

A Community Compost Exchange Manual:
reconnecting municipal organic waste and soil management

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Abstract

Ontario's Provincial waste strategy and Toronto's long term-waste management plan both clearly recognize that the multi-residential sector holds the greatest opportunity for increased participation and decreased contamination in waste collection. With this in mind, *A Community Compost Exchange Manual: reconnecting municipal organic waste and soil management* was made to highlight the impacts and connections a community-based waste management (CBWM) project has to the multi-faceted issues facing multi-residential waste diversion. This manual uses a collection of essays as a framework to connect different elements of (CBWM) to greater schematic themes impacting organics recycling in Ontario and Toronto. The work can be read sequentially, or each section can be read as a stand-alone piece that dives into the academic and experienced-based aspects of the Community Compost Exchange (CCE) an organics recycling program in Toronto. A methodology comprising of literature reviews, analyses from participant surveys, qualitative data through interviews and personal communications with current Toronto composters, and personal experiences of managing and scaling up the CCE are used to inform this work.

The manual starts with a soil acknowledgment that centers Indigenous knowledge and its contributions to composting and soil management. Then the programs goals and intentions are addressed in its mission statement along with the collected statistics beginning in 2015. Following that, an essay on current food waste diversion programs and techniques being utilized by *Solid Waste Management Services* of Toronto and local community groups is organized within a food waste hierarchy structure. This analysis shows that community initiatives do most of the work for preferred diversion methods but proportionally, are very under-supported by current municipal budgets. Then, the major components of the CCE are described in detail through three essays: 1. knowledge sharing and food justice at urban farm markets; 2. Incentivization of organics participation; and 3. best practices for processing municipal waste into nutrient dense compost for use in agricultural soils. Finally, an in-depth look at the policies impacting community composting, from the federal to municipal levels, identifies solutions and produces policy recommendations to grow decentralized composting across Ontario. Waste touches deeply on both social, political, economic, ecological and justice-based issues, which is why this manual works to thoroughly place the Community Compost Exchange into a diverse dialogue with these issues.

Foreword

Prior to starting my MES program, I managed organic farms in locations ranging from rural hillsides of Pennsylvania to *Highway 427* in Ontario. I have made compost from a variety of materials, anything from horse manure, to 50lb bags of crushed Oreo baking crumbs, to tractor trailers worth of scallions, all processed back into the soil. These experiences over the last ten years have been paired with experiencing food insecurity and living off food waste, being a farmer on food stamps, and being in awe as a child as I got to experience the miracle of a pumpkin sprouting from an abandoned compost pile. These lived experiences and intricate connections to food waste were just some of the catalysts for my deep interest in organics recycling. MES was an important opportunity to develop a theoretical knowledge base to inform my lived experiences and practical skill sets. The goal of this major project was to be a culmination of that merging through a practical manual that could inform both best practices and tools (the practical) while developing much stronger and critical connections to the multitude of actors and impacts facing waste management (the theoretical). The sections of this manual have allowed me to fulfill my learning objectives, and to engage in much deeper discussions that impact my on-the-groundwork. Understanding how this on-and-in groundwork relates to policy and regulation, food and soil justice, and barriers to participation in waste management – all within the neoliberal city – has been key to helping me further the impacts and strategies of community-based waste management. This work post-graduation is being turned into a printed book that will be made up of these essays paired with numerous photographs and visuals assembled over the last six years. This book, or manual, will be shared with policy makers and urban farm programs across Canada and the United States who are interested in establishing a Community Compost Exchange.

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Soil Acknowledgment

As community composters, we are inextricably linked to the earth. A handful of soil is a rich repository of history going well beyond its billions of bacteria, thousands of protozoa, hundreds of fungi and nematodes, ground down mountains, and elements formed from the big bang (Lowenfels & Lewis, 2010). Across the planet, humanity has a long history of employing nutrient recycling strategies to keep soil fertility and organic matter levels high, sustaining us all since time immemorial. These strategies are diverse, Indigenous, ingenious, and driven by local environments, conditions, and resources. Some examples are the use of fire for grassland management in the prairies, biochar production in the Amazon, African dark earth practices, and mulching with serrated wrack seaweed. These practices and more, fundamental to the continuation of human life, are in danger of eradication due to settler-colonial farming practices, extractive capitalist agriculture, land displacement, forced assimilation and the imposition of farming practices to survive in an economy that rewards colonial forms of food production (Penniman, 2018). This knowledge has been unrecognized as a form of erasure but is reappropriated when convenient. Through the process of creating this manual it has become clear to me that acknowledging the soil must involve celebrating the diverse people who care for it and recentering their knowledge of composting.

Soils in Tkaronto (Toronto) are shaped by both natural and anthropogenic impacts beginning with the retreat of the glaciers after the last ice age 11,700 years ago. The sacred soil that the Community Compost Exchange works on belongs to the traditional territories of the Wendet, the Anishnabeg, the Haudenosaunee, and the Mississaugas of the Credit First Nation. The enduring presence and earthwork practices of all First Nations, Métis, and Inuit peoples continue to contribute and protect the soil structures and health of the area (FoodShare, 2021). Diverse nutrient management and soil health practices—such as adding fish to mounds of Three Sisters plantings, growing nut-producing trees, and using fire to restore nutrients to forest floors - have profound effects on the productivity, health, and food producing abilities of forests, grasslands, and river valleys (Abrams & Nowacki, 2008). Much of this traditional Indigenous knowledge is now referred to as Agroforestry, a term used by conservationists to appropriate these practices (Rossier & Lake, 2014). Composting is one strategy for urban soil management. However, without a considerate construction of the narrative, it can become a tool for greenwashing the ecological waste and ruin produced by European colonization of Indigenous lands and non-western farming practices around the planet. Instead of using reactionary calls to

compost as purification for past wrongdoings, we look to the compost process of “breaking down” as one way to understand settler colonialism’s distortions of history and its continuation in the present.

Numerous formative books and sources on composting and organic agriculture highlight the work of George Washington, Sir. Albert Howard or J. I. Rodale (Blum, 1992; Coleman, 2018; Martin & Gershuny, 1992; Sidder, 2016). Though George Washington employed manure management practices, his need to compost arose because of an extensive cash cropping and plantation-based agriculture system that in 40 years wiped away millennia of soil fertility. Albert Howard, is credited with developing the ratio of carbon (brown) and nitrogen (green) materials used in modern aerobic composting methods, although he developed this in part from observing Indigenous agriculture techniques in India and Zimbabwe, while relying on indentured servitude to develop the labour-intensive method (Niemann, 2020). J.I. Rodale is credited as the father of sustainable agriculture, although he built on the work of George Washington Carver, who developed methods including crop rotations incorporating legumes and composting strategies that promoted the self-sufficiency of Black farmers (White, 2018). The choice of whom to solely acknowledge and whom to erase in a long line of successive knowledge building is a purposeful act of white supremacy.

Composting today is still a reactionary process. Waste management strategies facilitated by numerous municipalities maintain an ongoing disproportionate impact on First Nations. The Green Lane landfill, which is a dumping ground for much of Toronto's garbage, is located next to Oneida Nation of Thames community. After hundreds of complaints, community members completed surveys listing the landfill as the number one environmental threat to human health. In 2007, the community called for the immediate closure of the landfill, although Toronto still plans to send garbage to the site until 2040 (Albert, 2018). This is environmental racism. Complaints regarding odour and rats are largely a result of food waste and spoiled garbage, underscoring the need to process Toronto’s food waste close to the source. Composting is an immediately feasible solution, as it does not require a new innovative technology. Toronto can employ a decentralized community-scale compost program in partnership with multi-residential buildings to start the process of managing our own food scraps resources at home.

As a facilitator, community member, or urban farmer who is interested in creating a *Community Compost Exchange*, we need to center the word *exchange*. I encourage anyone who is starting this journey to look into your own ancestral knowledge around nutrient

management and soil fertility and be inspired by it. Understand the history of the soil you are working on, and as you utilize the processes and techniques that turn food scraps into humus, dive deep into questions of whose knowledge has given you these skills, who gets credit, and why. Composting is action-based and involves many steps. Community composting can play a big role in municipal waste management, although it is only one step and needs to be accompanied with calls for Land Back, reconciliation, incorporating Indigenous pedagogy in agricultural systems, acknowledging paths of knowledge, and amplifying Indigenous voices and organizations.

Mission Statement CCE

The Community Compost Exchange (CCE) is an exchange system incentivizing the resource collection of organics. Community members bring their kitchen waste to an urban farm and, in return, are given “market dollars” to purchase organically grown produce at weekly farm markets. The collected kitchen waste is then processed onsite into high-quality compost for use on the farm, in turn building a circular economy and closing the food waste loop. The exchange was created in response to the industrialization of organics processing and the currently under-realized but unique role that community-based waste management can play in the city of Toronto. Community based waste management specifically calls attention to the need for a decentralized, diverse, responsive and participatory-based plan for organics management in the multi-residential sector. With many of Toronto's urban farms close proximity to multi-residential buildings it is pivotal to use community composting as a way to augment the city's current organic collection strategies. Organics waste should be considered a resource that animates a circular economy while simultaneously providing nutrients and fertilizer needs for urban farms.

We envision an organic management system that uplifts all the people and places connected to the waste stream while giving them access to the economic, ecological and social benefits of composting. The CCE believes that composting rooted in environmental justice and located close to the source will create stronger, more resilient urban farms, increase availability and accessibility of local food markets, and create jobs for youth and community by creating pathways for a greener and more equitable waste management system. In choosing to incentivize organics collection the CCE moves beyond food scraps as waste to be diverted but instead seeing them as a resource to be captured at any cost – a resource that can help reshape our city.

Program statistics and authors connection to the CCE

The Community Compost Exchange (CCE) was a program that I started in 2015 while the farm manager for PACT's Grow to Learn program, an urban farm in Lawrence Heights, Toronto. I continued to develop this program with PACT until 2018. In 2019 I started work for FoodShare's Community Food Growing team and started a CCE program in the East Mall community of Etobicoke, Toronto. The CCE is an open-source concept and for 2021 will continue to be run through a partnership by PACT, FoodShare and the Flemo Farm project in the Flemington Park community in North York Toronto. Currently a collaboration of partners is working towards greater funding for the CCE which will involve the start of community-based waste management projects at numerous urban growing sites located in geographically diverse areas across Toronto.

From 2015 to 2019 the CCE has held 91 exchange markets on urban farms, has diverted from landfill and recycled 120,305 pounds of food resources and 490,000 pounds of wood chips. Over 472 households consisting of roughly 1416 individuals have exchanged their kitchen scraps for 51,559 market dollars¹. In 2020, in response to the pandemic, PACT provided emergency food boxes weekly to 400 individuals. Many of them are participants of its CCE program (PACT, 2020). FoodShare, unable to run an on-farm market because of Covid protocols, grew 34,712 pounds of organic vegetables to be distributed in their Good Food Box program while also still turning over 20,000 pounds of organic materials to compost.²

¹ These numbers were collected from end of year reports shared by both PACT and FoodShare

² From an internal End of Year report of FoodShare's SchoolGrown program.

Food Waste Reduction Hierarchy: A look at Toronto's current practices

Intro

Compost is an invaluable resource. Its production extends the life of landfills, improves soil's ability to retain moisture, manages stormwater, sequesters carbon, and amends soils to create a circular economy that gets food back on tables. Organic waste, the key ingredient to compost, makes up 32 percent (3,671,500 tonnes) of Ontario's waste stream yet only 39 percent (1,446,589 tonnes) of that is being recycled across the province (Ontario Ministry of the Environment and Climate Change, 2017). In Toronto, food scrap resources are managed in a multitude of ways. Fleets of both private and city owned vehicles pick up curbside waste from buildings every day of the week; residents in apartment buildings feed worm farms under their kitchen sinks; urban hens are fed food scraps for more nutrient-rich eggs; poop from the zoo is being made into biogas; schools are converting waste from culinary arts programs into black gold to grow more herbs; and food rescue trucks are redistributing organic resources across the city. From backyards to community gardens to kitchens, our food waste fuels so much. Though composting in Toronto is happening at many diverse scales, the roll out of Toronto's curbside organics collection (green bin) in 2002 sparked a steady decline in the promotion of composting scales outside of the city's new centralized system (Vidoni, 2011). The linearization, industrialization, and strict treatment of recycled organics as waste (rather than a resource) has brought with it community deskilling around compost production and food waste reduction.

Toronto's Long Term Waste Management Strategy (LTWMS), implemented in 2016, looked to usher in a new era of organics management, one focused on building circular economies and limiting the amount of material that needs to be processed in the first place (City of Toronto, 2016). The food waste hierarchy as outlined by the *Institute for Local Self-Reliance*³, is used in this essay to investigate and assess what food waste reduction and organics recycling strategies are currently employed in Toronto (Platt, 2017). Financial allocations of Toronto's 2019 Solid Waste Management Services (SWMS) budget will be placed in tandem with the food waste hierarchy to determine if funding matches the most preferred methods of diversion. Looking at community level initiatives and budget allocations by SWMS will allow a better understanding of the current landscape of the city's organics diversion strategy. This essay will focus on municipal food waste, specifically highlighting community level initiative's

³ The hierarchy is in line with other food waste researchers and governing bodies, (Environment and Climate Change Canada, 2020; European Commission, 2020; Gooch et al., 2019b; Rod MacRae et al., 2016; United States Environment Protection Agency, 2021)

and their contributions to reduction, but the success and greater impact of these initiatives rely on a whole systems approach, where numerous responsible actors are implementing change at the root cause of food loss and waste (Rod MacRae et al., 2016). Below, under each waste hierarchy heading current strategies, many of them community based, will be described consisting of a combination of city programs and initiatives being run by outside agencies. The city's current centralized anaerobic digestion program and a decentralized (community) composting strategy in Toronto are elaborated in more detail to better understand what opportunities are being missed by not using community composting to a greater degree to complement the city's existing organics diversion strategy.

