Composting in Prison

GUIDELINES BASED ON A PILOT PROGRAM AT DANVILLE CORRECTIONAL CENTER, ILLINOIS

WRITTEN BY the Productive Prison Landscape group, part of the Education Justice Project, University of Illinois, at the Danville Correctional Center.

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The mission of the Education Justice Project is to create a model college-in-prison program that demonstrates the positive impacts of higher education upon incarcerated people, their families, the communities from which they come, and society as a whole. In addition to offering upper-level college courses, EJP conducts reading groups, math and science workshops, writing and debate workshops, a guest lecture series, and English as a Second Language instruction at Danville state prison.

We gratefully acknowledge the support of the leadership at the Danville Correctional Center, where EJP is based. We especially acknowledge Warden Keith Anglin, Assistant Warden Victor Calloway, Assistant Warden James Luth, and the former Director of Dietary, Marcia Keys. Thank you to EJP’s On-Site Coordinator, Nicolette Elam, for facilitating our meetings.

We appreciate the Illinois Department of Corrections for their interest in and encouragement of this project.

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Affectionately known as the Big Blue Tank, the container above holds food scraps gathered from the kitchen and dietary at the Illinois Department of Correction’s Danville Correctional Center. The Blue Tank is filled to capacity about every ten days. It is then hauled to the Vermilion County landfill, emptied, and returned to the prison at an annual cost of $48,000.

The Danville Correctional Center houses approximately 1,850 men and serves about 6,000 meals per day. It is no surprise then that the prison needs a huge tank to store food waste or a line item in its annual budget that approaches $50,000 to manage the food waste.

Could this food waste be managed in a more cost effective manner? Is it possible to cut the expense associated with food waste disposal in half or by 75 percent? Could the procedures we employ to save this money benefit the prison and its inhabitants in other ways as well?

After a year of testing, we found that it is possible to reduce the amount of food waste going into the Big Blue Tank by as much as 60% by composting food waste. We believe we can reduce this amount even more in the months to come. The composting program means significant cost savings for the Danville Correctional Center.

A process for composting food scraps and other organic materials in dedicated bins was designed and established in Danville during the spring of 2012. The Productive Prison Landscape group, with support from the IDOC, and the leadership of the Danville Correctional Center, has joined to develop a composting program to convert food scraps and other organic materials into compost.

In the pages that follow, we show how to design and manage a comprehensive food-composting program using dry composting methods. Section One: What is Compost? Why Compost? describes what components make up compost, and the benefits of composting. Section Two: What to Compost. What not to Compost. Carbon/Nitrogen Ratios identifies materials that can and cannot be used for compost and explains the ratios of carbon and nitrogen mixes needed for the composting piles. Section Three: Procedures for Composting describes the step by step method for creating compost. Section Four: What are the Costs? provides a budget for beginning a composting project.

What Is Compost?
Compost is the finished product of nature’s decomposition process. Compost is made when food scraps are combined with a source of carbon, such as shredded paper, and soil, and then allowed to sit for several weeks. Composting uses natural processes to turn waste into valuable resources. Farmers who wish to improve their soil through an organic process often use compost. Compost transforms food and landscape waste into a dark, rich, productive soil amendment that can be used in a variety of ways.

Why Compost?
Businesses and institutions can save money by composting food scraps and landscape waste. Instead of sending these items to landfills, businesses and institutions can use food waste for composting instead. Doing so will benefit the environment, and saves money by reducing the need to transport food waste to landfills. Composting can also help your soil. Good compost is rich in nutrients that plants need for optimum growth, such as nitrogen, phosphorus, and potassium. Compost is also rich in micro-nutrients.

At the prison in Danville, we began composting in order to divert food and paper waste from going to the Vermilion County landfill, create educational opportunities for Danville Area Community College and University of Illinois courses, increase job training and preparedness skills for men who might want to find employment in the green industry, and produce a valuable compost product.

Components Of Compost
What goes into making compost? Below is information about what types of materials to compost, how much of each material to use, the amount of space required to compost, and types of composting structures that you might consider as you design and build your own composting system.

