



Redesigning Municipal Organic Materials Systems for Climate & Community Resilience & Equitable Economic Diversification

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Sponsoring cities

- San Francisco, CA
- Boulder, CO
- Fayetteville, AK
- San Luis Obispo, CA, and
- Cleveland, OH

The project was funded by the Urban Sustainability Directors Network, a peer-to-peer network of local government sustainability professionals from cities across the US and Canada dedicated to creating a healthier environment, economic prosperity and increased social equity.

Acknowledgements

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The Urban Drawdown Initiative
Trust for Public Land
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EXECUTIVE SUMMARY

“Cities, and the businesses and governments that make them up play an essential role in shifting away from the linear take-make-waste food system to an alternative, regenerative model based on the principle of a circular, regenerative economy”
- Ellen McArthur Foundation

The purpose of this guide is to catalyze a fundamental shift in the way municipalities manage their “waste” – particularly valuable organic materials. The guide will support cities in creating and initiating processes to transition from a linear, top-down system of organics waste management to an integrated, regenerative system that enhances soil and water quality, food access, and community health and well-being. This guide will help your city transition away from systems that direct organic materials to landfills, incinerators, or digesters, and create systems that ensure their highest and best use by re-visioning them as resources to sequester carbon, replenish soil, and strengthen communities.

On a global level, re-thinking how we manage organic materials can rebalance the planet’s carbon, nutrient, and water cycles. Compost is a simple and robust climate change solution that has mitigation, sequestration, and resilience benefits. At the local level, employing new processes for generating compost present opportunities for equitable urban revitalization and agricultural regeneration.

In efforts to address climate change, most cities have looked at energy, building, and transportation systems, focusing on reducing greenhouse gas (GHG) emissions through efficiency and replacement of fossil-based energy sources. Cities must continue reducing climate impacts of these “technological systems”. It is simultaneously imperative, as the Intergovernmental Panel on Climate Change notes, that we “draw down” already dangerously high levels of atmospheric carbon. We have a unique and wonderful opportunity to do this by supporting nature-based solutions, the “biological systems” through which carbon, water, and nutrients move.

As a major “end point”¹ for the carbon and nutrients carried by our food system, cities are well positioned to access these systems by rethinking how we process our organic materials such as food scraps; yard, park, and road trimmings; animal manures and human waste; and agricultural materials. Cities also manage vast, irrigated urban environments. We are in a unique position to re-connect our organic materials, and the nutrients and carbon they hold, to our land—enriching the soil and our communities and drawing down atmospheric carbon in the process.

We can transition our take-make-waste economy into one that uses organic materials as a valuable input for regenerative systems—in short, a circular economy. To do so we will need to design new political and economic structures and encourage new spaces for social connection and connection to

¹ Cities and the Circular Food Economy, The Ellen McArthur Foundation https://www.ellenmacarthurfoundation.org/assets/downloads/Cities-and-Circular-Economy-for-Food_280119.pdf

nature. We can make this process a “just” transition from an extractive economy towards one that is more socially just, holistic, and waste-free.

This guide identifies major components for the first stages of setting up a circular organic materials economy. It will take you through the basics of mapping your local organics systems, identifying and engaging stakeholders, investigating market drivers, and assessing funding needs to institute programs and policies that will ultimately redesign the system.

Engaging an intersectional team who possess the knowledge and skills to support both design and implementation will be central to this process. A primary task will be gathering macro-level data related to organic materials production to understand the potential amounts of compost your jurisdiction can create. This data is essential to calculating environmental and economic benefits and potential carbon sequestration. The process will also identify existing infrastructure, policies, service providers, and informal actors that make up your current waste management ecosystem to assess potential sites to make compost and the best ways to use it. This analysis will help you understand the gaps in processing capacity, as well as opportunities for developing innovative and diversified organics management strategies.

This process guide is accompanied by two documents—an excel workbook to help you collect data and other information you will need to assess your current infrastructure and capacity, and an online Soil Carbon Calculator to help you understand the valuable soil carbon sequestration potential of your compost resource. Information collected in the excel workbook will be expanded in the soil sequestration calculator.

This guide will help you assess your place along a continuum of organic materials management practices and create a comprehensive, but preliminary, review of core functions in the planning and implementation process. Your team will be able to identify those projects that have the most potential for capturing your organics resource and use it to help your city meet its carbon draw-down goals.

Finally, this guide will help you create a compelling narrative for policy makers and other stakeholders to secure their investment in systems that treat organic materials as a resource. If your city has not established carbon sequestration goals, this process will give you the tools to accelerate their adoption. It will be another tool your city uses to heal the planet and create economic and social benefits for residents and businesses.

Just Transition

A Just Transition creates a process for inclusion and redirection of assets to historically marginalized communities. Born out of the labor movement, it is a vision-led, unifying, and place-based set of principles, processes, and practices that build economic and political power to shift from an extractive to a regenerative economy. Facilitating a just transition means, “approaching production and consumption cycles holistically and waste-free. The transition itself must be just and equitable; redressing past harms and creating new relationships of power for the future through reparations. If the process of transition is not just, the outcome will never be. Just Transition describes both where we are going and how we get there.”

BACKGROUND

“Man is simply nature's agent or employee to assist her in her work, hence the more careful and scientific the man is the more valuable he is as an aid to nature in carrying out her plans methodically” - George Washington Carver

The Carbon Cycle

Carbon cycles through the planet in five major areas, which scientists refer to as carbon “stocks” or “pools”. It cycles through:

- the atmosphere (air) as carbon dioxide,
- the hydrosphere (water) as carbonic acid,
- the biosphere (plants, animals, and people) as carbohydrates,
- the pedosphere (soil) as carbon, and
- the lithosphere (oil, gas, and diamonds) as fossil carbon.

The time it takes for carbon to move, or “flow” between these stocks can vary. A forest fire can oxidize biosphere carbon and quickly move it into the atmosphere. On the other end of the spectrum, the deposition of atmospheric carbon to carbonic acid in oceans and subsequent calcification into ocean floor sediment takes decades.

In the Anthropocene,² humans have shaped the carbon and nutrient cycles through shifting stocks and flows, destabilizing these critical planetary life cycles. The way we care for and interact with land has significant consequences and can be immensely positive if we become aware of how our actions

can give back and help restore balance.