1. Source Reduction

The most important component of an organic waste management strategy is to prevent food waste from happening in the first place. Toronto has enacted, and supports programs working towards source reduction but as a municipality its major focus are education initiatives. The 2016 LTWMS was the launching point for the *Waste Reduction Community Grants*, a program to support innovative waste reduction strategies designed and executed by community members and groups of multi-residential buildings and equity seeking groups (City of Toronto, 2021c). *Love Food Hate Waste Canada* is a nationwide initiative that highlights how food waste can be avoided at home⁴ by employing strategies such as showing the personal financial costs of food waste, highlighting the staggering numbers of how many lettuce heads thrown away daily across Canada, and sharing recipes that range from food scrap broths to pickled beets (National Zero Waste Council, 2021). To extend the educational reach of *Love Food Hate Waste Canada* and other waste reduction promotions, Solid Waste Management sends a yearly calendar to all Toronto residents. The calendar's month of June is full of tips to reduce food waste in seven different languages. Toronto's *Community Environment Days* are another important educational tool for source reduction in Toronto. Each ward sets up a day-long community event for waste education, collects wastes not accepted in the garbage bin, and offers free compost to community residents (Draaisma, 2019). Though not a typical source reduction strategy highlighted by the city, many of its community garden, urban agriculture, and wilding front lawn initiatives indirectly act as important ways to reduce food waste. Self-grown, urban-grown produce generates less waste because growers feel connected to the process and

⁴ Municipalities have their own education incentives around waste for residents but the impact of these across food waste reduction might need further reevaluation considering consumers may make up much less of the food waste problem as was initially estimated from 51% (Gooch et al., 2010) to 14% (Gooch et al., 2019b)

better understand the value of the food they have had a hand in producing. Also, by purchasing a lower percentage of their fruits and vegetables from big box grocery stores, they can avoid food-waste-producing sales tactics such as two for one deals that push more food waste onto consumers (Gooch et al., 2019). Though these programs have been successful in bringing food waste reduction to the forefront, still based on a Guelph study, it's possible that up to 60 percent of the food waste ending up in green bins is edible and could be avoided (Toronto Environmental Alliance, 2016a). Getting this number to zero is crucial for the longevity and financial success of solid waste management divisions, but would go beyond initiatives Toronto could enact solely. A 60 percent reduction in food waste means Toronto's current organic processing capacities are sufficient to cover the collection and recycling of all organics from every household in the city. Currently, without this reduction, the city is shipping out over a third of its diverted green bin material to external contractors and is planning to build a multi-million dollar processing facility starting in 2028 to handle projected organics material (Solid Waste Management Services, 2019).

1.a Budget and Recommendations

Currently, source reduction initiatives mostly fall under the heading of education, and make up an extremely small portion of the budget of \$3.9 million for *promotion and education* and the \$600,000 for *community environment days*. The \$3.9 million budget is split between all three waste streams, and though its exact spending lines are unavailable, I imagine only a tiny fraction of that third goes towards source reduction of organics (Solid Waste Management Services, 2019). One suggestion would be to increase the amount of *Community Environment Days* from once a year to monthly per ward, the educational opportunities to share source reduction practices is not being fully realized, sadly the 2019 budget actually recommended reducing the number of *Community Environment Days* to reduce costs (Solid Waste Management Services, 2019). Also, growing urban agriculture and its accessibility across the city is a community source reduction initiative the city should support.⁵ Programs such as Sundance Harvest's Growing in the Margins and FoodShare's SchoolGrown are providing community training for urban farmers (prioritizing BIPOC and LGBTQIP2SAA youth) but land access is still a huge barrier. The Flemington Community Farm located in Toronto's ward 26, is a new agriculture initiative animating a portion of Toronto's electric corridor. Member Farmers from the community are given a plot of land to run their own farm businesses to earn

⁵ There have been numerous reports on ways Toronto can do this such as Toronto Food Policy Councils Report *Grow TO* (Toronto Food Policy Council, 2012) and a Metcalf report *Scaling up Urban Agriculture in Toronto* (Nasr et al., 2010) but Toronto's picking and choosing which parts of the reports to be active about doesn't allow the framework decisions or needed changes to take place.

supplemental income while building food security for the surrounding area. This project is a great example of the direction urban agriculture projects should take in Toronto but the initial startup costs of the program (permits, safety inspections, water and electricity access, infrastructure restrictions etc.) cost hundreds of thousands of dollars, making its scalability difficult. Hopefully this project can figure and work through some of the logistical challenges with the City of Toronto and Hydro One, so that it can be more accessible for community gardens to startup in the future.⁶

2. Edible Food Rescue

Food that is going to be wasted should first be rescued and diverted to human consumption and then sequentially diverted as feed for backyard chickens or the livestock of vendors at local farmers markets. Rescuing food that isn't suitable for marketing because of aesthetics or closeness to expiry date is tricky. It's a justice-based issue when the government relies on "what's to become food waste" to feed food-insecure individuals. Getting second rate, or close to expired food is not empowering. Rescuing that produce and converting it into fresh meals may be a better solution. *Feed it Forward*, a Toronto social enterprise, is rescuing food from grocery stores, bakeries, and restaurants, then converting the food into ready-to-go meals while also operating Canada's only pay what you can grocery store (Feed It Forward, 2021). *Second Harvest* operates the *Food Rescue* donation app that connects businesses with food waste to non-profits, charities, community centers, etc. that can redistribute or use the food for programming (Second Harvest, 2021). Connecting donors directly to organizations that can process the food waste into meals removes the logistical challenges posed by the central warehouse model utilized by food banks.

There are also thousands of tons of food growing in Toronto that isn't making its way onto plates and into pies. *Not Far from The Tree*, a fruit picking and sharing project, helps rescue harvests from Toronto's urban orchards. With over 1.5 million pounds of fruits growing in Toronto every year *Not Far from the Tree* schedules pick days and shares the harvests among volunteers, community organizations, and the tree's registrants. Since 2008, more than 182,000 pounds of fruits have been diverted. They currently only work downtown, but with so many fruit trees in Toronto, scaling out across the city could rescue hundreds of thousands of pounds more (Not Farm From the Tree, 2021). The City of Toronto predominantly relies on charities and not-for-profits for food rescue, but it does use its budget to support the *Urban Harvest Program*,

⁶ C. Leslie, personal communication, February 11, 2021

one of the city's 5 community reduce and reuse programs. Black Creek Community Farm and Rexdale Community Health Center work with residents that have gardens that grow food or have fruit trees in their backyards, helping them to divert any surplus to local community events. Rescued produce is then used to run community canning and food preservation workshops, using knowledge-based experiences to reduce food waste at home. As of 2020, the program has rescued 3,432 lbs. of produce and has run 215 canning workshops (City of Toronto, 2021a).

Though not a program of Toronto's SWMS, Toronto's *Urban Hen Pilot Program* is an unrealized urban waste diversion tool. Feeding kitchen scraps to backyard hens that convert it into eggs could have a bigger diversion footprint across Toronto. A three year urban hen pilot project started in 2018 was just recently extended for another year until 2022 when city council will vote on whether to make the program permanent (Grant, 2020). The successful pilot project has been presented as a food security project that is managed between Toronto Animal Services and MLS, but in other cities is also considered an edible food rescue project. In Austin Texas, residents can apply for a \$75 rebate on the purchase of chicken coop and associated expenses; the region of Flanders in Belgium has given hens to residents to manage waste in their backyard (Unwin, 2007). With each urban hen capable of processing 83 lbs. of food scraps a year (Breen, 2020)⁷, the 234 hens registered with Toronto's pilot project could have processed 58,266 pounds of residential food waste since 2018 (Grant, 2020). Expanding this pilot program Toronto wide, and providing community gardens and urban farms with the opportunity to keep larger numbers of hens would save the city from processing hundreds of tons of food waste. The success of these types of initiatives will require a more interconnected and harmonized response from city departments.

2.a Budget and Recommendations

Unable to find specific item lines in the 2019 budget, Toronto's *Long Term Waste Management Strategy (LTWMS)* lists reduction and reuse with a \$774,000 budgeted for 2021. Costs include-

Costs include: Campaigns to promote food waste reduction strategy, textile collection and reuse strategy, audits to measure pre- and post-implementation of options, professional and technical services, a mobile education unit and staffing.(City of Toronto, 2016, p. 84)

⁷ The 83lbs of food scraps a year is considered supplemental feed given to the hens after their mostly grain fed diet. This number could be much higher if hens were fed grain from breweries, also when urban hens have access to a backyard composter they consume less grain because they have a greater access to worms, slugs, larvae.

Factoring in that the city supports 5 *Reduce and Reuse* programs, I estimate that each program would get maximum funding of about \$100,000. With the success of numerous outside organizations conducting edible food rescue I recommend creating a larger partnership between these organizations and SWMS. Also, the success of the urban harvest program particularly with canning workshops could be scaled out and take place during *Community Environment Days*. Concurrently, Toronto needs to recognize its Urban Hen Pilot as a food waste reductions program because every ton of waste diverted higher in the food waste reduction hierarchy has a greater impact. If the pilot project is approved across the city connections between urban farms and breweries could be made to divert spent grains from the beer making process to increase the food waste diversion of the Hens

3. Home Composting

The third most preferred reduction method in our hierarchy is composting in backyards or vermicomposting in apartments. Such onsite material separation and processing eliminates disposal and collection costs. In 2019, backyard composters diverted 19,255 tonnes of organic material constituting about 12 percent of all the food waste diverted by Toronto (City of Toronto, 2021b). After the rollout of the green bin with its accompanying focus on a centralized anaerobic compost system the City of Toronto phased out support for backyard composting such as the technical support line, and cost subsidies for backyard compost bins. Then, in 2016 the city stopped selling backyard compost bins completely.⁸ I believe the city is missing out on an opportunity to divert a lot more food waste to backyard composting. 2020 was an unprecedented year for people starting gardening and growing their own food in backyards. The spikes in seed sales and garden equipment was like nothing I have ever seen. As a farmer, it was impossible to order seeds or equipment in 2020, and still in 2021 numerous seed companies are sold out and have had to shut down their websites for periods of time to deal with the huge influx of sales (Gowriluk, 2021). With more people gardening, now more than ever needs to be the time to support backyard composting. Every household processing their own organics onsite means collection trucks can complete longer routes creating larger savings for SWMS.

3.1 Budget and Recommendations

The City of Toronto currently does not have any budget for supporting backyard composting. It is important to note that it has been 5 years since the city supported backyard

⁸ M. Nevin, personal communication, January 21, 2021

composting yet it still makes up 12 percent of total diversion. This shows that investments in equipment and education for backyard composters have long term payback. With that said, residents living in multi-residential buildings would not have the same access to bin subsidies and programs, creating an equity issue. One way to deal with this is that the city could offer up both backyard composters at cost or through rebates, and also offer apartment-based solutions for free, such as vermicomposters, or larger outdoor bins for entire buildings. Along with offering the physical components of these composting methods, Toronto will need to re-offer supports in technical details and troubleshooting. This could be through mailed out resources to residents involved, demonstration sites, and best practice workshops at *Community Environment Days*.

4. Small Scale Decentralized Composting

Decentralized composting projects work collectively with community groups across Toronto to manage organic waste and create high quality compost for growing projects. Even if as much food waste as possible is reduced or rescued, there is still the 39.9 percent of inedible food waste that needs to be diverted from landfills and ideally processed as close to the source as possible (Gooch et al., 2019b). Community-based composting needs to work in conjunction with Toronto SWMS to process this remaining amount of organic material.

Locally-based composting circulates dollars in the community, promotes social inclusion and empowerment, greens neighborhoods, builds healthy soils, supports local food production and food security, embeds a culture of composting know-how in the community, sustains local jobs, and strengthens the skills of the local workforce. When materials are collected and transported out of the community for processing, few if any of these benefits are realized at the local level. In addition, these community-based operations can move from concept to operation in a relatively short time frame, and typically are welcome in the neighborhood where they are started (Platt et al., 2014, p. 5).

Michael Vidoni's 2011 report on community composting in Toronto looked at ways of closing the food-waste loop that were currently unrealized by the city's centralized organic management practices. Published after Toronto's implementation of a curbside collection program, Vidoni's report highlighted opportunities missed by the municipality due to its failure to use community composting to complement the existing city's organics diversion strategy (Vidoni, 2011). Sadly, since that time, some of the compost projects highlighted by Vidoni are no longer in operation or have reduced capacity such as FoodCycles and The Stop; while simultaneously Toronto has seen a substantial increase in urban farm projects at a scale of at

least one-half acre and larger⁹. This created a situation where there is a need for new community-scale compost solutions that go a step further and close the food-waste-farm loop¹⁰ by helping to recapture municipal nutrients for urban agriculture. The City of Toronto acknowledges community composting as a tool for capturing multi-residential building organic waste but believes its contributions to diversion would be insignificant, expecting to divert only 60 tons by 2026, even with multiple years of investing and promotion (City of Toronto, 2016). I believe this is an extreme under representation of the benefits and diversion potential of decentralized options. A 2019 study by Shantanu Pai, Ning Ai, and JunJun Zheng designed a methodology to calculate potential impacts decentralized composting can have on a specific municipal region's solid waste management practices. The methodology looked at Chicago, a city with a similar population as Toronto, through three lens (1) calculating food waste generation from residential households; (2) identifying suitable decentralized composting locations with a focus on parks and green spaces; and (3) considering the capture potential of those sites for that specific demographic, such as if local residents would need pickup or were close enough to walk to a processing site (Pai et al., 2019). The study showed that decentralized compost could capture 27 percent of all residential food waste for the city of Chicago (Pai et al., 2019). Though outside of the scope of this essay, a similar study needs to be conducted for Toronto to better quantify the possible impacts of decentralized composting. In Toronto, PACT Grow to Learn and FoodShare partner to run the decentralized compost program the *Community Compost Exchange*. SWMS also works with FoodShare to assist over 40 community gardens with compost workshops, bins, materials, and expertise. With this small amount of financial support, FoodShare was able to divert over 56,000 pounds of food waste in 2019. Through my interview with community composters, it was noted that even though SWMS wants to promote more community composting, a different city division, Parks, Forestry & Recreation does not allow composting in city parks, meaning more than 100 community gardens aren't eligible.¹¹ Mis-aligned policies within city divisions are a big hindrance to community composting in Toronto.

