental impacts of global warming. We have analyzed successful composting programs at neighboring institutions including Dickinson College, Middlebury College and Cornell University, for insight as to the most effective way to initiate a composting program. We believe Sarah Lawrence College, a small, liberal-arts

institution dedicated to civic engagement, could greatly benefit from a well-designed composting program, as it dovetails well with our commitment to promoting sustainability. Composting at Sarah Lawrence would transform pre and post-consumer food waste produced in dining facilities and in dorm rooms into nutrient-rich soils as well as reduce campus-wide trash collection expenses. Based on the research we have conducted, there are three main approaches to composting programs on college and university campuses that would be appropriate at Sarah Lawrence: on-campus composting in hand-made vessels, composting in specially designed containers, and composting using worms.

Traditional Composting:

Composting involves encouraging the natural decomposition of large amounts of organic material into smaller quantities of material which continue to break down slowly, releasing nutrients into the soil as it does so (Raabe 1). It begins when food waste and either wood chips or other dry organic matter are mixed together in a receptacle. Introducing plant material reduces odor and improves the composting process (EPA). It is important that whatever source the plant material comes from (ideally leftover material from campus landscaping) has not been sprayed with toxic chemicals such as pesticides if the resulting soil is going to be used to grow food, because these chemicals could become concentrated in the soil and it is difficult to measure their levels for safety.

Optimal decomposition occurs when the carbon to nitrogen ratio is thirty to one. In order to approximate this ratio without expensive testing, a good rule is to include about half wet or green material, including fresh grass clipping, food waste, and recently pulled weeds, and half

dry material, including dry grass clippings, dead leaves, and dry branches pruned from trees or shrubs. If these materials are scarce, non-laminated cardboard and soy-based newspaper make good alternatives (Raabe 1). The bin should maintain a temperature of between 140°F and 160°F for optimal function of the microorganisms which process the waste. If the temperature rises too much, beneficial microorganisms will be killed and the waste will stop composting. This can be prevented by weekly monitoring of the temperature and turning the contents of the bin with a shovel if too hot, or addition of more food waste to spark continued microorganism activity if too cool. Closed wooden bins with removable slats for easy access offer the most inexpensive and easy to maintain system. They also keep harmful bacteria, raccoons and rodents away from the compost, encourage heat retention and prevent odors from spreading (EPA).

On-campus composting has the potential to be the most inexpensive option, and it provides opportunities for campus engagement. In order to succeed, students and the administration would both need to be involved. For on-campus compost processing, a pilot program could be initiated using one aerated free-standing bin. Goshen College, with its small student run program, provides an example of this kind of program (Lopienski). If successful, more bins could be added as compostable waste accumulates. This could be achieved for a low cost by building simple wooden bins on site. In a non-electric composting system, the heat from decomposing food scraps triggers a chain reaction in which the waste breaks down into compost faster than it would in the open air. Compost can self-heat to over 140°F without the use of electricity (Lopienski). Specially designed aerated bins can aid this process and keep rodents out of the compost. Composting can be achieved either with or without the application of additional heat generated by electricity. Non-electric systems, although slower, are more affordable and

environmentally friendly. A pilot program could use a single bin capable of handling 75 to 100 of food waste per week for three weeks, before being rotated out for another bin. Each bin costs approximately \$150 to build. (Lopienski). This project could then be expanded to handle all the food waste produced on campus.

In-Vessel Composting System:

An easier alternative to building wooden composting bins is purchasing a pre-made in-vessel composter, which is a closed system and requires less maintenance. Some of these systems use electricity to bring the waste up to a high temperature faster, thus increasing the speed of the composting process. However, other models are available which do not need electrical input. They are designed so that it is easy to put waste and wood chips in one end, turn the handle to mix the contents, and remove processed compost in the form of soil from the other end of the machine.

The average amount of back of house waste (BOH, usually consisting mainly of fruit and vegetable scraps) produced in a typical week during the spring semester at SLC is 400 pounds per week, and the average front of house (FOH) waste output in the same time period is 259 pounds per week (information provided by AVI). FOH waste includes all kinds of food scraps and uneaten food, from fruits and vegetables to meat and dairy.