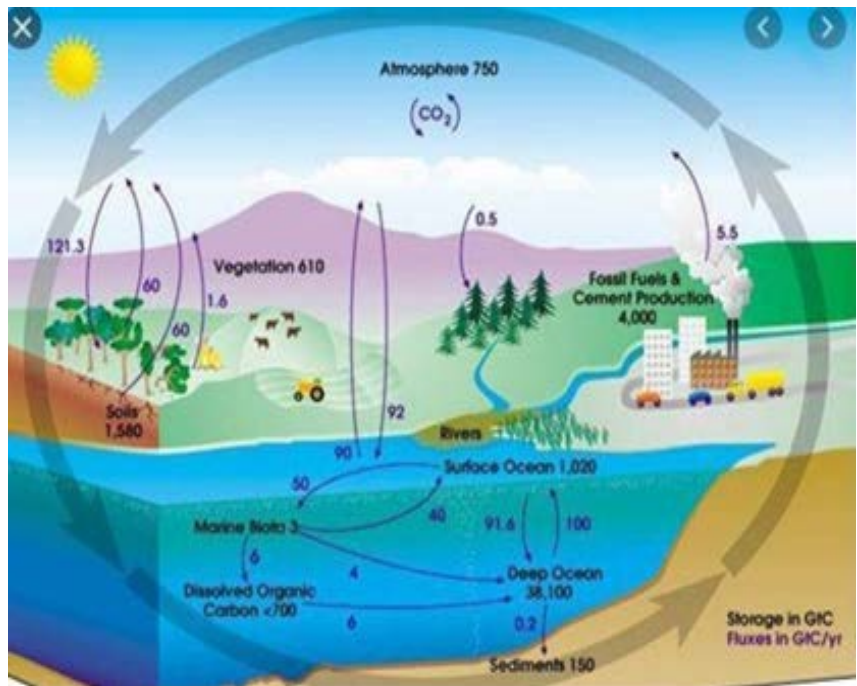


FIGURE 1 CARBON CYCLE

² the period of time during which human activities have had an environmental impact on the Earth

As we consider our role in the carbon cycle, it is important to expand upon our current framework for carbon accounting, which primarily focuses on linear flows of emissions. We must consider biological systems and goals and policies that address carbon as a biogeochemical cycle that has stacked and synergistic benefits.

In Earth's biogeochemical life cycles, carbon is both an "attractor" and "driver". Water and nutrients "follow" carbon in non-linear, synergistically stacked relationships. When we put more carbon in the atmosphere it gets warmer and holds more water, resulting in more intense rainfalls. When we put more carbon in the soil through compost application, we enhance the soil's ability to retain water and nutrients.

Reconnecting the Carbon Cycle and Stabilizing Nitrogen Cycling Compost

Photosynthesis is the primary biological function that supports life on earth. It is also the single largest human-managed "flow" or pathway for atmospheric carbon to move back into the terrestrial carbon pools of vegetation and soils. When we talk about soil carbon sequestration and natural carbon sinks, it is the plants, trees and their photosynthetic "mechanism of transfer" that we are talking about. Compost is a uniquely beneficial organic amendment that can heal poor soils and support plant growth and health. It provides a structure for beneficial microbiology and the soil food web. Mulch or wood chips also have positive benefits for tree health and soil stabilization. In short, enhancing soil function enhances photosynthesis, increases carbon capture, and enhances the soil's ability to store that carbon.

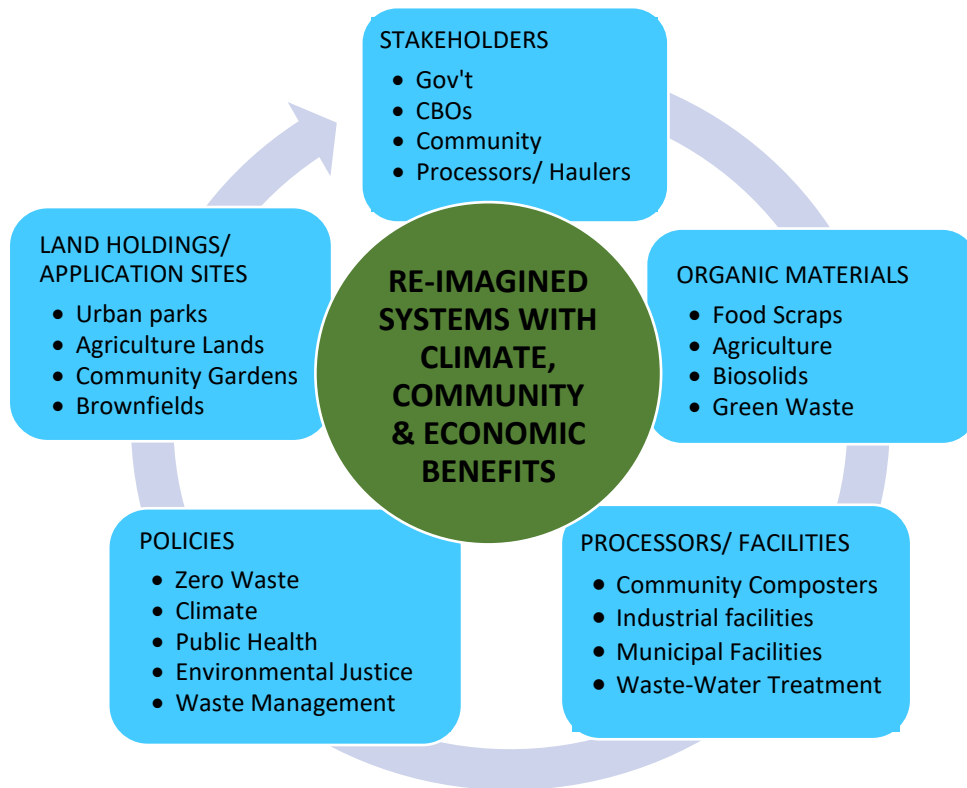
Re-linking this natural system allows us to participate with the global carbon cycle in a manner that benefits the climate. Food and other biologically based materials, such as fibers and building materials, can be grown, produced, and recycled in ways that support the photosynthetic flow of atmospheric carbon into soils and terrestrial ecosystems. Organic materials that would be burned or landfilled can be turned into compost and applied to soil to:

- add to its photosynthetically derived and stored carbon,
- increase its ability to retain water,
- lower surface temperatures, and
- increase nutrient availability and efficiency of plant uptake.

In addition to addressing carbon issues, we can ameliorate problems caused by excess nutrients such as nitrogen and phosphorus which degrade water and air quality. As a primary source of these excess nutrients, synthetic fertilizers and raw animal manure applied in excess are responsible for both groundwater and surface water contamination. Providing an alternative amendment that delivers nutrients in a more stabilized fashion helps to alleviate these environmental issues. We encourage you to dive more deeply into nutrient and integrated pest management, chemical applications, and water quality as you undertake this process.

PROCESS GUIDE

Gathering the data and background information necessary to plan for using your organic materials as a climate resource is a circular process. You will move between the various types of data many times as you frame a comprehensive picture of your current systems and resources and develop a vision for the future. This information will help prioritize projects and policies that will have the greatest potential for reducing emissions, sequestering carbon, and benefiting the community.



Depending on the availability of data, amount of staff time allotted to the process, and local and state laws and permitting requirements, the overall process will take 3 to 6 months to initiate and 24 to 36 months to fully launch. Identifying and engaging agency, business, and community organizations that can become development partners early on will help the project grow and evolve, contributing to successful long-term implementation. You may also consider hiring a coordinating consultant or community-based composter that has aligned values and a stake in achieving the desired outcomes.

Grounding this process within the framework of a “just transition” requires that we articulate where we are going and how we will get there. It may require restructuring the current political economy surrounding organic materials which tends to concentrate their treatment in large scale industrial processes, and instead to shift to diverse organic material economies of multiple scales to ensure that farmers, land managers, and residents all benefit.