⁹ When Vidoni's report came out FoodCycles at Downsview was the largest community urban farm project. Since then Foodshare operates a three acre farm, and ½ acre rooftop, PACT Grow to Learn operates a 1 acre and 1.5 acre schoolyard farms, Black Creek Community Farm animate 8 acres located at Jane and Finch, Fresh City at Downsview is growing on 2 acres and expanding (with multiple organizations) to 12 acres over the next couple of years.

¹⁰ A system that ensures organics waste is recycled back into the direct produce being consumed by those that create it- prioritizing farming and waste management as close to source as possible

¹¹ O. Lopez, personal communication, January 18, 2021

4.1 Budget and Recommendations

The City of Toronto has set aside a community composting budget as a part of its *Reduction and Reuse* programs, and as above in the section *edible food rescue*, this would account for close to \$100,000 a year. Toronto's LTWMS has also included community composting as a multi-residential organic's strategy with a viability planning period starting in 2021. It's hard to know if the current community composting budget will be introduced into that but the city has budgeted \$415,000 for Multi- Residential Services in 2021. Costs include; "Consultation for development standards, costs for IT to support development of reporting tools related to data management and other metrics, costs to support community composting (e.g. P&E and grants) and staffing (City of Toronto, 2016, p. 84)."

Throughout this manual are essays that share recommendations to support community composting in Toronto with a comprehensive list found in the executive summary. Toronto needs to conduct a study to determine the potential that community composting could have on food waste diversion, similar to the aforementioned 2019 study by Shantanu Pai, Ning Ai, and JunJun Zheng. With the success of the *Community Compost Exchange*, support for community composting programs from SWMS is needed. Like backyard composting, these financial investments have long term paybacks. In 1989 The Bain Housing Co-operative, located in Withrow Park, was given 7 composters to run a community composting program. Thirty years later they are still composting onsite to support the Co-Ops community gardens and surrounding trees. Even though Bain Co-op is a part of the green bin program, residents are still excited about community composting and they process up to 25 percent of organic waste onsite.¹²

5. Medium Scale and Locally based Composting

This is the scale that is usually employed by small towns and rural farms. The City of Toronto does not have any program or initiatives operating at this scale, but there are a few businesses that recycle their organics at farms outside the city. *Maizal Tortilleria*, a Mexican cafe that specializes in hand rolling tortillas, takes all of their food waste and processes it into compost at an affiliated farm. The compost produced is mixed back into the soil to grow more produce for the cafe. *Maizal Tortilleria* is a member of Toronto's Circular Economic Working Group (City of Toronto, 2020). *Waste not Worms* is a food waste reduction business that collects waste predominantly from office buildings in Toronto's downtown core. They then transport the waste to a farm outside the city and process it using a vermicompost method. Ontario's laws on

¹² M. Nevin, personal communication, January 21. 2021

waste hauling make this a very difficult scale to grow with current legislation. Both of these business operate in a grey zone, Maizal is simply moving waste they create onsite to a farm they operate and Waste not Worm is able to move office food waste because it is considered a feed source for their “livestock”, which in this unique case are worms.¹³

5.1 Budget and Recommendations

The City of Toronto does not currently have a budget for midscale and locally based composting. This method, mostly reserved for more rural municipalities, could be used in Toronto to support farmers when making trips to local markets to also collect food-waste from customers. This would take advantage of empty vehicles making trips back to farms and could offer some amendment freedom to farmers looking to make their own compost while being a small step in closing the rural and urban metabolic rift¹⁴.

6. Centralized Composting or Anaerobic Digestion

Toronto launched its green bin program in 2002 as a pilot in Etobicoke. Today it collects curbside organics from over 460,000 single family homes and is growing to include multi-unit residential buildings and businesses across the city (City of Toronto, 2021d). The green bin program is a centralized compost operation using 2 anaerobic digesters (Disco and Dufferin waste management facilities), that have a combined capacity to process up to 130,000 tonnes of organic waste every year (McKay, 2018). Anaerobic digestion is not the most common way of managing municipal waste in North America, but Toronto has had great success with its program (Logan, 2019). The Dufferin Organics processing plant was one of the first anaerobic plants in North America and has inspired numerous other municipal programs.¹⁵ Currently, green bins are collected weekly during curbside pickup and are brought to a waste transfer station, compiled, then re-loaded into larger transport vehicles and brought to one of the cities anaerobic digestion plants. The collected material is shredded, filtered and then rammed through a perforated steel box to separate out the contaminants from the food waste (Gorrie,

¹³ J. Molyneux, personal communication, February 10, 2020

¹⁴The Metabolic Rift is a Theory on sustainability described by Foster, (1999) “Marx employed the concept of metabolic rift to capture the material estrangement of human beings in capitalist society from the natural conditions of their existence. To argue that large-scale capitalist agriculture created such a metabolic rift between human beings and the soil was to argue that basic conditions of sustainability had been violated (Foster, 1999, p. 383)” and has been used more recently “as a concept to explain the links between contemporary crises of soil fertility and environmental degradation and the politics of increasingly long-distance global agricultural trade” (Schneider & McMichael, 2010, p. 465)

¹⁵ In 2019, at a compost conference NYC, when I introduced myself as being from Toronto to the Department of Sanitation of New York officials they excitedly told me that both their digesters and collection bins were inspired by Toronto’s centralized operation.

2017). Then it's blended and mixed with water to further separate any contaminants (lighter material like shredded plastic float and heavier contaminants such as batteries sink). Once the contaminated food waste is in the facility's large digestion tanks, it is processed anaerobically, or without oxygen, to produce both biogas and digestate. The biogas is captured and turned into renewable natural gas used to power the processing plant and fuel retrofitted collection vehicles. The digestate (now a more stable material) is then taken by All Treat Farms, where it is mixed with yard waste and aerobically composted (with oxygen) to produce a soil conditioner sold to gardeners and farmers (Logan, 2019).

Toronto has a very unique collection program that allows for items such as plastic bags, diapers, and pet waste. The goal to remove the “ick” factor means that many of these items are not considered “contamination” during collection but must be removed and landfilled during further processing of the materials. For every 100 tons of organics that are processed at the digester 12 tons are plastic bags, 2 tons are heavy contaminants like bones or batteries, 3 tons are small pieces of contaminants made up of metal, glass and plastic, 13 tons become biogas, 55 percent is water that needs to be filtered and processed, and 23 tons are digestate that can be composted (Gorrie, 2017). For a long time, the city burned off the biogas and only just recently converted it into renewable natural gas to fuel collection vehicles, before this only 23 percent of material from the green bin could be used to amend soils (Staranchuk, 2018). In a city as large as Toronto, some form of a centralized system is necessary to handle the very large amounts of waste produced in high density areas, but an over-reliance results in centralized composting taking up a larger share of the budget considering it being so low on the food waste hierarchy. Also, larger centralized facilities can create a disincentive to reduce food waste because the operation to function needs a large amount of food waste input. A more balanced blend of community composting practices across the city and centralized anaerobic program will be important to maximize diversion while benefiting from the social aspects of composting.

6.1 Budget and Recommendations

Organics collection for Toronto is made up of two streams, collection- transfer and processing-transport. Collecting and transferring green bin material cost \$26.2 million dollars and leaf and yard waste costs an additional \$14.1 million. Processing and transport costs \$30.7 million for green bin material and \$11.2 million for leaf and yard waste. Together Toronto spends \$82.2 million dollars on centralized composting and anaerobic digestion (Solid Waste Management Services, 2019). Another element of the budget is the projected long term infrastructure costs. Toronto will need to set aside at least 100 million dollars for planning and initial construction costs of a new organics

processing facility to start in 2028 (Solid Waste Management Services, 2019). Anaerobic digestion is always going to be the major diversion source for organic waste in Toronto but serious money should be spent on diversion goals further up the hierarchy. The continual need to retrofit, repair, and build new organics processing facilities will only increase over time if this is not done. This aligns with Amory Lovins ideas about energy, where efficiency is cheaper than new construction with the importance of a whole systems approach (Lovins, 2018).

7. Mechanical and Biological Mixed waste Treatment

A mixed waste processing facility with organics recovery is the largest and most expensive proposal laid out in Toronto's LTWMS. Single-source collection of materials are brought to a processing plant and materials would be mechanically diverted into green bin, recyclables, and landfill. Toronto reports that up to a 65 percent diversion of organics is possible from this process, but realizes that if the compost produced does not meet Canadian Environmental Quality Guidelines standards, expect a sub 30 percent diversion (City of Toronto, 2016). An updated study report on the mixed waste facilities feasibility was released in February 2020 by SWMS. Mechanically separating organics waste from garbage will likely cause an increase in contamination, causing all the recovered organics to be landfilled or used for landfill cover. High contamination, inevitable in mixed waste processing, would produce ungraded compost that would still need to be treated as waste. The provincial policy does not count diversion for processed organics that are landfilled (Ontario Ministry of the Environment and Climate Change, 2018b). The report also lists the numerous countries that have a ban or restrictions on the land use of facility-sorted organics, meaning that through a mixed waste processing facility, most organics recovered will need to be landfilled (Solid Waste Management, 2020). This option would conflict with Ontario and Toronto's circular economy and zero waste goals while further eroding the trust farmers and growers have in municipally made compost (City of Toronto, 2016).

7.1 Budgets and recommendations

The city has 28.8 million allocated for detailed studies, reports and development plans of the project but has not secured funding for the estimated \$310 million cost of this facility (Solid Waste Management, 2020). A mixed waste processing facility is for "numbers" because it would quickly increase multi-residential diversion rates but the materials it diverted would be of minimal quality. Toronto, in 2019, was projecting a reduced revenue of \$10.563 million because of contaminated recycling and changing

global markets. Single source collecting from mixed waste processing would only increase diversion numbers but make negligible impacts on the SWMS environmental impact, a good reminder that diversion numbers are not the tell all of a waste management system (Solid Waste Management Services, 2019).

8. Landfill and Incineration

Food waste needs to be treated as a resource and should be banned from landfills. Even with a multitude of food waste reduction programs, services, and waste reduction techniques 180,000 tonnes of organics end up in the landfill every year, not including another 280,000 tonnes from the Industrial, Commercial and Institution (IC&I) sector (Toronto Environmental Alliance, 2016a). Food Waste is one of the worst items in a landfill. As it decomposes it produces methane gas – a 25 times more potent greenhouse gas than carbon dioxide. It attracts rodents and produces a putrid smell that has to be dealt with by rural and Indigenous communities that did not produce the food waste (Albert, 2018). Organic runoff called leachate impacts groundwater and can contaminate agricultural land. With this in mind, Ontario is planning on banning all organic waste from landfills by 2022 (Ontario Ministry of the Environment and Climate Change, 2018a). Though a necessary future step on solid waste management, a landfill ban before implementing more food waste reduction practices higher up the food waste hierarchy can have dire effects. Nova Scotia, the first province to implement a landfill ban in 1998, ended up with a huge influx of organics material with processing issues and an inferior finished compost that farmers and gardeners refused to use (Logan, 2017). Even with an organics ban in 2015, The province was still sending 99,000 tonnes to landfill (Gorrie, 2015b). Similarly, in Vancouver a 2015 landfill ban only reduced the amount of organic waste going to landfill by 22 percent (Logan, 2017). Even in Toronto households with access to the city's green bin program, over 40 percent of the material found in their regular garbage bins should have been composted (City of Toronto, 2016). These numbers highlight that access to organics recycling or an outright ban is not the end all solution, further work through education and source reduction is necessary to reduce household food waste. Provincially, Ontario needs to do more to support a mixture of community composting, midscale, and centralized anaerobic digestion to make sure there is enough capacity to handle a sudden organic waste increase from a landfill ban. Without this in place Ontario will end up with huge piles of "aerated garbage" that won't find its way back into the soil and farm fields.

8.1 Budget and Recommendations

Toronto's garbage currently goes to the Greenlane landfill located in Southwold, Ontario. More food waste is sent to landfill than is diverted from municipal and the IC&I sector. Organics make up 41 percent of garbage from houses and 54 percent from apartments and condos (Toronto Environmental Alliance, 2016a). For this budget we will use 41 percent to calculate a percentage of the garbage stream collection-transfer and processing- transportation costs along with landfill costs and perpetual care expenses. Organics in garbage makes up a large percentage of landfill costs. Collection and transfer costs \$12.8 million and processing and transportation costs \$19.28 million. Organics in the Greenland landfill make up \$27.44 million yearly costs and another \$3.96 million in budget for the perpetual care of 160 closed landfill sites (Solid Waste Management Services, 2019). This equals a budget expense of organics going to landfill costs \$63.48 million yearly¹⁶. With the Greenland landfill expected to be at capacity by 2029¹⁷ the costs of its perpetual care combined with Toronto needing to find a new landfill will be astronomical. Recommendations would be for the city to utilize as much budget as possible to increase diversion through source reduction, edible food rescue, backyard composting, and community composting. The high amount of organics being landfilled and Toronto's serious lack of space is going to cause big changes to SWMS services over the next decade while impacting communities across Ontario.