What to Compost

Food Scraps and Green Landscape Waste
Food scraps and green landscape waste are rich sources of Nitrogen. Nitrogen is a necessary ingredient for your compost. Nitrogen-rich materials provide protein to the microorganisms that break down material in your compost. Nitrogen-rich materials include the following:

- Food scraps- These include most items obtained from the kitchen. Most food will work, but there are a few that are better...
Soil is a necessary ingredient for your compost. Soil contains the microorganisms which will break down food scraps into compost. In most cases, the soil you have at hand will work fine. Any good, dark soil will work. Avoid sandy soils or soils with a lot of clay. If you feel your soil may not work, you can use finished compost soils or soils with a lot of clay. If you feel your soil is too sandy or too heavy, you may have to add additional soil to your compost pile.

Paper Products and Brown Landscape Waste

Paper products and brown, woody landscape waste are rich sources of carbon. Carbon-rich materials are usually rich in sugar and act as energy for the microorganisms that break down the material in your pile. Carbon-rich materials include the following:

- Cardboard- We used a good deal of shredded cardboard in our process. It generally takes longer to break down than shredded paper, so it may be best utilized when the pile cannot be tended on a daily basis. We used it at Danville because there was a box making factory on site and thus an easily accessible source of shredded cardboard. If you use a waxed cardboard, it will break down more slowly than non-waxed cardboard. This should not be a problem, it will just take a bit longer for the compost to mature.
- Paper products such as newspaper, shredded office paper, or other paper items.
- Sawdust can be used. If your prison has a wood shop, you can collect the sawdust and use it as a source of carbon.
- Dry leaves.
- Straw.
- Woody plant pieces- Stalks, twigs and the like break down slower, so avoid using woody items as more than 10% of carbon source.

What NOT to Compost

The following materials should be avoided if possible or used sparingly as needed:

- Food scraps such as meat, bones, grease, fat, oil or dairy products. These can turn rancid and attract animals.
- Pet or human feces. These may transfer alkaline, they may contain chemicals that may harm your garden or planting beds if you were to apply compost to them.
- Treated wood.
- Plants treated with herbicides of pesticides.
- Seeds.
- Diseased plants.
- Plants with invasive roots.

In order to achieve high composting efficiency, a proper ratio of compost ingredients should be used. Ideally, you want a weight ratio between 35 to 1 and 40 to 1 of carbon to nitrogen. For people new to composting, you can begin by following a simple rule: two parts green to one part brown. That is, if you have a five-gallon container of food scraps, you should add 2.5 gallons of shredded paper or cardboard to the compost pile.

If you want to monitor your carbon to nitrogen ratio more carefully, you should read the remainder of this section.

### Carbon and Nitrogen Material

Because different materials contain varying amounts of carbon and nitrogen, the ratios of ingredients should be balanced depending on the materials being used.

If a carbon to nitrogen ratio between 20:1 and 40:1 is not achieved, compost will generally still break down, but it will do so at a slower rate. Other problems may arise as well. If the food scraps are not composting quickly, they may begin to rot and smell. Food scraps alone also provide poor air circulation, which is necessary for active composting. Brown landscape waste will become compost eventually, but it may take a while because these materials tend to be very dry.

On the right is a table of carbon to nitrogen ratios to use with different types of ingredients. Ingredients are listed by type as either a carbon component (C) or nitrogen ratios (N). In the ratio numbers following each ingredient the carbon ratio is always the first number, and the nitrogen ratio is always the second.