SECTION 1: Identify Organic Material Sources

You will need to collect macro-level data related to the production and type of organic materials in your community and assess the potential amounts of compost or other amendments your jurisdiction can create. This data is vital to calculating emissions reductions and carbon sequestration potential.

Organic material sources to be identified include food waste, yard and green waste, biosolids from wastewater treatment plants, and woody mass from dead and dying trees. While most of these feedstock materials will be generated within your jurisdiction, there may be some available nearby, such as livestock manure and excess woody biomass. Potential feedstock sources include residential, commercial, industrial, land management, transportation, and agricultural sectors.

Organic materials can be identified as being Carbon (C) or Nitrogen (N) heavy. Compost requires a balanced C:N ratio to start the composting process, usually 30:1. If the mix is too low in nitrogen, the compost will not heat up. If the nitrogen proportion is too high, the compost may become too hot, killing its microorganisms, or it may go anaerobic, resulting in a foul-smelling mess. Finished compost products will have a range of C:N ratios usually between 10:1 and 20:1.³ Higher N ratios will be appropriate for lawns, turf and row crops, while high C compost is best for rangelands and other settings where low nutrients are appropriate. The Soil Carbon Calculator has assumptions about appropriate or standard practice for C:N ratios built in.

Highest and Best Use

Creating a diverse economy that makes the highest and best use of organic materials, and supports a localized processing infrastructure, provides a resource for urban agriculture, farmers, and ranchers. It creates healthy soils, increases the potential for local lands to sequester carbon, stabilizes nutrient cycling, enhances water quality, and improves water conservation.

As you go through this data discovery and collection process you will need to track total existing and potential volumes by each material type/feedstock and total compost or mulch currently being generated. General questions include:

- What volume of each organic materials type is generated?
- Who is the generator and where are they located?
- Is a beneficial soil amendment or other bioresource currently being made with these materials? If so, how much?
- How much more compost could be created with full capture of available materials?

³ Cornell Composting Science & Engineering, Tom Richard and Nancy Trautmann
http://compost.css.cornell.edu/calc/cn_ratio.html#:~:text=The%20usual%20recommended%20range%20of,of%20the%20carbon%20and%20nitrogen.

The Activities Worksheet [“Organic Material Types and Volume”](#) includes information on these various sources of materials, as well as information on where to find these data.

SECTION 2: Identify Processing Systems and Infrastructure

This section will help you outline your current infrastructure and processing capacity and assess the gap in composting additional available organic materials. Understanding the current infrastructure, both formal and informal, will provide insights into economic factors and can inform where to locate and incentivize the creation of new processing capacity.

Traditional waste management companies, landscapers, community composters, or farmers may be hauling and processing organics. You will do a scan of the different regulatory agencies, private operators, and community providers that make up your current waste management system. In addition to shedding light on how much new infrastructure may be needed to process the total available organics in your community, this process will help to identify opportunities for fostering a diverse and robust organic materials recovery economy. Information you will explore includes:

1. What is the current processing capacity and who are the service providers?
2. What is the gap in processing capacity to turn your local organics into compost?
3. How are those materials that are not being composted managed now?
 - a. Where do they come from?
 - b. Where do they go?

EXISTING FACILITIES INFORMATION

Existing processing facilities may include commercial, municipal, and community composting, as well as agricultural and wastewater treatment plants. In addition to tracking their current processing capacity, you will also document the costs and distances from collection to processing site associated with each facility. This data will inform your system redesign and may reveal opportunities to locate new processing infrastructure within or near communities needing soil.

Community Compost: These valuable small to mid-scale sites are generally located at schools, parks, community gardens, on city or county park or open space land. They most often produce a clean and high-quality compost which is used locally, making healthy soil and locally grown food accessible to the community. A good way to understand this sector is to locate a community composter, as they generally will know how things are working on the ground and about others operating in the space⁴. Every effort should be made to invite community to the table in culturally appropriate ways (See Appendix C). Historical discrimination may have eroded trust with government institutions. Finding a community partner to help bridge this relationship between community and government can be beneficial.

⁴ The Institute for Local Self Reliance supports a national coalition of community composters and it may list those in your jurisdiction. <https://ilsr.org/composting/community-composters/>

Commercial/Municipal Compost: Your jurisdiction may operate or contract with a commercial operator for industrial scale composting. These sites are generally capable of processing large volumes of organic materials, but quality can suffer from contamination—such as plastics—in the organics stream, or if they are operated as an alternative to landfill, instead of as a compost first operation. Sites operated specifically to produce compost for local markets tend to have higher quality product and often support the carbon sequestration goals of their surrounding areas. These sites may be willing to expand to process more volume. You may consider incentivizing or directly opening new commercial sites.

Agricultural/On-Farm Compost: On-farm composters generally process their materials at their farm site, and the finished compost is typically used on-site or distributed to local farms. Depending on the legal and permitting requirements in your jurisdiction and state, farmers may not wish to disclose if they are composting. Information they share may be anecdotal and rough estimates may be all that you are able to ascertain. If you survey this community, it is best to find a way that stakeholders can respond without facing legal ramifications if they disclose their location and operations. Another way to assess volume going to farms is to ask industrial food processing or food service providers what weekly volumes are hauled away by farmers.