Conclusion

Placing Toronto's Solid Waste Management budget within the food waste reduction hierarchy shows that the city spends \$145.68 million dollars processing food waste on centralized composting and landfilling making up roughly 37% of the budget. These numbers are only from the yearly operating budget; factoring in long term capital projects would make this number even higher. The most preferred methods of food waste reduction (source reduction, edible food rescue, backyard composting, and community composting) only had a \$2.2 million dollar budget making up half of one percent of the operating budget. Though food waste reduction is complicated and involves many actors, this large discrepancy highlights that Toronto could do more to support or increase community initiatives for food waste reduction. Currently the fact that they make up such a miniscule amount of the operating budget means they are not thought of as serious models by Solid Waste Management Services.

¹⁶ It's true environmental cost would be higher.

¹⁷ The City of Toronto is attempting to extend the landfill's life to 2040 but without mitigation it will fill up by 2029, part of this mitigation strategy is to secure space at other landfills (Romeo-Beehler, 2018).

Using it all: rethinking edible plant parts

The Green Revolution and supply chain logistics have increased convenience and accessibility at the expense of expanding food waste. Part of this growing food waste comes from discarded secondary plant parts¹⁸, those parts of plants which are edible and available but excluded from the contemporary food supply chain. This food waste is often uncounted in food loss figures, creating an invisible, poorly understood waste stream. An exceedingly complicated food system has impacted which edible parts of plants we eat through a long process of exclusion in favour of efficiency. Fifty eight percent of all food that is produced in Canada is not consumed by humans, instead vanishing in an obscured and intricate supply chain involving complex relationships between food producers, food sellers, and consumers (Gooch et al., 2019b). There is an opportunity to raise awareness about these uncounted but vital food parts, and to simultaneously increase available food in the supply chain while diverting organic waste from urban farms to human consumption.

This essay begins by exploring the myriad ways researchers gather and define food loss data. Then sketches out the historical landscape to begin showing why we eat the parts of plants that we do, and how food systems have reduced the varieties that are available for consumption through plant breeding favouring logistical efficiency. Next, Community Compost Exchange markets demonstrate a framework on how to start recouping lost secondary edible plant parts on urban farms. And finally, the discussion looks to intercultural and intergenerational knowledge to offer an opportunity to help close a gap that has been widened by a historic trend of targeted consumer deskilling.

Defining food loss

Even though the terms food waste and food loss are intricately connected, they are generally used to describe two different components of the waste stream. Food loss is the unintended discarding of food at the farm and production level, ranging from losses incurred due to environmental conditions, fluctuating market prices, and the discarded waste from the manufacturing and processing of food (Baker et al., 2019). Food waste is viewed as more consciously lost edible food that happens at the shipping, retail, and consumer levels. It is made

¹⁸ “Secondary” is used to describe these plant parts because they are not harvested or marketed in the current food supply chain, but many of these edible components are also important cultural food items and are “seconded” through disconnecting access to food growing.

up of waste from activities such as overstocking in grocery stores, produce spoiling in a refrigerator, and discarded plate scraps at a restaurant (Baker et al., 2019; Gooch et al., 2019b). As food loss waste (FLW)¹⁹ research continues to grow, it is increasingly important to have a standard for uniform research.

A joint report by the *World Resources Institute* created a global standard, but not a definition, in hopes to guide more consistent numbers for comparable reporting around the world (Hanson et al., 2016). This report acknowledges how difficult it is to differentiate between edible and inedible food parts. For example, chicken feet in some parts of the world are inedible but in others are a part of the food supply chain (Hanson et al., 2016). This highlights how complex it is to create a universal definition: everything from eating prawn heads to broccoli stalks will be classified differently based on food culture, socioeconomic class, and industry processing. For example, recent reports from Waste & Resources Action Program (WRAP) in the United Kingdom and Second Harvest in Canada have utilized varying definitions in reporting. WRAP's *Courtauld Commitment 2025* does not consider food redirected to animals as food waste but Gooch et al., (2019) for Second Harvest in the *Avoidable Crisis of Food Waste* considers human-intended food fed to animals as food waste (Gooch et al., 2019b; WRAP, 2018). These differing methodologies come from researchers with divergent priorities, beliefs and intended audiences of the reports. Currently, most food waste research has focused on the downstream food waste sector, with less attention paid to on-farm food loss (Baker et al., 2019).

Up to now, most farm-based food loss estimates have been derived from interviews, self-reporting, or outdated crop estimates that focus on just a few produce items such as carrots or tomatoes to gauge estimates across many vegetables (Baker et al., 2019). Using this type of reporting led to estimates of 20% loss at the farm level in North America (Gustavsson et al., 2011). Recently, more detailed studies utilizing in-field measurements have determined that 33% of marketable yield produce is lost in northern and central California. The percentage of lost marketable yield was even as high as 57% in a case study at a North Carolina farm (Baker et al., 2019; Johnson et al., 2018). These high percentages of loss do not even factor in secondary edible plant parts. Further understanding of farm-based food waste is important because the push to increase yield and maximize production as a response to rising world population may be misguided; instead reducing field losses could be a more sustainable solution to increasing food availability (Johnson et al., 2018; Rod MacRae et al., 2016; Mauser

¹⁹ Food loss waste or FLW is the combination of both terms and is used in talking about food waste across the entirety of the system.

et al., 2015). Given this potential, it is pertinent to reconsider why some farm-based food is wasted and to identify potential solutions for diverting this food waste back toward the consumption stream. To aid in this discussion, I propose a more specific definition of food loss: any edible plant part removed from the food supply chain, including those plant parts which are sent to compost, anaerobic digestion, used in waste to energy, or ploughed into the field. Looking more closely at food loss in these terms reveals that a significant portion of wasted food matter contains edible and nutritious food parts, often with distinct cultural narratives and the potential to increase the productivity and usefulness of small farms to the communities they serve.

Factors determining perception of edible plant parts

The current retail food landscape reveals a trajectory which has eroded plant varieties and removed opportunities to consume secondary edible plant parts, even where culturally appropriate. This can be easily understood in the produce section of a contemporary grocery store. Many of the choices we have as consumers have been created for us by complex interplay between food sellers, plant breeding, advertising and transportation logistics. Between the aisles, it is easy to begin to see how a capitalist economy has transformed our food into a market commodity controlled by transnational entities.

Targeted consumer deskilling by agro-food business started after World War II and continues to transform today's food industry. After World War II, food sellers waged a new campaign to get women out of wartime factory jobs and back into domestic roles in the kitchen (Fabrizio, 2015). Food sellers sold convenience through more processed, packaged and canned foods as a way to show they were responding to public consumer demand (Jaffe & Gertler, 2006). Increasing the sales of industry-transformed foodstuffs were used to shift the understanding of food as an ingredient to a processed commodity (Winson, 2013). By removing the processing of food at home, producers could more easily control the processes of food production. All of this has contributed to what can be understood as consumer deskilling around food preparation and a shift from kitchen to corporation of food processing through the creation, marketing, and selling labour saving kitchen technologies (Jaffe & Gertler, 2006). Even today, chefs may do little more than tear open bags of frozen pre-sliced carrots, feeding an increasingly machine-run kitchen. As these food sellers went global with their control, a shift in skill sharing around food production has resulted in a loss of intergenerational knowledge and food cultures (Winson, 2013). Today, the food system is widely dictated by commercial interests which are now the driving force behind agricultural decision-making (Jaffe & Gertler, 2006).

The sources of food are remote and ever changing, and the route from field or factory to table grows ever more complex and opaque—even when there is a tendency to simplify some of the individual steps in production. There is a growing gap between what consumers may know and the information that may be possessed by the leading actors in the food chain. This translates into a growing gap in power and a growing capacity on the part of the manufacturers and retailers to manipulate tastes and buying behaviors (Jaffe & Gertler, 2006, p. 145)

In the produce section of the grocery store predominantly placed and well stocked shelves of fruits and vegetables at the entrance is used to catch the consumer's eyes and create a false sense of unlimited choice and freshness of product (Winson, 2013). Artful arrangement is used to create a visual variety where plant variety no longer exists. As long as there is one yellow and one red onion or three colors of peppers, consumers are led to believe they are being given an abundant amount of choices (Winson, 2013). In reality the over 50,000 pepper varieties available around the world have been reduced to the simplicity of three colours in the produce section. The need for the pepper plant to fit within the logistic supply chain also means that its secondary plant parts have been excluded from inclusion in the food supply chain. Pepper leaves from bell peppers and chilli plants are popular in dishes in China, Thailand, and the Philippines, and can be used like spinach in many dishes. Pepper leaves make up more plant mass than the conventional marketable yield of fruit per plant (Ospina et al., 2018). Efforts to remove food producing skills and marketing control have made it so that culturally appropriate and cuisine-defining plant parts such as pepper leaves, a secondary edible plant part are being left in fields, wasted, instead of being made available to consumers.

The story of the grocery store consumer follows a very similar trajectory to that of the North American farmer. Seed saving and in turn, plant breeding, was the domain of the farmer, who by selecting plants based on desirable qualities helped create a huge genetic foundation for agriculture across the globe. Between 1862 and 1924, the USDA used over a third of its budget to ship over 1 billion packages of seeds across North America to farmers so they could continue to develop new genetic variations (Barker, 2012). However, the introduction of seed hybridization and the emergence of agricultural biotechnology allowed global seed companies to consolidate seed ownership. The 1980 *Diamond vs. Chakrabarty* U.S Supreme Court case made it possible to patent a seed for life (Barker, 2012). Since the Green Revolution, seed corporations and plant breeding have focused on breeding specifically for increased yields, pest

resistance through genetic engineering of resistance to pesticides, and to meet the needs of a logistical infrastructure for global shipping, mechanical harvesting, uniformity, and shelf life (Mintz, 2006). Consumer-based preferences such as taste have been almost completely removed from the equation. This convoluted process can be traced through a tomato, illustrating a process common across farm-grown foods. Tomato seeds, which are the intellectual property of American seed corporations, are altered to be grown in Mexico to withstand the rigours of chutes, conveyor belts, boxing, palleting, and international truck shipping to Canada (Barndt, 2002).

Plant breeding has rigorously eliminated the multi-faceted abilities of crops. We consume a scant 200 of the over 300,000 species of edible plants in the world. Of those 200 species, over 75 percent of the varietal biodiversity and genetic information has become extinct in the last 100 years. The extinction number is even higher for some crops such as cabbage and field corn, where over 90 percent of known varieties have been lost (Seeds of Diversity, 2020). A 1916 report in Nova Scotia stated that over 2,000 species of apples were grown there at the time but today only 5 are sold in grocery stores in the province (Winson, 2013). Even the tomato, which has some of the most rigorously preserved heirloom varieties, has seen a loss of 81 percent (Wilson, 2012). This remarkable loss of plant species shows that in less than a century, the consolidation of plant breeding by producers and food sellers has almost eliminated 10,000 years of plant breeding focused on regional resilience. This has led to a more fragile food system that is vulnerable to widespread crop failure and climatic variation. As fewer and fewer varieties make up worldwide caloric consumption, there is the increasing likelihood for fungal and pest infestations to spread. A loss of regional resilience through mono culturalization could be fuel for large crop failures. Continuing to rely on the creation of new lab created cultivars versus intercropping with multiple varieties that already exist will cause large on-farm food loss events. An example of this can be seen in North American wheat.

With the green revolution and an increase in nitrogen-based fertilizers, wheat heads became increasingly weighty. Because of this, wheat heads started lodging, which is when the stems bend over causing a reduction in yield; as a result of this, the crop cannot be mechanically harvested. To counter this, shorter varieties of wheat were grown to increase yield capabilities, but the newly introduced varieties were more hollow stemmed (Vergauwen & De Smet, 2017). This, combined with tighter field turnover and less variety in crop rotation, led to a huge increase in the wheat stem sawfly (*Cephus cinctus*), an insect that lays its larvae in hollow grasses. Infestations of the sawfly became so widespread that they were designated an official pest in the middle of the twentieth century. Infestations of the sawfly destroy up to 70 percent of

the crop in the first 200 meters of the field and up to 30 percent of the overall crop yield (Thomas & Bradshaw, 2018). The Canadian prairie provinces experienced losses of over 50 million bushels because of the sawfly (Government of Alberta, 2020). To combat this, farmers are reverting to solid-stemmed wheat varieties using the genetic variants of more locally resilient seed sources. Shorter, hollow stemmed wheat also jeopardized the multi-faceted aspects of farms. Many farmers who traditionally would mix wheat straw with manure to make compost found that the mixes were no longer correct because of the change in straw composition.

Multifunctionality of plants has been forgotten, for control and convenience. Could increasing edible biomass available for consumption by introducing secondary plant parts into the food supply chain have matched the yield increases from the technical advances in agrobiotechnology while simultaneously preserving the genetic variety key to a resilient food system? As consumers and farmers are given choices produced by the market chain where does an opportunity exist to incorporate more edible plant parts into our diets? Instead of a pumpkin being bred for only a thick flesh, what if a balanced selection between sweetness of flesh, seed production, and vine edibility was considered? By looking to backyard, community garden and urban growers we can see what's possible in growing spaces where a variety of vegetables are produced, harvested and prepared using intercultural and intergenerational knowledge.