The following material ratios represent the amount of carbon or nitrogen in each individual material. Each time materials are added to the pile, you can work to achieve an optimal carbon to nitrogen ratio. Given two different materials (and thus two different C:N ratios), and given a set amount (of weight) of one of the materials, how much of the second material is needed to balance the first material at C:N ratio of 40:1? The formula below will help achieve a desirable ingredient mix.

\[
\frac{\text{mass 1} \times \text{ratio 1}}{40} + \frac{\text{mass 2} \times \text{ratio 2}}{40} = \text{mass 1 + mass 2}
\]

1 = material number one
2 = material number two
For example:

Let’s say you have 5 kilograms of cooked oatmeal and a bunch of shredded paper. Both are commonly available at correctional centers. The respective C:N ratios of the materials are:

<table>
<thead>
<tr>
<th>Material</th>
<th>C:N Ratio</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooked Oatmeal</td>
<td>20:1</td>
<td>5 kg</td>
</tr>
<tr>
<td>Shredded Office Paper</td>
<td>170:1</td>
<td></td>
</tr>
</tbody>
</table>

If we use 5 kilograms of cooked oatmeal, how much shredded office paper is needed in order to create a pile of material balanced at a 40:1 ratio? Let’s plug in some numbers:

\[(\text{ratio } 1 \times \text{mass } 1) + (\text{ratio } 2 \times \text{mass } 2) = (40)(\text{mass } 1 + \text{mass } 2)\]

\[(20 \times 5) + (170 \times \text{mass of paper}) = 40 (5 + \text{mass of paper})\]
\[100 + 170 \times \text{mass of paper} = 170 + 40 \times \text{mass of paper}\]
\[210 \times \text{mass of paper} = 100\]
\[\text{mass of paper} \approx 0.5\]

Solution: 0.5 kilograms of shredded office paper mixed with our 5 kilograms of cooked oatmeal will create a mixed material compost pile with a 40:1 carbon-to-nitrogen ratio.

Let’s say we had 5 kilograms of shredded paper instead. How much vegetable waste would be needed to effectively break down the 5 kg of shredded paper?

\[(\text{ratio1 } \times \text{mass1}) + (\text{ratio2 } \times \text{mass2}) = 40 (\text{mass1} + \text{mass2})\]

\[(12 \times \text{veggie mass}) + (170 \times 5) = 40 (\text{veggie mass} + 5)\]
\[12 \times \text{veggie mass} + 850 = 40 \times \text{veggie mass} + 200\]
\[650 = 28 \times \text{veggie mass}\]
\[23 = \text{veggie mass}\]

That’s right! It will take 23 kg of vegetable scraps to effectively break down the 5 kg of shredded paper. Obviously, this is the ideal situation for composting two materials. However, in most circumstances an educated guess will suffice.

**Area Requirement**

How much space is needed to develop and run a successful composting program at a prison? The answer depends on the kind of composting system you use, the amount of food you want to compost, and how many bins are to be used. Our suggestions here are appropriate for facilities of approximately 1,800 people.

There are several kinds of composting structures to consider.

**Open Piles**

For some prisons, it may be appropriate to create compost in open piles that are aligned in regular rows. Open piles have no construction surrounding the compost. They are out in the open and could be compiled anywhere on the prison grounds that the Wardens deem appropriate. The only cost are for tools and labor. Open piles also give the project a natural look, and they often cause the compost to mature faster and evade fewer odors.

The drawback is that if the piles are not stacked neatly they can look unkempt and unsightly. Open piles can be of any size, but they should be no more than four or five feet in height. The pile can be any length or width, but you will need extra space to flip the pile and walk between the piles. The size of the piles determines the amount of space needed. For example, if you make a pile four feet wide by four feet long, the area for the pile needs to be ten feet long by four feet wide. The extra space includes a two-foot gap for the person turning the pile and an extra four feet for the pile to be turned onto. If you have more than one compost pile, you will need an additional six feet per pile (four for the pile itself and two feet between piles), plus another 6 feet of space next to the first pile so that when this pile matures, you can flip it into that open space. Then, when the second pile matures, you can move it into the space originally occupied by the first pile.
Wooden Bins
For other prisons, it may be appropriate to create compost in wooden bins. Bins have a wooden structure surrounding the compost piles. At Danville Correctional Center, we built 24 wooden bins that you can see in many of the pictures in this manual.