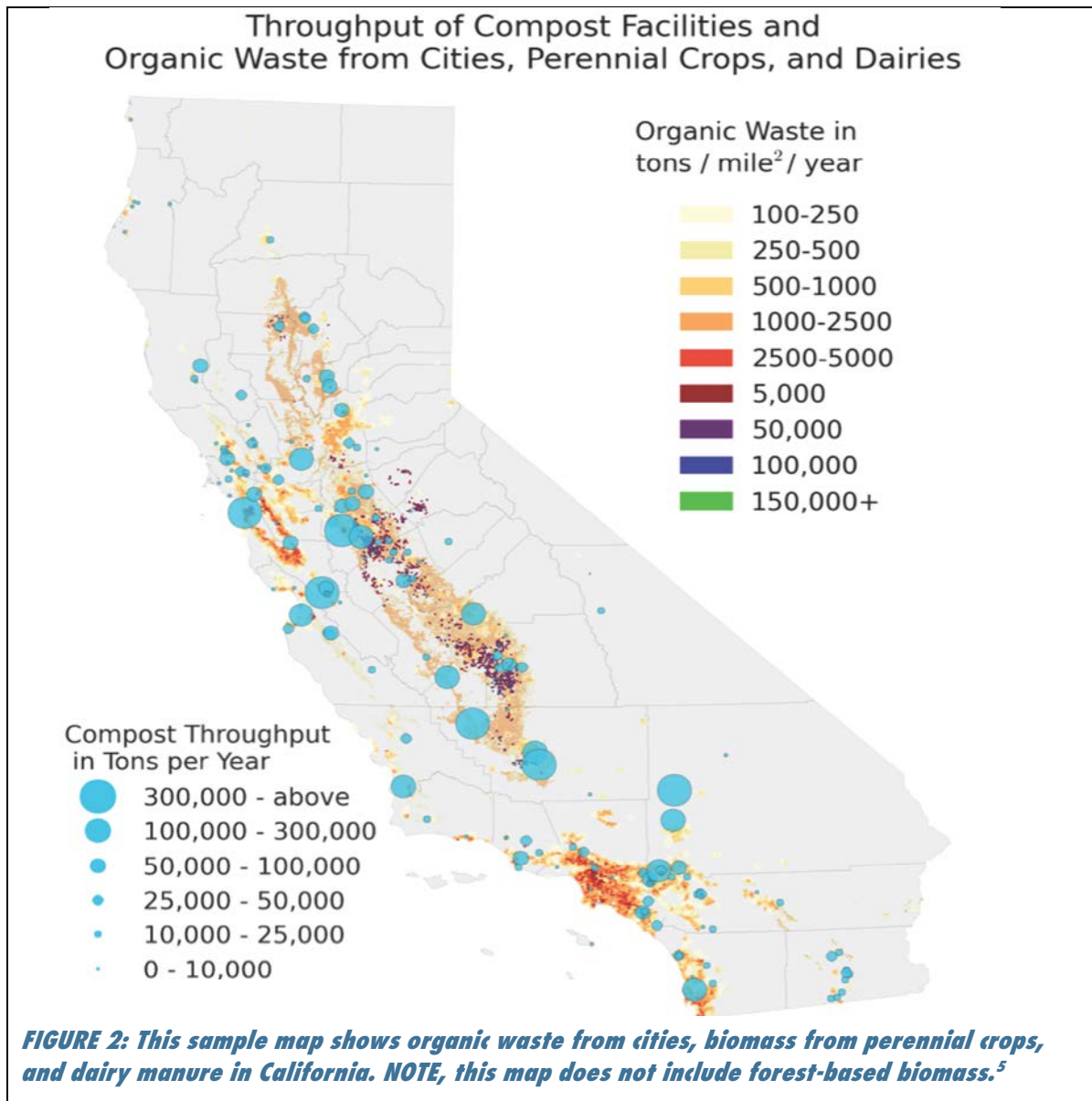
Waste-Water Treatment Sites: These operations may already compost their biosolids either onsite or with nearby composters. They can be potential sites to locate new processing due to their possession of relevant permits and zoning.

Landfills: While it is unlikely, landfills can also become compost sites. More importantly, understanding where the landfills are located and the distances between pick-up and processing will inform decisions around transportation of organics. New compost sites may do better if built closer to sources of feedstocks than existing landfills. Likewise, documenting the tip fee for area landfills will inform the economic and political analysis of restructuring your system.

MAPPING MATERIAL SOURCES, TYPES & FACILITIES

Creating a visual representation, or “heatmap,” on volume and source of organics can help tell a comprehensive story and guide the development of new processing infrastructure to access available carbon and nitrogen rich materials. Information on existing infrastructure can be applied to a simple GIS or Google map.

Looking at this data alongside total potential organic feedstocks (from Section 1) will help you assess the need for new processing capacity and optimal locations for this new infrastructure.



The Activities Worksheet, [“Existing Processing Infrastructure”](#), will help you compile vital information on infrastructure locations, processing capacity, and management.

SECTION 3: Identify Your Team and Engage Community Stakeholders

Achieving your goals will be contingent upon identifying a core team inside your jurisdiction and building relationships with key community and business stakeholders. Co-designing solutions that rely on the expertise, experiences, needs, cultural context, and economic parameters of these partners will allow you to build systemic solutions that are good for both people and planet.

⁵ Notes & Sources: Municipal waste based on 2013 population density and CalRecycle Statewide Waste Characterization Study (1999). Orchard and vineyard wood waste from KroodSma & Field (2006) and NASA CropScape (2014). Dairy cattle manure from CA Water Board (2012)

The core city/county working team may be drawn from your department, different agencies, or local service providers. It will help to build internal political will and provide the technical capacity to support the planning and engagement process. Ideally, they will participate for the project duration, and even be involved with implementation after planning is complete. Possible Core Partners/Action Area representatives from government agencies include:

- Climate Action
- Public Works
- Wastewater Management
- Open Space/Recreation and Parks
- Racial Equity/Environmental Justice
- Economic Development/Small Business
- Planning
- Public Health

You will also want to engage community partners and local business in the design process. These key constituents must be included in conversations around goals, planning, and development. In the long-term these relationships will serve to generate political will, which is paramount for successful funding and implementation.

The California Alliance for Community Composting (CACC) outlines a successful approach in its Composting for Community Green Spaces.⁶ Taking inspiration from these methods, we encourage you to reach out and learn about activities taking place in your community. This will help you identify community strengths, concerns, and common language, while understanding their needs and challenges, to ultimately support their goals.

More information on identifying organizations and individuals who should be included in this process is outlined in Appendices A and C, and in the Activities Worksheet [“Development Partners & Stakeholders”](#).

CCAC’s Approach

“CCAC’s community engagement processes are characterized by intentional outreach, active listening, community dialogue, sharing relevant resources, and creating open & collaborative spaces. Our approach to building the overall capacity of community composting in California values knowledge sharing and co-creation to accurately identify the true needs of individual sites and communities. In this way, we hope our program outcomes will provide state and local agencies with strong evidence that, given adequate funding and technical assistance, decentralized community composting networks of nonprofits and small businesses will...contribute to California’s methane reduction and compost facility development targets”

SECTION 4: Outline Policies and Plans, Incentives, & Public Information

Organic materials have largely been regulated as a secondary aspect of waste management or have fallen under agricultural materials rules. To create a political economy that supports the beneficial reuse of these materials will require identifying mutually beneficial social and economic relationships between the various producers and end-users. Start by identifying existing policies that may be related and increasing transparency around rules, incentives, and contracts.

⁶ California Alliance for Community Composting Project Goals 2020 <https://www.thecacc.org/projects>

Policies to Consider: Zero Waste; mandatory composting; hauling contracts; closed, cooperative, or open franchise agreements; rules governing movement of organic materials and associated vehicles; compost facility sizes and environmental requirements. Conducting a review of all policies pertaining to organic materials will help you understand opportunities for additional policies or revisions that would incentivize the market, while supporting diversification and building small, medium, or large businesses. See Appendix B for a comprehensive list.

Existing & Related Goals and Plans: Identify the goals and plans, such as zero waste or climate goals, your municipality has adopted that may be related to this work. Understanding these goals will provide context and build relevance to stakeholders and elected officials.

Data to Make Available: Making your organics materials data public supports community awareness, market research, and business planning. This data includes waste characterization studies, organics generation, current facilities, etc.

Site Identification: A primary consideration for both commercial and community scale composters is site location. Identifying desirable locations or listing publicly available land sites can provide support to operations looking to partner with the local jurisdiction.

Permitting Support: Navigating the myriad permitting requirements, from local land use to regional and state environmental requirements, can pose a barrier to both community and commercial scale composters. Providing a list of all applicable rules that apply to size and type of composting operations will help composters succeed with permitting.