Making a Shift to Using it All

Currently, it would be difficult to apply a new framework to shift edible plant part designation for industrial monoculture farms where breeding and growing of plants is focused on their ability to be easily processed. Table 1, adapted from "*Secondary Edible Parts of Vegetables*", shows that many of the secondary edible parts identified are the leafy green sections of plants (Stephens, 2005). Presently, collard, mustard, endive, and turnip greens have the highest shrink rate in supermarket produce sections, with mustard and turnip greens having an over 60% rate of spoilage (Porat et al., 2018). Urban agriculture, in light of this, becomes unique. By differing from traditional grocers, it's possible to begin to see ways of incorporating secondary plant parts into markets. Urban agriculture as a local food source removes logistics of food needing to travel thousands of kilometers (Rod MacRae et al., 2010). Opportunities for direct farm-to-consumer purchasing means that many plant parts, regardless of storability, can make it to the consumer's kitchen.

In central Etobicoke, at the BCI Community Compost Exchange market run by FoodShare, a neighbourhood chef fell in love with golden beets. He would incorporate the

leaves into smoothies and stir-fry's. After mentioning it to neighbours at the market, he brought a big smoothie sample for everyone to try. Those of us behind the market stand suddenly realized that the number of customers asking for us to remove the beet tops started to go down. Similarly, mothers from a local daycare asked to harvest hot pepper leaves for Tinolang Manok, a Filipino chicken soup. After some community members tried them, pepper leaves became a popular harvest during fall gleaning days²⁰. Throughout the season, these food stories became common, transforming ideas of what could be eaten for many market-goers. This knowledge sharing meant that when the BCI farm needed to field-strip produce²¹ for storage it could more easily redirect it for human consumption. For example, when packing large amounts of daikon radish, tops are cut off to better store the roots. Instead of the tops ending up in the compost, residents dried the leaves for *shiraegi*, a Korean soup. This sparked the sharing of other preservation techniques and all of the sudden plant residue usually destined towards the composter or being tilled into the field was diverted for human consumption.

From these observations, Foodshare is looking to collaborate with local residents to create community “whole-plant” recipes that will be shared to further disseminate knowledge around preparing and preserving parts of plants hard to find in Toronto grocery stores. These recipes will be shared with community gardens and urban growers who typically have access to limited growing space, so that it may be possible for them to produce more from their plots and create less plant residual waste. Recent specialty cookbooks such as *Root to Stalk Cooking* and *The Southern Vegetable Book* use a “root to stalk ” mentality that looks to incorporate roots, seeds, stalks and flowers into everyday dishes (Duggan, 2013; Lang, 2016). By utilizing and sharing recipes at the market from local residents, the goal is to “formalize” the knowledge sharing that is happening naturally. An urban farm’s market becomes a space of consumer re-skilling where social activities involving sharing recipes are used to discourage on-farm food loss (Lim et al., 2017). Interesting things begin to happen when markets put as much focus on food loss as they do produce sales. A few recipes I have collected for this project can be found at the end of this manual in the resources section.

Growing this idea will rely on gathering new data. Statistics that currently exist on marketable field yields are from conventional agriculture; there is little data about a crop’s full biomass and even less about the weight per acre of the many specific edible secondary plant

²⁰ Gleaning is the harvesting of left over crops unable to make it to market. For the BCI farm at the end of the season community glean days are used to harvest hundreds of pounds of green tomatoes, immature peppers, baby carrots, etc.

²¹ When harvesting to be more efficiently packed for refrigeration many secondary edible plants parts may be removed such as the outer leaves of cabbage

parts listed in Table 1. Further research will need to be conducted to calculate the edible biomass of secondary plant parts so that it can be further added to the discussion on urban resilience and community growing. Calculating these data will further add to research that has been conducted on what percentage of vegetable requirements could be grown within a city's boundaries. Leaf weight data from two agricultural studies, one on tabasco peppers (Ospina et al., 2018) and the other on beetroot growing conditions (Gaharwar & Ughade, 2017), showed that for both crops the secondary edible plant parts (leaves) are equal to the marketable components, fruit and root, of the plant. A Toronto study by Macrae et al. (2010) and an Oakland, CA study by McClintock and Cooper (2009) concluded that it is feasible with currently available growing space and rooftops for the cities to produce 5 - 10 percent of their vegetable needs. These studies used conservative measurements based on conventional yield data (MacRae et al., 2010; McClintock & Cooper, 2009). Utilizing the recent data about on-farm food loss alongside introducing secondary edible plants to the food supply chain, would increase these percentages, which is important in better understanding urban agriculture's capacity to feed cities.

Utilizing secondary plant parts will not be easy given the current state of the food system. Industrialization and grocery store marketing of plant parts has drastically altered what we consider an edible plant part in the marketplace. Intergenerational plant knowledge and cooking skills cannot take place in the same way when using only what is found in grocery stores. When this knowledge is re-incorporated into gardens and urban farms, the available percentage of edible plant material rises, the amount harvestable produce per bed increases, and the pounds of on-farm food waste is decreased. A shift in prioritizing intercultural and intergenerational food knowledge as the basis for food-systems decision making will raise awareness about what is currently an invisible element of on-farm food loss.

Table 1. Adapted from Stephens, M. (2005). “*Secondary Edible Parts of Vegetables.*” University of Florida. Updated with shared food knowledge from the BCI farmers markets participants

Vegetable	Marketed Edible Parts	Secondary Edible Parts
Beans, snap	pod with seeds	leaves
Beets	root	leaves
Broccoli	flower	leaves, stalk, flowers, seed heads
Carrot	root	leaves
Cauliflower	immature flower head	flower stem, leaves, stalk
Celery	leaf stems	leaves, seeds
Cilantro	leaves	roots, flowers, seeds
Corn, sweet	seeds	young ears, unfurled tassel, young leaves, fungal smut
Cucumber	fruit with seeds	stem tips, young leaves, tendrils
Eggplant	fruit with seeds	leaves edible but not flavorful
Kohlrabi	swollen stem	leaves
Okra	pods with seeds	young leaves, flowers, seed pods (ground up as a coffee substitute)
Onions	root	young leaves
Parsley	tops	roots
Pepper	pods	leaves after cooking, immature seeds
Potatoes, Sweet	roots	leaves and stem shoots
Radish	roots	Leaves, immature seed pods
Squash	fruit with seeds	seeds, flowers, young leaves
Tomato	fruits with seeds	Leaves (consume in moderation)
Watermelon	fruit -- interior pulp and seeds	rind of fruit (pickled), seeds

Building Community Participation in Organics collection: a deeper look into incentivization

Intro

The Community Compost Exchange (CCE) differs from most decentralized composting projects by incentivizing participation in organics recycling for residents of multi-residential apartment buildings. The CCE's market dollar program, a farm-based currency, honours the exchange of labour between community members of multi-residential buildings diverting organic waste to nearby urban farms in need of soil-building organic inputs. In choosing to incentivize organic waste collection, the CCE is making a statement that food scraps are a community resource to be captured, shared, and utilized for urban food production. Can this unique take on residential waste utilize community participation to build new waste separation habits, increase farm markets, strengthen urban agriculture, and build Ontario's soils? This essay will start by looking at the factors that led to the creation of the CCE's market dollars. Then, incentivization of organics recycling will be used to explore waste management and place the program into larger discussions and critiques of urban agriculture and agroecology. Finally, we will explore how policy can promote incentivization to create better end use for compost on organic farms.

CCE History

The CCE started at the PACT Grow to Learn schoolyard farm program in Lawrence Heights, a community situated between Highways 401 and the Allen in Toronto. One of the program's partners and neighbours, the North York Harvest Food Bank (NYHFB), used a part of the local high school as a distribution warehouse. This same space also housed the Lawrence Heights food bank. In 2012, PACTS's school farm started a small-scale compost system that handled the Lawrence Heights Food Bank's weekly food waste, which mostly consisted of a few heads of leaky lettuce and moldy tomatoes. Their successful diversion of the local food bank's food waste to composting quickly grew into the program handling the organic waste from the distribution warehouse of the NYHFB. This drastically changed the scope of what PACT was processing from odd vegetable scraps to over 70 bushels of scallions or truckloads of dragonfruit that arrived rotten from the Ontario Food Terminal. Though a pallet worth of dragon fruit makes for a vibrant compost, this large amount of waste stems from larger systemic issues impacting agriculture and waste management in Ontario.

Ontario's 2013 tax credit for farmers donating produce to food banks was introduced to reduce on-farm food waste and tackle food insecurity. Instead, as I have witnessed and as addressed by Kinach et al. (2020), various issues made this extremely challenging. Donating

unsellable produce is still a secondary thought to farmers and not worth the associated labour costs. At the same time, food banks do not have the labour and fridges needed to properly store and distribute fresh produce donations (Kinach et al., 2020). By the time donated produce would be made available to clients, it was only a short step away from being composted (if it made it to them at all). I argue the same points as Tarasuk (2015) does that produce donations to food banks is not a solution for food insecurity or food waste management (Tarasuk, 2015). Though the CCE cannot address many of these larger food chain issues, a huge influx of food “donations” going to waste led to the food bank having increased waste disposal fees, in turn starting the implementation of a larger scale composting system. This mid-scale compost operation allowed GTL to create all the compost it needed to operate a one acre urban farm.

An intersectional moment initiated the creation of the Community Compost Exchange. When NYHFB moved out of the area, PACT’s mid-scale composting system no longer had any organic waste inputs, but the visibility of the compost system over that year sparked the community’s curiosity. Soon, people from all over the neighbourhood brought bags of food waste to the farm. Being so impressed by how thoroughly dedicated everyone was to diverting their food scraps, a labour exchange emerged whereby community members that regularly brought their food waste would harvest a week’s worth of vegetables from the farm. As this exchange grew, and as the farm manager at the time, I decided to build a more formal program around it in 2015. With the creation of our farm currency, which we call market dollars, residents would be given dollars they could use at an on farm market in exchange for every bin of food waste they dropped off. This simple act gave community members living in multi-residential buildings in the area an opportunity to partake in more sustainable waste management practices. Community members that regularly brought their food waste became more connected to the urban farm. One week when they would visit, I would be preparing beds and planting seeds, then four weeks later they would see me harvesting ruby red radishes. Seedlings and saplings grew before their eyes and they got to experience the beauty of an ever changing garden topography fuelled by sun and the compost they were helping to create.

Incentivizing organics collection in Toronto allows for a broader discussion connecting food waste and urban farms, that looks towards centering and prioritizing community members involved. The three sections highlight different elements of incentivization around organics. Market dollars will be used to show that the program gets people composting, increases waste stream knowledge, builds waste habits, while highlighting the importance of creating a universal market currency that can be multipurpose and destigmatizing. Next, an urban agroecology lens illuminates incentivization as a way of closing the food waste rift, and uses nutrient cycling

between an urban farm and the local community to explore issues of access. Finally, this paper dives into what work needs to be done to ensure compost ends up in agricultural soils.

Market Dollars

As a way to formalize the CCE and to recognize the labour participants were under taking, a farm market currency called the market dollar was created. Community members living in multi-residential apartment buildings have many more barriers to composting than residencies with curbside pickup. Urban farm's needing nutrient-dense material to make high quality compost fosters a unique relationship in which the CCE participant acts as separator and hauler of organic waste to the urban farm where it's going to be processed. The market dollar system allows a form of labour contribution to be acknowledged, but this unique relationship between food and waste also creates an important educational component to the program. As with all waste collection, education is one of the most important components of a successful waste system. Rarely are waste producers also responsible for its collection and intimately connected by the outcomes of its disposal. CCE participants know that the waste they bring to the farm will be used to grow the vegetables for sale at the market stand, this intimate connection allows for an almost zero percent contamination rate in the organics collection in stark contrast to 20 percent contamination across most southern Ontario municipalities (City of Toronto, 2015)²². Every time a participant drops off their kitchen scraps bin they do so in front of another volunteering participant, this "waste audit" drastically lowers contamination. Having participants act as waste sorters, collectors and haulers coupled with very small contamination rates saves urban farmers immense time and labour during compost production, essential during a busy growing season. These time saving activities, made possible by market dollars, are essential in making the CCE expandable to other urban farms.

Toronto's waste generation audits from 2010 and 2016 show that there is still a lot of work that needs to happen in Toronto to capture more organic waste. Organics still make up 41% of the waste found in single family garbage bins with access to a green bin, and 54% of multi residential garbage (Toronto Environmental Alliance, 2016a). This shows that access to Toronto's green bin program alone will not be enough for the city and province to meet their

²² Toronto reports a five percent contamination rate for its green bin, this number is so much lower than the southern Ontario average because of the non-conventional items it accepts such as plastic bags, diapers, etc. This may also mean that the accepted items are being counter as green bin diversion possibly skewing numbers (City of Toronto, 2015).

long-term waste goals. In FoodShare's CCE survey from 2019²³, 78% of participants did not compost before joining the program and in PACTS's 2018 CCE survey, 50% percent of participants did not compost before joining the program even though most of the participants' buildings offered a green bin service. For both Toronto CCE programs 82% of participants composted more after joining the program and 94% felt more excited about composting after participating in the CCE, impressive considering these surveys were completed after a summer of dumping stinky bins. These surveys are just two examples showing that incentivizing participating in organics recycling could be a good way to get people composting who are not already doing so.