We propose that Sarah Lawrence College invest in one large-sized in-vessel composting bin, called the Ridan Composter, for Bates Dining Hall kitchen. Bates Dining Hall produces between 35 and 50 pounds of pre and post-consumer food waste everyday. However, the Ridan Composter, an \$8500 investment, would reduce food waste production dramatically. The Ridan,

a closed system, is able to store up to 105 pounds of pre and post consumer food waste and produces compost in 14-21 days. With continual addition of waste and removal of compost, it can recycle up to 440 pounds of food waste per week. Therefore a large size model could handle all of the BOH food scraps produced in Bates, and during the summer it may be able to handle all waste. Due to it's design as a closed system, the Ridan Composter can safely handle meat and dairy products, which traditional composters cannot do. We have pinpointed this particular composting technology as the most appropriate for our College's needs because it is simple to operate and after the initial investment it is an inexpensive way to maintain an efficient and successful composting system.

Vermicomposting (Worm Composting):

Vermicomposting is another method of composting which can be done on a small scale and has some benefits not offered by traditional composting. It is less labor intensive because worms are the ones doing a great part of the work in consuming the organic material and breaking it down. The rapid decomposition also means there is less chance for odors to escape. The worms produce something called worm castings. These are worm excrement, which are full of nutrients, making them a natural fertilizer that unlike industrial fertilizer, does not contribute to methane production. The success of plant growth with worm castings is so great that businesses are opening up and selling it as an organic alternative. Worm compost does not contain any toxic chemicals and can protect plants from disease, because antibiotics and actinomycetes found in vermicompost promote plant resilience.

Caution must be taken in choosing an appropriate type of worm for this process. The genus *Amynta*, also known as the Asian earthworm, has been noted to actually be invasive species which can disrupt an ecosystem with catastrophic consequences. There are a few options which are appropriate, including the *Eisenia fetida*, or “red wiggler”, most commonly used for its high reproductive and growth rates. *Lumbricus rebellus*, or “redworm” is another good option. The worms can be attained by going to suppliers who specialize in farming worms for this purpose.

It would take about a pound to start a compost bin. Setting up a vermicompost bins can be done on a small scale, a good example being the worm bins that are set up on campus at the Early Childhood Center. They were created with the goal for the children there to become involved and play a role in trying to help the environment. Worm bins can be acquired by searching for them online and set up in places around campus such as outside of Bates, near the Pub, and outside library. Poultry which contains ammonia is not recommended to be put in the bins for the worms to feed on nor waste containing inorganic salt because they are very sensitive and will die. Not only that but meats can attract flies and other pests. Things with high acidity should also be avoided. It is important that the appropriate food waste goes into the compost bins for this method to be successful and that those that are adding to the compost bins are well informed of what would not be put into a bins by having a sign. Fruits, vegetables, and other organic waste would be ideal. Lastly, worms should be provided with some kind of grit to grind their food because they have no teeth. Rock dust is a form of grit they can use. Despite these restrictions, this method of composting is convenient because the worms do not need to be fed on

a schedule. They can be fed with organic waste every so often and can go up to a month without food.

Conclusion:

Composting has biological, environmental and social benefits. It rejuvenates soil that has been leached of nutrients, supports the production of healthy fungi and bacteria, both of which create humus, an organic matter high in nitrogen content, and promotes moisture retention in soil. Composting also reduces waste in landfills, resulting in a decrease in methane emissions (when organic matter decomposes in a landfill, it is not exposed to oxygen, resulting in the anaerobic decomposition of organic matter, a process that produces methane). It acts as an organic fertilizer, reducing the need for synthetic fertilizers on campus. Composting programs also offer opportunities for civic engagement and environmental education.

Sarah Lawrence College has the capacity to explore a variety of campus-wide composting programs. We recommend that the institution explore the off-campus composting avenue because of the College's lack of financial resources to construct the necessary infrastructure to organize an effective, campus-wide composting movement. Therefore, by utilizing an off-campus processing facility, we would partner with one of the aforementioned waste management companies, have the company treat our compost, and transport it to a location in which the compost will assist the growth of organic foods on select organic farms throughout New Jersey. Overall, a composting program would bring sustainability initiatives at Sarah Lawrence to the forefront, build a sense of community among participating students, and mitigate the harmful effects of landfill waste and bi-products of waste incineration.

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