Local Grants & State Advocacy for Funding Sources: Offering local incentives, whether financial or tax benefits, can help projects get started. Cities or counties may be able to offer a local grant and/or advocate on behalf of state programs that support healthy soils and organics diversion from landfill.

Providing Direction to and Coordinating with Technical Assistance Providers: Technical assistance can be one of the most important factors in long-term success. The number of political, financial, and technical steps can be overwhelming and unfamiliar to new or small-scale actors. Good resources for communities include the Institute for Local Self Reliance, CACC, and Trust for Public Land. For Agriculture, resources include Soil & Water Conservation Districts, Regional Natural Resource Conservation Service Offices, and Agricultural Extension and Land Grant Universities.

The Activities Worksheet, [“Policy, Plans and Goals Scan”](#) will help you brainstorm and document the range of policies, goals and directives that can support this work.

SECTION 5: Imagining a New Design/Assessing Application Potential

As we move from a linear process to a circular, regenerative process, "waste management" becomes "resource recovery + creation". Reimagining and redesigning a system in which "waste" is transformed into a "resource" that can improve ecological and community well-being must include planning for how to use the end-product.

As you assess gaps in the system and reimagine a new design, it is useful to consider creating a diverse system that increases community participation, provides local and regional benefits, and supports a variety of economic and community stakeholders.

Fostering new, complementary, and mutually beneficial economic relationships between industrial, community, and on-farm composters requires a thoughtful political economic strategy. Industrial compost facilities can process large quantities of organic waste materials, but are often sited further away, requiring more transportation and the finished material may not be as accessible to the community. Smaller community-based facilities and farmers may produce less but are ideal partners for local distribution.

You will need to know more about the acreage of lands under different uses in your community and where compost could be made and used.

There are many scales of operations that may work for your community. They can all work together or you may have one or two of these situations that work best. Each type and size of compost site will require a different type of location and has varying economic benefits and costs. Some of the end uses and processing infrastructure you may consider include:

Parks & Green Spaces: Compost application can increase water holding capacity in lawns and turf and replace or offset the use of chemical fertilizers. Strategically locating and developing small to medium-sized compost systems for green waste or green and food waste can support these landscapes. They can be co-managed by municipal staff and community or small-scale commercial composters and provide opportunities for community education and outreach.

Considering the End-User

One of the most important things to consider when redesigning your system is the end use and user. Will the compost be given away or purchased, and if purchased at what price point?

In urban settings compost can be used in landscaping, gardening, and farming. For agricultural uses it may be replacing another product. For example, is compost offsetting the use of synthetic Nitrogen? What specifications does the compost need to serve that end use? How does buying and applying compost compare to the cost of using the original product?

Ensuring community members and farmers and ranchers have access to finished compost and healthy soils that meet their needs is essential for successful uptake of its use and the realization of potential carbon sequestration benefits.

Community Spaces & Gardens:

Supporting community composters and gardeners create and manage small scale systems for schools, places of worship, or community sites keep these operations financially viable. They can reclaim and restore urban green spaces, while providing community engagement and education. There are various models of these programs—from the [Institute of Local Self Reliance](#) to local Master Gardener and Composter programs.



Ameliorating Urban Blight, Post-Industrial Operations, and Industrial Agriculture:

If your community suffers from the negative health consequences of industrial manufacturing or industrial agriculture, you may consider restoring brownfields or abandoned lots to green spaces. The US EPA has funding available for Brownfield Restoration and the US Chamber of Commerce offers tax benefits to investors who invest in businesses located in economic opportunity zones. You might consider encouraging new compost operations to locate on these sites and creating terms for long-term, low-cost leases in exchange for a percentage of compost produced.

Residential & Commercial Properties: You also may consider supporting residents or local commercial enterprises to enhance carbon management in private yards and gardens or business campuses by offering backyard or other composting programs.

Agriculture: You may consider supporting farmers and ranchers to compost on-site or use compost in conjunction with “whole farm” planning. There may be opportunities to support development of watershed-scale on-farm compost operations. You may investigate whether land that your jurisdiction owns could be leased to commercial or community composters with preferential terms in exchange for a percentage of compost.

Waste-Water Treatment Plants & Other City or County Lands: Co-locating mid- or full-sized compost facilities on public property may provide benefits for a range of partners. Long-term leases at attractive rates with private companies in exchange for a percentage or reduced rate compost can add capacity to organics processing in your jurisdiction and ensure that new commercial compost facilities are beneficial to your community.



Sustainable
Economies
Law Center

Organics on the Move in Oakland Mapping our Ecosystem



The City of Oakland worked with the Sustainable Economies Law Center to map out a new flow for organic materials and appropriate composting infrastructure.⁷

Questions:

1. Will new processing capacity need to be built for the volume of organic materials?
2. Could additional processing needs be met with or enhanced by a mix of distributed mid-scale processing in communities and on farms?
3. What are possible sites for new facilities based on this information?
4. Could you build a new municipal facility or partner with a private business to build a new commercial facility?
5. Are there existing farms or ranches and do they have space for, and interest in composting?
6. What benefits do these different types of infrastructure and processes bring?
7. Where is there a need for healthy soils in your city?
8. Are there farmers or ranchers that will be using compost to help transition to regenerative or healthy soils management?

Review and compile maps of open land and land use types appropriate for potential processing infrastructure and/or application of compost (small, mid-sized and large). The Activities Worksheet [“Assessing Application Potential”](#) will help you outline potential end-use land holdings and begin to calculate environmental benefits.

SECTION 6: Articulating Environmental and Community Benefits

Compost is a simple and robust climate change solution that has mitigation, sequestration, and resilience benefits. Once you have data on how much organic materials your community generates,

⁷ © 2012 The Sustainable Economies Law Center <https://www.theselc.org/>

have assessed how and where to process those materials, and understand who will be using them you are ready to calculate environmental benefits.

Diverting organic materials from landfills, incineration, or water-based manure management reduces methane emissions. The application of compost has been shown to catalyze and enhance soil carbon sequestration or reduce loss of soil carbon from intensive management or extreme drought or fire. The added resilience benefits for lands that have received compost or mulch include enhancing plant health, increasing soil's infiltration rates and water holding capacity, and lowering ground surface temperatures.

TO CALCULATE GHG BENEFITS YOU WILL NEED:

- Total organic material currently going to landfill
- Total available and total possible tons of compost (gained from feedstock data)
- Current organic material management practices (landfills, compost facilities, incinerators, open burning, manure ponds, etc)
- Acres of land in your jurisdiction and surrounding area by land type and knowledge of current land management practices. The more granular and specific you can be the better. You will want to understand acreage for the following land types: rangeland, orchards, row crops, impervious surfaces, community green spaces, areas that could potentially become green spaces, lawns, turf, golf courses, residential green spaces.