New Britain Roots, a food justice organization in Connecticut, started a food waste collection program at a farmers market called *Makin Green* where bins of food waste are collected in exchange for *Bee Bucks* (CCE equivalent of the market dollar). *Makin Green's* goal is to increase the number of people who are composting in New Britain. In 2018 they offered \$5 exchange per bin of food waste; then, in 2019, they offered \$2 a bin, and for 2021 are planning to do a free bucket program. Notably, even though many participants signed up because of the incentive, they acknowledged that composting was a new and rewarding habit and that they would continue composting without incentivization.²⁴ This has also been true for incentivizing collection of organic waste in Toronto. In 2016 GTL's CCE offered \$5 a bin then switched to \$3 in 2018, even though the incentive costs were less, there was no drop in participation and more organic waste was diverted that year. Similarly, FoodShare's CCE program started off at \$3 a bin in 2019 and plans to offer \$1 per drop off for 2021 after consults from community members. This shows that building new waste habits paired with the connections being made at the markets and excitement around composting are as if not more important to participants than the incentives. Incentivizing community members to recycle organics may help build long term habit changes that will have lasting impacts on Toronto's long term waste management goals and create an important tool in realizing the cities zero waste goals.

The market dollars are an important tool to create a farm-based currency that can be utilized beyond just participants bringing in compost. CCE market dollars in Toronto are distributed to volunteers, students, and interns helping at the farm. Market dollars have been shared with the local schools counsellors to be given to students or families and can also be

²³ I was given access to the raw data of FoodShare's and PACT's yearly surveys from 2015-2019 of their CCE participants. Some of this information is available in end of year reports but most is not publicly available.

²⁴ J. Listro, personal communication, December 7, 2020

purchased with a credit card so community members can share them, or make cashless market purchases. At New Britain Roots, *Makin Green* bee bucks are purchased and distributed by local companies as part of employee wellness programs, local community health practitioners give them to clients, and they are distributed with SNAP (Supplemental Nutrition Assistance Program) purchases at market.²⁵ A market currency being earned and used by many different community members creates opportunities for them to be given to individuals facing food security issues without the tokenizing or stigmatization that comes with accessing traditional programming. My personal experiences of being on SNAP in the states and using New York state's EBT (Electronic Benefit Transfer) card led to multiple instances of insecurities, having my bags checked by security at grocery stores, and an unjustified arrest underscoring the importance of why I wanted to create a farm market currency that didn't create any unjust distinctions. Though food bank organizations such as Daily Bread are making operational changes such as offering a summer produce market for their clients, larger and more systemic change is needed (Daily Bread Food Bank, 2021). The market dollars could be a way for urban farms to connect with offering up produce to individuals facing food insecurity in a more respectful way.

Urban agroecology

Agroecology is generally thought of as the utilization of nature-based solutions in agricultural production. As with the inherent complexity of ecological systems, agroecology as a framework for food systems becomes more socially focused:

[Agroecology provides] a way of redesigning food systems, from the farm to the table, with a goal of achieving ecological, economic, and social sustainability.

Through transdisciplinary, participatory, and change-oriented research and action, agroecology links together science, practice, and movements focused on social change (Gliessman, 2016, p. 187).

Applying this lens to urban agriculture is a newer research practice and was used by Siegner et al. and Tornaghi as a way to better understand urban agriculture's diverse impact in cities (Siegner et al., 2020; Tornaghi, 2016). In the terms of the CCE, an agroecology framework starts to show how food cycling in urban environments is a food justice issue and how incentivizing participation in organics collection at a community scale can readjust those cycles.

A common critique of urban agriculture across Europe, the United States and Canada is that while UA is often thought of as being a radical "response" to counter current food regimes,

²⁵ J. Listro, personal communication, December 7, 2020

in reality it more often replicates many of the factors that led to its development. Though I strongly believe in the restorative, self-determinate, and justice-based work that can and does take place through urban agriculture, it's impact will continue to be marginal while it "remain[s] an inadequate answer to the failures and injustices of neoliberal urban environments and food markets (Tornaghi, 2016, p. 782)." An example of this is already happening in Toronto where urban farms will grow produce in one community of the city and then remove it from that neighbourhood's food-cycle by selling the produce at a market elsewhere in the city where they can fetch higher prices. All this being done while working on what is usually public land that was removed from the commons for exclusive urban agriculture use. Similar to issues addressed by Slocum (2006), Ramírez (2015), and Tornaghi (2016) these urban agriculture food practices fuel community displacement, welcome in gentrification, perpetuate neoliberal urbanism, and create farms not representative of the neighborhoods they inhabit (Ramírez, 2015; Slocum, 2006; Tornaghi, 2016). Extractive practices like this are more representative of industrial agricultural practices; cheap labor replicated with an urban farm's reliance on volunteers, cheap land replicated by growing in "less desirable" or abandoned areas, profit driven mono-cropping replicated by urban farms selling to the highest bidder. Removing a natural systems influence, urban farms begin to erode community resilience through a displacement of local food-cycling. Viewed through an urban agroecological lens, the removal of produce from one community to a richer neighbourhood represents an unnecessary, unsustainable, and unjust displacement of "nutrients" from both local food consumption and soil cycling. Though this might be preferable over current agriculture models it would be detrimental not to address these issues before scaling up urban growing. Sustainability needs to factor in both ecological and social conditions when practiced in an urban context. Though words such as local, sustainable, and organic allow higher prices from farm markets in affluent neighborhoods, those same words are not accessible to community members living closest to urban agriculture projects, local becomes so far away even in your own backyard.

Incentivizing participation of organics recycling to nearby urban farms creates an opportunity for increased community turnout to an on-farm market, key for more justice based nutrient cycling. Most CCE participants bring their organic waste to the farm every week and on the days that there is a farm market. There is no better weekly reminder to come to the farmers market than the need to empty an overflowing bin of kitchen scraps, over 88% percent of CCE participants surveyed in Toronto attend their local urban farms weekly market. This extremely consistent community support does two very important things for urban agriculture. First, with such a reliable weekly turn out an urban farm no longer needs to seek out multiple markets

across the city, after starting the CCE PACT no longer needed to sell produce to Souraren farmers market, instead now selling 100 percent of produce grown on the farm to local community residents. FoodShare's SchoolGrown program used to sell their produce at Borden and East Lynn farm markets but after starting a CCE program in 2019, SchoolGrown was able to sell exclusively to community residents at their own farm market. An adoption of the CCE model across urban farms in Toronto will increase the amount of farmers markets happening in Toronto, important because 96 percent of CCE participants surveyed said that going to the market makes it easier for them to access fresh produce. Both of these important shifts in where urban produce was being sold happened after the introduction of an organics incentives program that was focused on participation. Now, not only are these urban farms processing the organic waste residue of their produce, but they are also making sure the caloric nutrients of the produce they grow are cycling in the immediate community and returning to the soil around it. The CCE is a small step in closing micro-urban metabolic rifts occurring in urban agriculture while addressing social and ecological impacts through an agroecology lens.

Getting compost into the soil

The discussion around incentivizing participation in organics recycling needs to cover the entire food-cycle, including compost's end-use in agricultural soils. The reasons for manure's and compost's declining use as a crop fertilizer involves a complex combination of post war switch of nitrogen production from bombs to fertilizers; the shifting of dynamic farms to mono-industrial crop production; and increased support, through legislation, regulations, and subsidization, of fertilizers, pesticides, herbicides, insecticides, and fungicides – all having an enormous impact on Canadian soils and their projected future productivity (Ogburn, 2010). These factors, being extremely intricate are outside of the scope of this paper but are important to mention because they continue to impact municipal waste management today. The removal of livestock farming that traditionally co-existed with crop production has had a big impact on the use of manure and compost as a field fertilizer.²⁶ The steady increase of municipal composting programs in southern Ontario may, out of necessity, be the needed avenue for farmers to once again use compost as a fertilizer and soil amendment. Currently, most municipal compost finds its way back into urban markets, with the remainder being used for soil erosion, or based upon its quality as a landfill cover. Today, with urban markets at capacity and regulations impacting compost's end use, new places for it to be used are going to need to be found (Gorrie, 2015a).

²⁶ See section *Using it All* for more details

As Christine Brown of the Ontario Ministry of Agriculture and Rural Affairs (OMAFRA) said, “if every municipality had an [organics] collection program they’d have more compost than what the urban market could bear (Gorrie, 2015a, p. 1)” This reality is happening now. With the provincial vision of a circular economy and the publishing of its *Organic Food and Organic Waste Policy and Action Statement*, most municipalities in Ontario are supposed to have between a fifty and seventy percent diversion rate by 2025 (Ontario Ministry of the Environment and Climate Change, 2018b). Within these plans, Ontario is also calling for a phased in organics landfill ban starting by 2022 (Ontario Ministry of the Environment and Climate Change, 2018a). All of this leads us to a point that farmers need to be on board as soon as possible to use municipal compost in their fields. Ontario’s policy statement and action plan call on the increased promotion of the beneficial uses of compost, but they do so without establishing much of a framework for how to do this, instead expecting owners and operators of organic resource and recovery systems and municipalities to shoulder the responsibility (Ontario Ministry of the Environment and Climate Change, 2018b). Loose regulation does not bring forth much change.

Considering that the financial factor is a big challenge to farmers switching over from chemical fertilizers to compost (Brown, 2015), I am suggesting that an incentive program be put in place for farmers, helping to offset the cost difference. The effectiveness of this will also simultaneously rely on more educational opportunities to teach farmers about soil health, and municipalities focusing on decreasing contaminants ending up in the compost (Sawyer et al., 2015). An “ecological nutrient management act” with Federal and Provincial government support could be a system redesign principle as suggested by MacRae (2021) that would increase end markets for municipally made compost while simultaneously building Canada’s long-term soil health and stronger local economies less reliant on inputs from other countries (MacRae, 2021). Incentives would need to cover the price difference per acre for farmers versus chemical fertilizer application and be locked in for a set period of time because the soil quality benefits of compost take three or more years to be noticeable (Brown, 2015). Support would also need to be given for additional expenses incurred by farmers in transitioning to new methods and the need for different application machines. Gorrie (2015b) cites Frank Peters, who operates composting facilities in Hamilton and Guelph, and found “that if he can convince farmers to try compost they’ll continue to use it. It’s easier he notes to sell the idea to those who have previously treated their land with manure, since it shares similar qualities although not its strong odor with compost (Gorrie, 2015a, p. 5).” An Ontario based study finished in 2015 showed that, generally, compost the first year applied, increased per acre crop yield while also increasing

soil's environmental resilience to climatic weather (Brown, 2015)²⁷. This study, paired with what the Compost Council of Canada is doing to promote compost and soil education especially through their *Soils at Work* program, will help to once again bring compost to Ontario's soils (Compost Council of Canada, 2019).

Conclusion

The food - waste cycle is reliant on participation from many different actors for its success. This essay has explored incentivization as a tool to acknowledge the labour of residents that participate in a municipal collection system; it looks at how incentivization can further food-justice goals in urban agriculture through alternative currencies, and how incentivization may be important to build both urban and rural soils. A key finding is that becoming an active participant in a system may lead to habitual changes that can have a greater impact on the waste system. These actions range from a community resident dropping off kitchen scraps to an urban farm for the first time to a farmer using compost in its fields to replace chemical fertilizers. Food waste can become an interesting space for the intersection of food justice and soil justice, with incentivization helping to further the goals of both. These same incentives, over time, become long term investments working towards waste management sustainability and soil conservation.

²⁷ The nitrogen difference between yard and leave compost vs municipal compost varies from total nitrogen being .89 percent to 2.78 percent. This means that compost made from municipal source separated organics will be much cheaper for farms to apply and transport than yard waste compost (Brown, 2015).

The Dollars of Incentivization: CCE budget breakdown for a 1 acre urban farm

Linking an incentivized organics collection program to an urban farm brings numerous benefits that are hard to quantify on a budget sheet but important to understand in making a decision to start such a program. Currently, all CCE programs operating in Toronto rely on external funding through grants and donations that go towards program expenses. Though the CCE offers a unique secondary funding stream for urban farms, understanding if the program can be integrated into a farm's budget without external grants will be key for its long-term viability. Using data from both PACT's and FoodShare's costs and expenses I calculated the needs of running the CCE with 100 participating households on a one-acre urban Toronto farm. Costs paid out directly by the farm include incentivizing the market dollars purchases, labour costs for compost production, program materials, and tool upkeep. Money saved by the farm includes expenses not spent on buying soil amendments, market fees, and produce transportation costs and increased revenue from market sales and with policy adjustments, reimbursements from Municipal or Provincial Government. *Table 1* and *Table 2* cover the general costs of the CCE program, with low and high end budget estimates because of all the factors impacting costs. Below, we will look at a roadmap of the costs a farm or project might look at in implementing a CCE program.

The largest expense is the trading of market dollars with community participants. As described in the previous essay, the incentive cost per bin of food waste can vary over time. The number decided upon by the farm can range between \$5 and \$1 a cost difference of \$10,000 or \$2,000 a season. I strongly recommend any CCE program to start an exchange between \$3-\$1 with the goal to bring it lower (with community consultation) over time meaning it's important to budget between \$6,000 and \$2,000 for exchanges of market dollars. Labour, the second largest component of the expenses, costs \$2,560 this accounts for 8 hours a week of maintenance at \$16 an hour. The seasonality of the works means that there are programs available to help with covering labour budgets. FoodShare has traditionally covered this cost by accessing youth summer jobs programs, such as Canada Summer Jobs, that will cover 75 to 100 percent of wages. The CCE's direct link to an urban farm means many of the farm tools (wheelbarrows, mulching forks, shovels) are multi-purpose and can be used for both farm and compost operations. Though the scale of the operation, as covered in the best practices section, can impact these costs I have factored in \$200 a season for tool upkeep costs. All together a

farm should expect to pay out between \$9,060- \$5,060 to implement a CCE program in conjunction with their own farm operation costs.