The piles in the wooden bins are open at the front for air circulation. Within each row, we left the first bin open and put food scraps into the second bin. That way, after three weeks or so, when the pile had matured enough for us to flip it, we had an open bin available. You’ll want to avoid filling all the bins in a row because then, when you want to flip a pile, you’ll have to move it to another row via a wheelbarrow.

The costs associated with creating the wooden bins include the cost of material (wood, screws), cost of tools, and cost of labor. Many people find that composting in wooden bins looks more attractive than in open piles. The drawback, however, is the cost of material. If the aesthetic quality of the compost operation is not an issue, we recommend that you use an open pile system because it costs considerably less and it is easier for two people to turn the piles.

We recommend that the wooden bins be 4 feet wide, 4 feet deep and 4 feet high. In order to save lumber, the bins can be placed back-to-back (so that two bins share a back edge). You can build any number of bins this way. We found that for a structure of twenty-four (24) bins (or two rows of twelve, back-to-back), each 4’x4’ worked well. This configuration also requires a 3’ aisle on each side of the bins that provides easy access to the front of the bins.

Plastic Bins
An alternative to open piles and wooden bins is to use plastic bins. Plastic bins are containers that hold 50 to 90 gallons of material. We did not use plastic bins because they were too expensive and too small. But you could start small by experimenting with plastic bins and expand into the other types of composting, as you get comfortable with the process. The plastic bins could be used either indoors or outdoors. The drawbacks include the cost of the plastic bins, which are more expensive than the other options, and that you cannot flip the pile completely inside a plastic bin.

Windrows
There is another method of composting — the windrow — that does not require building a structure. In a windrow, you develop one long, continuous pile. This type of composting is suitable for large commercial composting facilities in which you create one long row in a short period of time. We do not recommend using this approach within the Illinois Department of Corrections.

Indoor Space
We do not recommend that you create compost bins indoors, but you will need some indoor space to store tools and, if you have easy access to space that you can store soil in the winter, some space for soil.

Tool Storage. The area needed for tool storage is the size of a regular tool shed (usually 10’x12’). In many cases, an extra closet will work. The area needs to be large enough to fit all the tools that are typically used in composting — some shovels, rakes, and a wheelbarrow (See the Materials and Costs section below for a complete list of tools that we recommend). Tools can be hung along the walls. Bins used for transporting kitchen scraps could be stored in this space or outside.
Basic Composting Procedures

Begin by gathering the necessary tools to collect, layer, and turn each day’s piles. See “Materials Needed and Costs” below for the list of tools you will need.

**Step One:** Collect the food scraps from the kitchen. Our practice is to coordinate with the kitchen workers responsible for emptying pots and pans of leftovers. They set aside the appropriate discarded food in labeled plastic bins by the back door for easy pick-up.

**Step Two:** Collect and transport the food scraps to the compost pile by taking a four-wheel cart to the kitchen. In addition to food scraps, you can also create compost from landscape materials such as grass clippings, weeds, hay, and other organic matter.

**Step Three:** Collect cardboard, shredded paper, or another source of carbon to add to the compost pile along with the food scraps from the kitchen.

**Step Four:** If you are beginning a new pile, first, loosen the top six inches of soil with a shovel or pitchfork. Put down a layer of rough, woody materials as the first layer if you have such materials available (e.g., twigs or sticks). But if these materials are not available, just put your first layer of food on the ground. If you are adding to an existing pile simply continue layering upon an existing mound until it is four or so feet tall.

**Step Five:** Using a bucket, collect a small amount of food waste from the larger container that you used to transport the food waste to the compost area. Spread the first layer of food waste and, if the food scraps are dry (e.g., dry bread, dry oatmeal), water the food with a moistening spray from the hose. Next, add a layer of a carbon-rich material such as shredded paper, shredded cardboard, or dried leaves. Finally, add a thin layer of soil on top.
Step Six: Blend these three layers together. You need not make the mix incredibly thorough. Just a bit of mixing is enough.