Nature-based carbon cycle management is comparable to a traditional life cycle analysis and does not neatly fit into the system of standardized measurements we currently use in climate planning. However, the co-benefits of this type of implementation may be easier to see and track. These co-benefits have tremendous value to the community, small businesses, or the farmer who can see and feel them. For example, additional benefits of soil restoration include:

- Building organic matter in soils
- Decrease in soil erosion
- Healthy mycorrhizal communities that help bioremediation of pollutants and chemicals in post-industrial soils
- Increased local water quality
- Increased water efficiency and reduced need for irrigation, leading to energy savings

Examples From Other Cities

Fayetteville, Arkansas has a municipal system and local and state regulations allow for farmers to pick up organic materials and compost on a farm. Importing material to farms for composting on site in California and in Colorado is cost prohibitive due to several layers of regulations.

Boulder County is building a municipal facility that will offer reduced rates for compost to farmers and ranchers engaged in carbon farm planning. The City of Los Angeles is currently supporting community-based facilities on park lands that will supply compost to neighboring communities and help meet the park's land management needs.

- Reduced need for herbicides and synthetic Nitrogen fertilizers, leading to cost savings and reduction in air and water pollutants that tend to disproportionately impact minority communities
- Increased agricultural resilience to extreme weather events
- Lowered urban temperatures via the support of urban forest, gardens, and other green spaces
- Improved air quality
- Enhanced ability to grow food in food deserts
- Increased social connectivity and associated resilience
- Improved community well-being, social interaction, reduced mental and emotional stress
- Cultural engagement and connection to nature

Preliminary information on land categories and overall acreage can be entered into the Activities Worksheet, [“Assessing Land Potential”](#). This data will be used in the Carbon Calculation Tool to help fully understand the carbon sequestration potential of your organics and land resources.

Conclusion

Going through the steps of this process guide provides an understanding of how we are, or are not, supporting biogeochemical life cycles. Bringing natural systems into our climate policies will require expanding our framing from purely static goals, such as, “50% emissions reduction below baseline by 2050”—to include both absolute reductions for emissions sources AND goals to increase carbon stocks in biomass and soils. This guide will help you step outside traditional carbon accounting principles of “permanence” or absolute reduction and consider comprehensive metrics, in addition to stand-alone emission or sequestration numbers.

The Earth’s lifecycle is a dynamic system that requires policies and programs related to carbon cycling and biological nutrient management. Articulating the co-benefits of a transition to a circular economy, that uses these biological nutrients for the highest and best use will help you get buy-in from policy makers and other stakeholders and secure their investment in systems that treat organic materials as a resource.

Much like the earth’s dynamic system, the process of collecting data and outlining your existing resources is not linear. With each iteration, you will identify new stakeholders and resources to help develop a more comprehensive picture of current systems and policies and craft a vision for the future that ensures a truly Just Transition.

Creating Green Space

Access to parks and green spaces support community well-being. Integrating community composting and gardening at parks provides positive social and environmental connections, volunteer opportunities, facilitating a sense of safety and nurturing, while providing healthy waste management and food access. Supporting these projects at parks greatly enhances community education and outreach, raising awareness around organic waste management and healthy soils for climate change mitigation.

APPENDIX A: Creating Your Team

Identify Existing Goals and Assigned Staff: You may want to review existing government goals that align with this project, identify staff responsible for achieving those goals, and recruit them for the core team. For example, if your City also has a waste management goal, you may identify and reach out to the person or team who is responsible for the implementation of that goal.

Adopt New Goals/Targets: If your municipality does not currently have any goals related to zero waste, we recommend adopting one. The Urban Sustainability Directors Network has examples of other cities' zero waste goals.

Motivations, Needs, and Goals: Once you have brought your core team together to identify related policies and plans and go over project goals, you can identify individual needs and implicit motivations with regards to this work.

Funding & Leadership: Ensure that you and your core team members can apply their current budgets or time to this kind of project, and/or locate outside funds that can be used to support this new endeavor. Ideally, you will identify an elected official who is willing to champion this work and carry this goal forward if a vote of your governing body is required in the future. If a relationship does not already exist with this official, start to invite them to learn more about the issue and share resources.

Questions for the core working group:

- Why are you/your department engaged in this exercise?
- How do you see this project helping to meet the goals of your agency?
- What do you want to see happen as a result of this project?
- Are there other goals that your city, your community, or your surrounding area may have that can be supported through this work?
- What community that you work with outside of City/County Government may wish to be involved in this process going forward?

APPENDIX B: Policy Scan/Restructuring the Political Economy of Organic Materials Management

One of the primary challenges to building a new economy in the organic materials space is a lack of transparency and cohesion in current policies that apply to organic material processing and handling. Requirements for permitting, health and environmental quality, agricultural regulations, and licensing are most often held in different agencies. Local businesses and communities face a morass of local and state regulations that often deter innovation or force people to operate in legal “grey” areas.

Generally, the movement and processing of organic materials has been regulated as a secondary consideration and not with market creation as a primary motivation. The current political economy for municipal organics has resulted in a dysfunctional market where demand is often not enough to generate new supply in some areas. Conversely, compost may sit in municipal custody with no available markets.

Restructuring rules and successfully cultivating new markets related to organic waste will require understanding the overarching framework including:

- **Access:** In areas where access to organic materials is not heavily regulated, informal economies or small businesses may already exist. Do you want to support their growth and provide best management practices? In areas where materials are heavily regulated such as with exclusive franchise agreements or there is little public or farmer education, demand for compost is often not enough to increase supply, indicating that the market is not working.
- **Movement:** The ease at which feedstocks can move between where they are generated and where they can be composted largely influences production costs. This freedom of movement may be limited by policies. It may become apparent that to make the economics work, your jurisdiction may need to pass new laws or modify existing ones.
- **Geography:** The economics of compost are also highly geographical. Materials are heavy and transport adds significant cost. Keep in mind that the ability (or not) to set or influence pricing through rates and tip fees will significantly influence your market.

You may need to create or revise existing policies that govern these areas to help lower the barriers of entry for small business and communities in the organic materials economy.

Municipal “Waste” Management & Contracting: It is imperative to understand the services provided, who is providing them, and the contracting system for solid waste management. This will give you information on what LEVERS your jurisdiction can access to change current management, as well as identify WHEN you will be able to execute these.

- What services are offered for residential and commercial customers? (i.e., recycling, no compost, residential compost, compost for commercial but not residential, etc.)
- How many collection bins are currently in use and what are their colors (compost, yard waste, landfill, recycling)?
- Is composting mandatory?
- Is organics collection incentivized? (e.g., lower rates, educational programs, etc.)
- Does your city/county have control of the waste “utility” via contracting processes with private providers?
- How often are these contracts renewed?
- Who sets the rates and what is the process for rate setting?
- Does the municipality haul refuse, organics, and/or recycling?
- Does a private company (or companies) haul local refuse, organics, and/or recycling?
- Who has legal access to pick up organic materials?
- Do you have an exclusive franchise or an open bid system for hauling?
- Is it legal to haul organics if you are not a licensed hauler?
- Can residents and businesses contract directly with an entity providing organics collection?
- What permits, health codes or other requirements does your jurisdiction have that apply to haulers?