One Hundred participating households will bring between 12-15 tons of organic waste to a participating farm, when mixed with a carbon source (woodchips), that will produce about 30 yards of finished compost that can be used by the farm next season. As was common across my interviews of Toronto community composters, good compost is impossible to come by, making this a priceless resource and an important reason in implementing the CCE. Fertilizing and building soil quality with compost produced on site, an urban farm will save between \$1,500 and \$2,000 in amendment costs for an acre operation. The extremely consistent turn out at markets of CCE participants means that the urban farm will more efficiently harvest, leading to less waste at the end of the market and lowering the on-farm food waste and loss revenues. Not over harvesting also allows for improved crop planning. Moving to an on-farm market cuts market fees for urban farms, which at \$40 or more a market is a savings of between \$800-\$1000 and the transportation time and associated vehicle costs to get to those markets will save an additional \$980. An onsite farm market creates opportunities to further reduce on farm food waste by making available produce that wouldn't normally be brought to market. An example is the FoodShares CCE program in 2019 was able to take a big harvest of over 200 bunches of spinach, that had just started flowering because of an abnormally hot spell, and offer them for a reduced price at their farm market. An item that would normally not warrant the table or transportation space to market was easier to sell onsite, community residents gladly bought 5-10 bunches. Also, with 96% of CCE participants talking to friends, family, or neighbours about the program an urban farm can save \$300 in yearly marketing strategies.

There are current policy changes and opportunities needed that could further fund the program. Because the CCE is diverting residential organic waste from landfills it may be possible that CCE programs could be reimbursed for the costs saved by the city of Toronto which pays between \$140-160 dollars to process a ton of food waste (McKay, 2018). Also, many arborists are paying dumping fees of \$500 dollars per truck, diverting this to CCE sites to be used as a carbon source in the composting operation is another possible source of income for an urban farm. Though contentious, recent commitments and increases in the price of the carbon tax from \$30 to \$170 per tonne by 2030 create a revenue opportunity for community composters (Tasker, 2020). Cities throughout Ontario sell their emissions reduction from waste management practices in the form of Carbon offset credits. If the CCE is able to link reimbursements for the residential organic waste it processes and removes from the city's waste stream then there will be an opportunity to also sell back its emissions reductions. The

emissions reductions from the CCE could be worth anywhere from \$662 to \$3753 based upon the carbon credit market. Before accessing provincial and municipal reimbursements an urban farm implementing the CCE will save \$3,755, over time if these reimbursements are adapted an incentivized organics collection program could save up to \$10,494.50 off of farms operating costs. Showing that it is very possible for an urban farm to pay community members for their organic waste at a financial value to themselves with tremendous increase in community support, quality compost, and soil health.

Table 2.
Shows associated cost saved by an urban farm running a program like the CCE.

Savings through running the CCE			
	Amount	Cost	Total
Compost produced Through CCE	30 cubic yards	\$50.00	\$1,500.00
Transportation costs of compost	1x triple axel truck delivery	\$275.00	\$275.00
City cost of processing organics \$140 a tonne *	15 tonnes	\$140.00	\$2,100.00
Arborist cost of processing a ton of wood waste 120*	24 tonnes	\$120.00	\$2,880.00
Market Fees \$50 x 20 weeks	20 markets	\$50.00	\$1,000.00
Market Transportation .50c a km x 50KM round trip x 20 trips and 1.5 hours of time at \$16 x 20 weeks	1000 kilometers	\$0.50	\$980.00
Carbon Credit calculated at \$170 per tonne *	10.35 tonnes of Co2 equivalent	\$170.00	\$1,759.50
		Current Savings	\$3,755
		* Savings policy support	\$10,494.50

Table 3.
Shows associated costs to an urban farm in running a program like the CCE.

Costs of running the CCE – 1 acre urban farm			
	Amount	Cost	Total
Labour to process compost- 8 hours a week x 20 weeks	160 hours	\$16	\$2,560
Market Dollars distributed-100 families bringing 1 bin a week at \$3 x 20 weeks	2000 market dollars	\$3	\$6,000
Market Dollars distributed-100 families bringing 1 bin a week at \$1 x 20 weeks	2000 market dollars	\$1	\$2,000
Tools for community scale composting estimated for yearly upkeep	1 time a year	\$200.00	\$200.00
Labels, printed material, workshops	1	\$300	\$300
		Cost at \$1 a bin	\$5,060
		Cost at \$3 a bin	\$9,060

Community Compost Exchange Best Practices

Turning residential waste into compost for Toronto's urban farms.

Intro

When determining whether to run the Community Compost Exchange (CCE) at an urban growing space, one of the first considerations is that scale and expectations need to match the capacity of the growing. This involves taking into account labour support, budget, and time. Decentralized compost operations function best when reflective of the community. Flexibility, being a successful CCE component, means that adaptation of the program will look different everywhere²⁸. The CCE came to be because of community action and continues to change with community input and direction. Because of this, success does not lie in exact mimicry of other programs, but rather a willingness to adapt to on the ground experiences. Having said this, best practices involving tools and techniques of the composting processing of food waste will apply across programs. This best practices essay follows food waste from a CCE participant's kitchen to its finished use as compost in the field, encompassing food scraps' transportation to the farm, the pre-processing and composting steps, and finally the composts transformative actions when used as an amendment back into the soil. Through this journey I will be describing best practices that I currently follow, derived from over 10 years of experience as an active community composter. These practices have been informed by composting elders, workshops, failures, site visits, and interviews. What follows here explores the process, tools, and site design that will benefit the Toronto composter.²⁹

Signing up Participants

The three most successful ways to get residents involved in the CCE are 1) word of mouth from participants to neighbours and community members; 2) operating a visible compost operation that's also open to the public and 3) offering information and sign-ups for the program at farmers markets. PACT's 2017 survey showed that 96% of CCE participants talked to

²⁸ For example in Toronto, residents and gardeners of Humber Properties community garden held a CCE exchange and market as a one-time event to promote waste management in their buildings (O. Lopez, personal communication, January 18, 2021). PACT's CCE runs a weekly dinner at their market where participants are welcomed after shopping to stay and share a meal cooked from the farm's vegetables (L. Shipman, personal communication, January 13, 2021). FoodShare's CCE works with the Ontario food terminal, ordering produce to their market that they cannot grow such as mangoes, plantain, and oranges to increase availability of culturally appropriate fruits and vegetables.

²⁹ The technical details of composting are covered in numerous detailed sources, and will not be covered in depth during this essay.

friends, family or neighbors about the exchange program. This word of mouth approach has proven successful in growing participation of the CCE - PACT grew the program without having to do outreach such as flyering or tabling at events. A visible compost operation is another way to spark interest, residents local to an urban farm who do not have access to organics management are an important catalyst for community composting in Toronto. In Lawrence Heights, residents coming together with the desire to divert their organic waste is what helped created the CCE in the first place. Introducing local residents to the CCE also takes place at onsite urban farm markets. This allows a more coordinated educational approach where tours of the compost operation can be given, and community members can watch the exchange process taking place. Once residents know about the program, are feeling excited, and want to get started, it's time to get them registered.

CCE participants sign up once yearly, receiving program information along with a container to hold their food scraps. The containers have stickers reminding participants of accepted materials and drop off times, plus a laminated infographic full of tips and tricks that can be put on their fridge with recommendations such as keeping the food waste frozen to deter fruit flies and odour, the dates of all the farm markets for that year, and information on volunteering. Once confident in the process, CCE participants will take their food scraps bin out of their freezers, then by walking, biking, or taking public transit will transport it to their local urban farm. Over 95 percent of participants meet someone new from the community when participating in the CCE, jump starting unique waste-based mutual aid actions. For example, when bringing the waste to the farm, participants with a vehicle will pre-plan pick up's of multiple people on market days; some participants will gather and collect their neighbours food waste and donate the market dollars received. A participant even build a homemade bike trailer from a lawn seeding tool to transport multiple people's food waste from their building.³⁰

Once at the farm, food waste is deposited at a specific area designated for collection. At the food waste collection station, there are wheelbarrows and donated green bins (older models retired by the city) for holding the food scraps, clearly labeled garbage bins for plastic bags or any contaminants, a self-washing station for rinsing used kitchen bins, and a volunteer or market worker that checks to make sure incoming waste has no contaminants and hands out the market dollars. It would also be worth exploring ways to convert the collection steps into a self-service station, especially later in the season once participants have had enough "waste audits" and feel confident processing their own waste. With a clean bin and market dollars in

³⁰ L. Shipman, personal communication, January 13, 2021

hand, the CCE participant will then start shopping at the farm market, having worked hard to separate, transport, and divert their food waste from the landfill. It's now the farm's turn to transmute food waste into black gold.

Processing the waste and creating a feedstock

Once enough organic matter (food waste) is collected it is time to start processing it to get ready for composting. Move all the collected food waste to the composting operational area, a space that should be as close to the farm as possible. Select an open area with a hard surface such as asphalt, cement or crushed gravel, making sure there is as much distance as possible from nearby buildings. All the collected materials that are mixed together sparking the composting process are known as feedstocks, every feedstock is made up of varying amounts of nitrogen and carbon. Feedstock composition impacts the composting process, for example animal manure will be mixed differently than food waste, because of this it is important to understand the materials you will be using.³¹ In Toronto the CCE generally uses both a nitrogen heavy feedstock (collected residential foodwaste) and a carbon heavy feedstock (wood shavings, wood chips, leaves, and garden debris). The first processing step is to increase the amount of surface area by decreasing the particle size of the material feedstock. For the residential foodwaste (nitrogen) this means crushing or grinding the materials, the cheapest and simplest way of achieving this is using a long handled ice breaker or flat shovel to break up the organics inside of the bin you have collected it. If processing more waste, or with a larger budget, waste can be ground or pulverized in a task specific machine. FoodShare's compost operation uses a hand and bike powered stainless steel grinder made by *Filamaker*. This smaller shredder, being safer to use, makes it more accessible for volunteer participation. On the heavier duty and larger-operation end of the spectrum is the 3 hp *Bokashicycle Food Waste Pulveriser* which uses rotating chains to break up food waste. This is the best option for a CCE managing more than 200 household's worth of waste a week. It's equally important to increase the surface area of the carbon materials. Wood shavings which can be collected from wood shops are already fine enough; wood chips can vary dramatically in size based on the type of tree and chipper used by the arborist company. Michael Nevin, a community composter in Toronto, prescreens his woodchips using milk crates, saving the finer material for the

³¹ A table of the nitrogen and carbon ratios of different feedstocks can be found in the Rodale Institutes Composting book.

composting operation and the larger pieces for mulching trees or using in a garden pathways.³² Leaves are also an abundant and free carbon resource for Toronto composters, during fall many Toronto neighbourhoods leave bags of leaves curbside for collection. In just a day, it's easy to gather all the leaves needed for a year of composting. Smaller leaves such as those from locust trees can be used as is, but bigger leaves from oaks and maples should be shredded or left to decompose overwinter before using as a carbon feedstock.

Making the compost

Now that all the feedstock is processed, it is time to start the composting process. Proceed by mixing the feedstocks at a ratio of about 2 parts carbon and 1 part nitrogen. Having colour coded and same-sized bins at the operation site is a great way to accurately measure and mix materials and a good way to store your feedstock. One of the biggest operational decisions you will have to make is the kind of vessel or method for processing the residential food waste. Below, I will be recommending and briefly describing four aerobic methods and practices that are successfully run at CCE programs in Toronto.

1. Wooden Three Bin System

These are the quintessential Toronto compost bin that have been used for decentralized composting operations at housing Co-ops, multi-residential buildings, schools, and community gardens across the city. They are easy to build and when made from cedar and galvanized or stainless steel mesh can last for years. Their design is easy to implement and can be modified - customized bins have been made from reclaimed materials such as pallets and found doors. It is also possible to build multiple three-bin systems in parallel to increase the site's capacity. These bins work for a program collecting waste from 100 families or less.³³

Advantages

- Rodent and animal proof – the bins, completely covered in mesh, are very good at keeping animals out
- Long lasting – many bins last ten years or more
- Very neat and tidy looking – good for public spaces or in situations where there are composting aesthetic concerns
- Scalable – many bins can be placed in sequence or parallel, increasing amount of waste processed at a time

³² M.Nevin, personal communication, January 21, 2021

³³ Plans from FoodShare are available for free on their website

Disadvantages

- Expensive- materials such as cedar and weather-proof mesh can be costly
- More labour intensive - composting material, when processed, must be moved over or around the side wall of the container

2. Straw bale Bins

Straw bale bins are made of stacked straw bales that are formed into 6'x6'x3' interconnected squares. One of the greatest benefits to this system is that the container's material, straw bales, is worked into the farm's operational costs. A small farm uses straw to protect spring planting of brassicas (kale, broccoli, cabbage, etc.) and fall plantings of garlic and perennials. A one-acre farm will go through about 120 small square straw bales during a season, the perfect number to build enough compost bins for a CCE program. Using straw as a building material before its use in the field is a weed reduction trick. Straw bales can be full of wheat, rye, or weed seeds that were not threshed during bailing. These seeds produce weeds that can over-run the fields the straw was used in. This can be avoided when the straw bales are used to build composting containers; the high processing temperatures and moisture kills or prematurely sprouts most seeds. Once the bales start falling apart, they can be cycled back into the farm operation for the following season. Also, when straw bales are used in a compost bin for a year, they soak up compost leche and worm castings that convert the straw into an organic slow-release fertilizer. Straw bales are a circular solution to bin building and are appropriate for processing the waste of up to 150 households

Advantages

- Cheap – a circular solution that is built into existing farm expenses
- Insulating – helps with preserving worms over winter
- Modular – bins can be built to any size or shape that best fits the operation, allowing the use of onsite farm tractors and front loaders to flip material

Disadvantages

- Not rodent or pest proof – forces operators to flip and process the material more often; food waste needs to be completely covered
- Labour Intensive – composting materials need to be flipped over each cell's wall
- Sourcing – straw can be difficult to find in cities

3. Passively aerated Windrows

Composting windrows are triangular mounds made up of mixed feedstock that can vary dramatically in size and scope. I have seen enormous windrows processing hundreds of tons of municipal waste, and small three-foot piles at community gardens. Many larger operations add in a system known as Aerated Static Pile (ASP), where air is forced through perforated pipes at timed intervals to increase oxygen in the pile. ASP promotes an aerobic environment, with the added benefit of not needing to turn the composting piles as often. Because of Toronto's robust municipal collection system, this kind of scale and infrastructure is usually not necessary for the CCE. I prefer to use a modified version of this made popular by Canada Composters (Gershuny, 2004) where perforated pipes are laid horizontal to the pile and covered with a layer of large wood chips. This method relies on the natural convection of a compost pile, where internal heat rises towards the top of the windrow and cooler air is pulled in through the sides. Adding the perforated pipes with breathable materials layered on top amplifies natural convection promoting better airflow through the pile. Passive aeration allows piles to sit longer between turnings and requires resulting in less work and labour to produce a finished compost product. Windrows are particularly suitable for collecting food waste from 100 or more households.