Step Seven: Repeat the sequence beginning with another bucket of food waste. This process of alternating layers is called a “lasagna method” and should be continued until the pile is about four feet tall. This completes the process of initially creating a compost mound.

Step Eight: Document the materials used, the location and date and time of the pile’s creation in order to effectively monitor the progress of decomposition. Using a calendar may be a useful way to mark advanced dates so you remember to turn the pile in three weeks and to check the pile for how mature the compost is in six or eight weeks.

Step Nine: Check other piles and turn those that are ready. You should check the moisture level of the pile when you turn it. The pile should have the consistency of a wrung-out sponge. Wet the pile if it is too dry.

Step Ten: Clean and return the plastic bins to the dietary department and the tools to storage.

Composting Timeline

Everyday: Move food scraps from kitchen to the compost piles and layer in a source of carbon, such as shredded paper or shredded cardboard, and soil. The more food scraps you compost, the less material has to be taken to the landfill.

Every 3-4 days (depending on rainfall): Water the pile with the hose so that it stays moist without necessarily being saturated. This step will not be necessary if it rains. Freezing weather will also prolong the maturation schedule and will require less water. If the temperatures stay below freezing, do not water the pile.

Three weeks: After three weeks a pile should be checked to see if it is ready to turn. Assess whether any of the original materials are showing signs of effective decomposition and if there is any detectable odor emanating from the pile. If recognizable materials or odors are present, the pile is not ready to turn and needs to mature further. Advance the calendar date to re-check this pile in another week to ten days.

When a pile is ready to turn, use a shovel or pitchfork to invert the pile and blend it so that the finer, looser material buries the rougher, larger materials.

Six or more weeks: When a compost mound has matured to the point where none of the original material is recognizable, it is time to sift the compost.

We suggest turning the pile into an adjacent empty bin or open space so that this re-layering and inversion takes place naturally. After it is turned, water the pile again and record the date so that you’ll be reminded to check the maturity of the pile again in another three weeks. Water the pile periodically as necessary. Rinse and return all tools to storage.

<table>
<thead>
<tr>
<th>Bin</th>
<th>Date bin full</th>
<th>Contents</th>
<th>Turn bin</th>
<th>Date in 8 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>11.4.13</td>
<td>Food scraps (95%) and some green garden materials (5%)</td>
<td>12.30.13</td>
<td>1.6.14</td>
</tr>
<tr>
<td>17</td>
<td>11.7.13</td>
<td>All food scraps</td>
<td>11.28.13</td>
<td>1.2.14</td>
</tr>
</tbody>
</table>
A compost sifter is a wooden box with a screen at the bottom that sifs granulated materials through the grated screen and into the awaiting wheelbarrow beneath it.

The technique for using this sifting mechanism requires two people.

The sifted material in the wheelbarrow should be stored in a cool dry place such as a barrel or drum until it is incorporated into garden beds or used for other applications. The larger, rough materials left in the sifter can be re-utilized in a subsequent compost mound. Record the date and document the amount of compost harvested. Clean and return all tools to storage.

Composting in Winter

The process of composting during the winter is the same as during warmer times of the year. The difference is that you will need additional resources and that composting takes longer in colder weather. It’s ideal to store enough soil to add to your compost piles or bins in a warm space during the months when the soil is likely to freeze. This can be a challenge at many prisons. An alternative is to place a black tarp or straw over some soil that can then be used even if the temperatures dip below freezing. If we get a very hard freeze, you may have to halt your composting process until you can get a shovel into the soil again.

The rate of decomposition will slow down considerably in the winter compared to the summer. Don’t be discouraged, though; you can insulate your pile(s) by adding additional leaves, sod, or straw. Compost piles started at the beginning of winter should be completed by spring, but allow your pile(s) a few additional weeks to mature, if necessary.

There are a number of costs associated with establishing and maintaining a composting program, none of which outweigh the savings associated with such a program.

A critical resource in building a composting program is the human resource. Having a dedicated team of composters is essential to the program’s success. Human power is necessary for making, maintaining, and sifting the finished product. Other than the cost associated with people, investing in a comprehensive compost program is a relatively inexpensive endeavor.