Community & Agricultural (On-farm) Composting: It is likely that these activities are already taking place at some scale in your community. If rules are not in place that prevent transport or processing on site, natural economies between farmers, restaurants, and communities are likely to already be in place. On-site composting often offers the most economical means for an agricultural producer or land manager to access compost. To assess the potential for distributed and onsite composting it will be important to ascertain:

- Is composting on private farms legal? If so, at what scale (size limit)?
- Is it legal for farms to import organic materials to compost onsite?
- Is community composting legal? backyard, gardens, hubs in parks, etc? At what scale (size limit)?

Facility Permitting & Community Benefit Agreements: Composting facilities are permitted for operation by local governments, based on their location in agricultural, industrial, commercial, or residential zones. The scale allowed is generally dictated by zoning.

- What kind of permits are required to build new facilities in your jurisdiction? (Water quality, air quality, food vs agricultural vs green materials, etc)
- What are the size parameters for “community”, “on-farm” or industrial scale facilities?
- What restrictions exist that new facilities would need to work around? (Hours of operation, noise, order)

If your jurisdiction does not currently require new facilities to create a Community Benefits Agreement with the surrounding community, this should be considered as part of the Just Transition

process and to head off issues with future neighbors. The California Association of Composters guide for implementing Community Benefit Agreements can be obtained by request.

The Institute for Local Self Reliance provides a [Policy Guide for Community Composters](#) that you may reference and share publicly.

CHANGING AND CREATING POLICIES

After assessing existing policies and understanding the potential for composting in your jurisdiction, what is needed to shift the political economy of this sector? Questions to consider:

- What policies are barriers to new compost businesses, and how could these be changed, or new ones be created? (this may be a long-term policy strategy that requires state engagement)
- What barriers do communities face in setting up garden or community composting, and how can these be addressed?
- What are key issues that will prevent agricultural producers and land managers from using/purchasing the compost or organic amendment products?

APPENDIX C: Engagement and Education

Engagement is most effective when it is collaborative and mutually beneficial demonstrates a shared connection to the issue and outlines a future vision. As you go through the process of mapping your resource materials and existing infrastructure, you will continue to identify stakeholders, each with their own needs and goals. However, no matter who they are, showing up and following through consistently builds trust to ensure that engagement efforts are fruitful and effective, creating genuine collaboration among partners and city officials.

By implementing public outreach, documenting shared goals early in the process, and partnering with local groups, you can reduce the potential concerns that may be raised during the public permitting process for new facilities and developing new markets for finished compost. Structured outreach meetings at which you provide background education on the subject and share the internal goals and vision that you identified with stakeholders will support core actors. Invite participants to share feedback as well as their goals, values and concerns or drivers for existing practices, conditions, etc. and agree upon next steps. Development partners may be appropriate hosts for these meetings as they often provide familiarity and have an existing trusted relationship. Confirm point people with key stakeholder groups to manage the engagement process going forward.

This outreach also lays the groundwork for future educational campaigns once actual programs and facilities are in place. A clean and quality supply of organic amendments is essential to the sale of compost and ongoing market expansion. And education is the single most important factor in increasing public participation and decreasing contamination rates. As you identify what matters to your communities, how they learn, and who they trust when it comes to environmental information, you can begin to craft these campaigns.

Environmental Justice Communities: Low-income communities of color have historically been the sites for disposal of society's waste—from landfills, to incinerators, to wastewater treatment facilities and industry. The long-term success of community composting projects or new facilities that may be built in, or adjacent to, environmental justice communities, depends on significant support from diverse and committed teams. It is imperative to work with residents from the beginning of the process.

- Work with trusted community leaders such as community composters, faith-based organizations, local advocates, or parks and library officials to host meetings.
- Consider budgeting for a facilitator that will provide a "safe presence" at meetings, reimbursement for transportation, and on-site child-care, alongside culturally appropriate snacks and healthy beverages.
- Structure community engagement processes with the following characteristics: intentional outreach, active listening, community dialogue, sharing relevant resources, and creating open and collaborative spaces to address the social and political structures that have privileged access to democratic processes for some communities over others.

More ideas for engagement can be found in the [Principles of a Just Transition](#).

Neighbors/Those who will live or work near facilities: Engaging those who live near composting facilities—small, medium and large—is crucial to ensure a smooth process. Much like working with Environmental Justice communities, respect, trust, and communication are key.

Agricultural Producers: Farmers and ranchers work hard outside all day. Consider timing when planning engagement strategies. Is it spring, during calving or planting season? Is it fall, during harvest? Are you asking them to come in during a time when they need to be on duty full time? Off seasons, such as winter or mid-summer before harvest may be better times.

- Consult with your local Agricultural Extension or Conservation District to get a sense of timing. Agricultural producers are, in general, private people. Be aware that requests for information or practices before you have established a mutually respectful relationship may result in them pulling away from the process or feeling overburdened.
- Consider hosting meetings in already familiar facilities (the Extension Office or the Fair Grounds or Farm Bureau) and at convenient times during the day and season.
- Offers to reimburse transportation and the provision of food are also helpful for producers who may have to travel to attend a meeting after hours.
- If conducting meetings online, be sure to check in via phone beforehand to ensure that the individuals you are working with have access to and knowledge of the technical systems and platforms you are using.

Ongoing education is also essential for agricultural producers and land managers. The single biggest indicator of market adoption in these fields is technical assistance in the form of ongoing, relationship-based education from a technical specialist.

LAND MANAGEMENT PLANNING. To determine the potential for specific areas of land, you will need to work with agricultural and land management to co-design Carbon Sequestration Plans or Carbon Farm Plans. These plans are co-designed with land managers to include other management goals, such as recreation or production.

Owners of Existing Infrastructure: Waste haulers and landfill owners most likely do not have an existing incentive to compost. Their business models may be constrained by ownership of landfills or the existing political economy. For example, they may lose money if they reduce the volume of materials going to their landfills, where they own the existing infrastructure outright, as compared to having to finance the development of new facilities but do not control the rate process (which is publicly held).

- Convene a meeting to outline goals of the project and identify how much more processing capacity might be brought online at existing facilities/explore interest in new facility development and barriers to this.

EDUCATIONAL and FUNDING RESOURCES

1) **Farmer Education**

- a) [USDA NRCS Carbon Farm Plan or Soil Health Plan](#)
- b) [Agriculture Extension](#)
- c) [Mad Agriculture](#)
- d) [Fibershed](#)
- e) [Quivira Coalition](#)

2) **Composter Education**

- a) [United States Compost Council](#)
- b) [ILSR Guide to Community Composting](#)
- c) [California Alliance for Community Composting](#)
- d) [Master Gardeners and Composters](#)
- e) [Kiss the Ground](#)

3) **Public Education**

- a) [San Francisco Signmaker](#)
- b) [EcoCycle](#) (links)

4) **Funding Resources**

- a) [California Healthy Soils Program](#)
- b) [Environmental Grantmakers Association](#)
- c) [EPA Brownfields](#)
- d) [EPA Cleanwater State Revolving Loan Fund](#)

Funding for water quality can often be applied towards manure or nutrient management scenarios and the EPA Clean Water Fund offers funding for projects that improve water quality.

- e) [Fundors for Regenerative Agriculture](#)
- f) [OneEarth](#)
- g) [General USDA](#)
- h) [USDA Community Composting](#)
- i) [USDA Environmental Quality Incentives Program](#)

5) **States with Healthy Soils Policies**

DEFINITIONS

Active compost is compost feedstock that is in the process of being rapidly decomposed and is unstable. Active compost is generating temperatures of at least 122 degrees Fahrenheit during decomposition; or is releasing CO₂ at a rate of at least 15 milligrams per gram of compost per day, or the equivalent of oxygen uptake.

Aerated static pile composting is a process that uses an air distribution system to either blow or draw air through the pile. Little, or no pile agitation or turning is performed.

Agricultural material is material of plant or animal origin from the production and processing of farm, ranch, agricultural, aquaculture, floricultural, horticultural, silvicultural, vermiculture, or viticulture products, including manures, orchard and vineyard prunings, and crop residues.

Anaerobic decomposition is the biological decomposition of organic substances in the absence of oxygen.

Biosolids are solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Biosolids include, but are not limited to, treated domestic septage and scum or solids removed in primary, secondary, or advanced wastewater treatment processes.

Chipping and grinding operations and facilities are those which mechanically reduce the size or otherwise handle organic material. Chipping and grinding facilities do not produce compost, though some compost facilities also have chipping and grinding activities on site.

Circular Economy is based on three principles: 1) design out waste and pollution, 2) keep products and materials in use, and 3) regenerate natural systems. It represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. The concept recognizes the importance of the economy needing to work effectively at all scales – for large and small businesses, for organizations and individuals, globally and locally. Transitioning to a circular economy amounts to more than adjustments aimed at reducing the negative impacts of the linear economy. It looks beyond the current extractive industrial model to redefine growth and entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital.

Compost as defined by the US Composting Council is “the product manufactured through the controlled aerobic, biological decomposition of biodegradable materials. The product has undergone mesophilic and thermophilic temperatures, which significantly reduces the viability of

pathogens and weed seeds and stabilizes the carbon such that it is beneficial to plant growth. Compost is typically used as a soil amendment but may also contribute plant nutrients.”

Compostable material is organic material that when accumulated will become active compost.

Compostable material handling operations or facilities are those that process, transfer, or store compostable material. This includes chipping and grinding, composting, screening, and storage activities related to the production of compost, compost feedstocks, and chipped and ground materials.

C:N Ratio Carbon to Nitrogen ratio (C:N) is a ratio of the mass of carbon to the mass of nitrogen in a substance. For example, a C:N of 10:1 means there are ten units of carbon for each unit of nitrogen in the substance.

Community Composting ranges from relatively small neighborhood projects to those that cover large districts. Whatever the scale, community composting projects bring together like-minded people who want to ensure that organic materials are treated as the valuable resource they are, rather than being “wasted”.

Enclosed composting is a method where the area used for processing, composting, stabilizing, and curing of organic materials is covered on all exposed sides and rests on a stable surface with environmental controls for moisture and airborne emissions.

Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people bears a disproportionate share of the negative consequences resulting from industrial, governmental, and commercial operations or policies.

Feedstock is any compostable material used in the production of compost or chipped and ground material including, but not limited to, agricultural material, biosolids, food material, green material, and mixed solid waste.

Food material is any material that was acquired for animal or human consumption, is separated from the municipal solid waste stream, and that does not meet the definition of "agricultural material". Food material may include material from food facilities; grocery stores; institutional cafeterias such as prison, school, and hospital cafeterias; or residential food scrap collection.

Green material is any plant material that is separated at the point of generation and contains no greater than 1.0 percent of physical contaminants by weight including but not limited to yard

trimmings, untreated wood wastes, natural fiber products, construction and demolition wood waste. Green material does not include biosolids, food material, mixed solid waste, material processed from commingled collection, wood containing lead-based paint or wood preservative, mixed construction, or mixed demolition debris.

Greenhouse Gas (GHG) is any gas that has the property of absorbing infrared radiation (net heat energy) emitted from Earth's surface and reradiating it back to Earth's surface, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapor are the most important greenhouse gases. Surface-level ozone, nitrous oxides, and fluorinated gases also trap infrared radiation.

Handling is the processing, transfer, and storage of compostable materials. Handling includes composting, screening, chipping and grinding, and storage activities related to the production of compost, compost feedstocks, and chipped and ground materials.

In-vessel/anaerobic digestion composting is a process in which compostable material is enclosed in a bin, drum, reactor, silo, tunnel, or other enclosed/sealed container for the purpose of producing compost. It is maintained under uniform conditions of temperature and moisture where air-borne emissions are controlled.

Manure is accumulated herbivore or avian excrement. It is an agricultural material.

Mixed solid waste is material that is part of the municipal solid waste stream, and is mixed with or contains non-organics, processed industrial materials, or plastics. A feedstock that is not separated or contains 1% or more physical contaminants by weight is mixed solid waste. Compostable material that contains mixed demolition or mixed construction debris is considered mixed solid waste.

Pathogen Destruction: The thermophilic composting processes if properly cultured destroys all pathogens and harmful bacteria. The time and temperature criteria for the USEPA Process to Further Reduce Pathogens by composting of biosolids has been adopted as a general composting time/temperature standard by both the USDA National Organic Program (NOP) and by the State of California waste management authority, CalRecycle. To ensure pathogen destruction please refer to time/temperature records, or compliance with standard E. coli and Salmonella reduction criteria, to ensure compost quality ([See the EPA's Water Quality Handbook](#)):

Physical contamination or contaminants are human-made inert products contained within feedstocks, including, but not limited to, glass, metal, and plastic. Please refer to compliance with [USEPA](#) standards for metals. These metal standards for compost have also been adopted by USDA NOP and the State of California.

Prohibited feedstocks include asbestos-containing wastes, biomedical wastes, hazardous wastes, radiological or toxic wastes, and any other prohibited wastes defined under state law.

Soil Restoration Soil is the foundation of food and natural fiber production. It is also the basis for functional small water cycles and food security. Erosion, nutrient depletion, and other threats are causing soil to rapidly deteriorate globally. Restoring soil means nourishing below-ground biodiversity and increasing soil carbon levels.

Stabilized compost is any organic material that has undergone a Process to Further Reduce Pathogens (PFRP) and has reached a stage of reduced biological activity as indicated by reduced temperature and rate of respiration below that of active compost.

Soil organic matter (SOM) is made up of large, complex organic molecules. These molecules have negatively charged exchange sites, which means they increase a soil's ability to retain positively charged nutrients (termed cation exchange capacity, or CEC) and polar water molecules (termed water holding capacity, or WHC). SOM physically separates clay particles and contributes to favorable soil structure, or "tilth," allowing plants to make better use of water and nutrients, creating habitat for desirable microorganisms and reducing pests and disease, and making soil easier to till. Loss of SOM due to land degradation is a concern for agricultural and livestock productivity.

Thermophilic process breaks down biological waste with thermophilic (heat-loving) bacteria. A key advantage of thermophilic composting is that the high temperatures kill diseases.

Windrow composting is the composting process in which compostable material is placed in elongated piles. The piles or "windrows" are aerated and/or mechanically turned periodically.