The major costs are for containers and bins in which to move food scraps and store the finished compost. Aside from items listed as essential in the procedure section, many of the items listed here are optional. Building composting bins is optional. Bins are an aesthetic alternative to the simple pile process. We have a sense that many Wardens will prefer compost bins to open piles, but the finished product is no different. The choice between composting in bins or piles is really one of aesthetics.
### Recommendations

Regardless of your knowledge, resources, or the amount of space you have, it is always a good idea to start a composting program in a small way. Make sure that you have a surplus of composting materials before attempting to start a composting program. The material that is likely to be in short supply is your source of carbon.

The responsibilities for every step of the composting process should be clearly stated to prevent any “I-thought-you-did-it” conflicts. In the event that your facility or institution should encounter problems with the composting project, and you find the manual does not answer your questions, you can contact William Sullivan at the University of Illinois: wcsulliv@illinois.edu.

Finished compost will be rich, black and full of nutrients. You can use your compost on vegetable gardens, with Horticulture or Biology classes, and in greenhouse to maintain a nutrient rich soil. If you have more compost than these uses demand, you can bag it and sell it as a high quality compost fertilizer.

Good luck with your composting plans!

### About Productive Prison Landscapes

Through the Productive Prison Landscape program, we work to transform the landscape of the Danville prison into a living-learning laboratory for sustainability. We use the resources available at the prison (e.g., open space, rich soil, enthusiasm and talent of the men incarcerated there) to create an outdoor laboratory for learning that is substantially more sustainable and productive than the existing landscape at the prison.

We are working to convert some of the 13 acres of turf grass at the prison into a system of outdoor laboratories that can be used to study biology, soil science, food production, plant propagation, composting, and business management. Our intention is two fold: 1) to increase opportunities for active, engaged
learning at the prison, and 2) to conduct small experiments on the process of transforming an unsustainable institutional landscape into a setting that produces both knowledge and food.

We will also evaluate the impact of our efforts. There is reason to believe that transforming the landscape into an outdoor laboratory will have a variety of positive effects. We will measure the:

• Impact on learning in the college & university courses taught at the prison;
• Effect on the men who create and who view the landscape;
• Value of using a local institutional landscape to produce food to be consumed within the institution;
• Reduction in prison operating costs;
• Impact of employing incarcerated men in activities that have been shown to reduce levels of aggressive and violent behavior;
• Increase in the suite of job training programs already offered to men at the Danville Correctional Center.

Working with the leadership of the Danville Correctional Center, the men in the Productive Prison Landscape program are planning the next phase of our efforts. We may be working on the development of a prairie planting that will allow us to harvest native prairie plants for use along Illinois’ highways and roadways. Or we may develop plans for a meditation garden at the prison. Or we may work on ways to enlarge the garden and increase the food production activities at the prison. We will make decisions about these possibilities by discussing them with our EJP students at Danville and with the prison administration.

We have received generous support for these efforts from private individuals, the Ann Arbor Area Community Foundation, and the Department of Landscape Architecture in the College of Fine and Applied Arts of the University of Illinois.

At any one time, there are about 14 men from EJP who participate in the Productive Prison Landscape program. One of the members is William Sullivan, Professor of Landscape Architecture and Director of the Sustainability and Health laboratory at the University of Illinois.

The Education Justice Project (EJP) is a unit of the College of Education at the University of Illinois at Urbana-Champaign. Since 2008 we have provided upper-division courses and a range of extra-curricular activities to men incarcerated at Danville Correctional Center, a men’s medium-security state prison in Central East Illinois. Each semester about 125 men participate in course work, writing and math workshops, our English as a Second Language program, Productive Prison Landscapes, and more.

EJP is committed to expanding higher education within American prisons as a matter of justice. We invite collaboration with interested partners on publications, research, conferences, and other initiatives.

Funding for EJP comes from the University of Illinois, private donors, and external grants. You can learn more about EJP at www.educationjustice.net.