Advantages

- Very little needed – all you need are some pipes for the aeration
- Less turning – less labour needed and windrow design makes turning easy

Disadvantages

- Weather – windrows can be impacted by the weather, either drying too quickly or getting overly saturated (there are design tricks to minimize this)
- Weed seeds – if weeds are improperly managed around the operation site, weed seeds can blow into windrow piles after they have hit high internal temperatures.

The CCE Method

I believe the best decentralized compost system for Toronto utilizes a combination of wooden bins, windrow piles, and vermicomposting. A multiple wooden three-bin system is the initial holding space for any incoming food waste and carbon feedstock, and keeps away any rodents or pests from the food waste when it is in its most attractive un-composted state.

Incoming materials are collected in each bin until at least 6 cells are filled or whatever material is collected within a three-week span. Next, the material is removed from all wooden bins and formed into a windrow pile, on top of aeration pipes and wood chips. Once the pile is formed, it is watered and capped with 6 to 12 inches of wood chips. After two weeks, the vermicomposting process is started by adding red wiggler worms to the capping layer. Waiting another two weeks, the first windrow pile is turned over to introduce oxygen. This process is continued every two to four weeks until the food waste is no longer discernible and internal temperatures of the windrow are the same as outdoors. Finished compost is then tarped and left to mature and cure for a minimum of two months.

Site Design

As the residential waste we collect is being consumed by microorganisms I wanted to review some best practices for site design and operation. As mentioned in the essay (policy), work needs to be done to create site standards so that smaller community composting operations can be exempt or have a realistic path for a certificate of approval to operate. A very successful site practice that has been adapted at CCE sites is the use of bio-berms to collect run off liquid from composting windrows.

Bio-Berms

As the scale of your compost operation increases, a management plan for leachate is important – and necessary for waste site approval. Leachate is liquid runoff created during the decomposition of organic material, and is a pollutant and needs to be kept out of stormwater, drains, and lakes. Considering this, it is important the slope of a compost operation is accounted for in its design and setup. Make sure that the linear movement of turning the compost piles is set up in a way that any leachate would run off into a pile of the same or earlier stage in the decomposition process, ensuring that there would not be any cross contamination. Incorporate a three-foot tall and five foot wide bio-berm made from wood chips on the downward slope side of the operation, running adjacent to the windrow piles and length of the site. This berm will absorb and capture any leachate produced during the compost operations and windrow runoff from both rain and watering.

After a year of use, the berm also has the added benefit of being able to be incorporated into the compost operation as a source of carbon, recapturing any nitrogen runoff. Also, because the wood chips in the bio-berm will have already begun breaking down, they will create a finer finished compost that requires minimal shifting. Two

observations I have made from these bio berms call for further research. First red wiggler eggs have washed into the berms from the site's windrow compost piles. Though there has not been much research into whether red wiggler worms can live exclusively on a cellulose-heavy diet such as wood chips, it looks like a combination of leache and fungi breaking down the wood shavings will create a hospitable environment and food source for the worms, possibly providing worm castings and a source of vermicomposting income for the site. The second observation worth further exploration involved mushrooms growing from some parts of the berms. Though the mushrooms that have spontaneously sprouted from the bio-berms are not choice edibles, there may be opportunities to inoculate part of the berm with marketable fungus such as winecaps or oysters. This would create another profitable crop for the farm while helping break the woodchips down more quickly and because of the filtering abilities of hyphae to better capture more leachate (Stamets, 2005). I will continue to document this process and look forward to defining best practices around using a valuable waste product, such as wood chips, as a vital site-design component of a compost operation.

Shifting and using the compost

Now that the compost has been made and cured it should be rich in colour, smell like sweet earth and have stabilized in temperature. For the CCE, I would only shift compost if you needed to use it in the greenhouse or to prepare a very fine seeding bed. If panning on shifting your compost, below are the recommended best practices based on scale. A smaller operation can simply build a wooden rectangle that fits the size of wheelbarrows onsite, staple one inch by one-inch galvanized mesh, and shift the compost into the wheelbarrows. For shifting more compost, quicker, build an "A" frame that rests on the ground using the same materials as the screen mentioned above, the difference being that when compost is thrown on the A frame gravity shifts the material as it slides down the metal mesh. If planning on shifting a lot of compost building a trommel will be the most time efficient. PACT's CCE program in Toronto uses a trommel made from bike rims with welded hardware mesh mounted onto a wooden frame and rollerblade wheels used as bearings. This trommel can be powered by a bike or with a motor depending on electricity access at the site.

The end use of the compost product will determine what type of treatments it will require. I strongly advocate for applying unscreened compost directly into the soil. Many gardeners have been conditioned to using very fine, sifted, and fluffy compost. Extremely uniform compost can be a sign that the operation had many contaminants

that needed to be sifted out multiple times during processing. The extreme processing that much municipal waste undergoes in a centralized composting system causes large amounts of microplastics to end up in finished composting – some large enough to be noticed by a farmer but many times too small to be visible (Watteau et al., 2018). A study looking at municipal composts impacts on environmental microplastic contamination found that compost made from municipal anaerobic digesters had over 120 pieces of plastic per kilogram of dry weight compost (Weithmann et al., 2018). Factoring in that 40 percent of compost weight is water and a cubic yard of compost weighs 465 kilograms, an urban farm using 30 cubic yard of compost a season, adds 669,000 pieces of micro plastics into the ground, year after year. Contamination at these rates alone is a strong incentive for urban growers to make their own compost. Using compforost you produced that simultaneously gives you peace of mind, is an extremely rewarding act as a farmer. Nine years ago I switched from purchasing to producing all the compost I needed onsite for farming operations. With this I have been witness to changes in both the soil and surrounding environment that has inspired me to take on numerous other research projects on the farm. When not bringing in literal tons of foreign material, there was a decrease in the amount of new weed varietals that needed to be dealt with. It's much easier to come up with management plans for weeds that you have dealt with for numerous seasons then constantly needing to change those plans for new varietals. Gaining a deeper understanding of the lifecycles and the food web of composting organisms in a compost pile carried over to the farm's soil. A diversity of compost and mulches turns into homes for numerous beneficial insects, ground beetles make hideouts under clumps of compost, garden spiders webs go to work catching pests woven between compost fed pepper plants, millipedes thriving in the moist compost enriched soil shred down organic material, continuing to break down organic material finer and finer. These insects also become the catalyst for a whole beneficial life web on the farm, providing a food source for other beneficial insects assisting in keeping beneficial insect numbers high so they can deal with any pest problem on the farm. I believe increased insects decrease time and energy spent fighting off pest infestations.

At both urban farms running the CCE any heavy rain would leave sections of the farm under water, more hospitable for ducks then carrots, but after years of compost application these areas are productive and protected from flooding. At FoodShare, compost is being used to establish a reforestation project along *highway 427* allowing native bushes and trees to

flourish under extremely compacted and clay heavy soils. As the compost conditions and improves the hard urban soil and the trees' leaves deflect and absorb noise pollution, I have started taking and recording decibel readings every month to determine the sound absorbing qualities of compost application in urban environments. To further understand the unique ways compost use and mulching impacts the urban farm environment I started cataloguing changes in fruiting mushrooms that took place on the farm and am building an urban mycology collection on *Inaturalist* to see the differences in species taking place over time. From burr oak leaves absorbing noise pollution, to larvae pierced on an assassin bug, from a preying hawk in the sky to a nematode springing a trap on a bacterium, compost connects so much on an urban farm.

Farm-Food-Waste:

An in-depth look at Ontario and Toronto's Waste Policy through Community Composting

Intro

All levels of Canadian government, from federal to municipal, are shifting perspectives on organics management, looking at the myriad ways it impacts economic, environmental, and social aspects of our everyday worlds. In 2019, Canada released its National Food Policy listing food waste as one of 4 key action areas, and the federal government also launched a food waste reduction challenge in 2021, investing \$20 million into food waste reduction technologies. Earlier, in 2018, Ontario issued its Food and Organic Waste Policy to support the province's goals of circular economy and in 2016 Toronto started enacting its new Long-Term Waste Management strategy to guide the city's waste management decisions for the next 50 years towards a zero-waste society. This essay will use community composting as a lens to explore recently published policies by the province of Ontario and the city of Toronto. Organic waste management is at the forefront of these documents and will be shown as a key point when these policies are analyzed through their three main connecting themes: circular economies, zero-waste strategies, and increasing organics recycling in multi-residential apartments.

The three levels

Vidoni's Current Issues Paper from 2011, *Community Composting in Toronto Closing the Food-Waste Loop* introduces the three governmental levels that manage waste regulations. I will use two of Vidoni's introductions of the jurisdictions and legislations impacted by the different levels of government and then will introduce the newest components of Canada's policies added after his 2011 publication.

1. Federal

“In Canada, the sale and import of fertilizers including compost are regulated by the Federal government through the Canadian Food Inspection Agency. The Fertilizers Act empowers the agency to regulate such matters as labeling, safety and use. The Canadian Council of Ministers of the Environment (CCME) has developed guidelines intended to harmonize provincial and federal regulations for the quality of compost. This document provides specifications for

compost products, and is intended to be adopted within provincial regulations” (Vidoni, 2011, p. 9).

The federal government through its Waste Reduction and Management Division of Environment and Climate Change Canada participates in global conversations around food waste. The Canadian government alongside both Mexico and the United States formed the Commission for Environmental Cooperation that published a 2018 report on Food Loss and Waste in North America (CEC, 2017). Within the Canadian government food loss and waste is becoming a concern of numerous different departments between departments, for example Agriculture and Agri-Food Canada’s (2019) National food Policy lists food waste as one of 4 key action areas to be addressed within the next five years (Minister of Agriculture and Agri-Food, 2019). Considering that decentralized organics management works best for handling small business and residential municipal waste, we will keep the aforementioned national policies and jurisdiction out of this review. That said, these recent federal policies and reports show that food waste is now a national concern that is being linked to food security.

2. Provincial

While the day-to-day operation of waste management falls under municipal jurisdiction in Ontario, the province’s Ministry of the Environment (MOE), regulates the manner in which both municipalities and private enterprises can haul, process and store waste. There are five provincial acts that regulate compost production and use in Ontario:

- The Environmental Protection Act, R.S.O. 1990, c. E.19, (EPA) and Regulation 347 (General – Waste Management) made under the EPA.
- The Nutrient Management Act, 2002, R.S.O. 2002, c. 4 (NMA)
- The Ontario Water Resources Act, R.S.O. 1990, c. O.40 (OWRA)
- The Clean Water Act, 2006, S.O. 2006, c. 22 (CWA, 2006)
- The Environmental Assessment Act, R.S.O. 1990, c. E.18, (EAA) and Regulation 101/07. (Vidoni, 2011, p. 9)

Provincial waste policies and strategies dictate municipal waste management planning, thus having a great impact on community composters. In 2016, Ontario enacted the *Waste Free Ontario Act*, the *Resource Recovery and Circular Economy Act*, and the *Waste Diversion Transition Act*. These acts were put in place to guide the creation of a circular economy and to achieve zero waste production in Ontario. Then, in 2018, Ontario’s Food and Organics Waste Policy Statement (OFOW) was published laying out in greater detail organics resource recovery mandates based on municipality size, setting out diversion targets, and indicating what

strategies are allowable to meet them. The OFOW policy has a direct effect on community composting in Toronto and is covered in more detail throughout this essay (Ontario Ministry of the Environment and Climate Change, 2018b).

3. Municipal

Municipally, Toronto controls waste transfer stations within the city boundaries and is able to develop its own waste management plans and strategies as long as they align with Provincial policy (Vidoni, 2011). Currently, Toronto's waste management practices and activities are guided by the Long-Term Waste Management Strategy (TLTW) which was first published in 2016. The TLTW serves to provide a framework for municipal policy for the next 30-50 years. Fears of Toronto's only operational landfill (Greenlane) filling up by 2029, coupled with the Provincial governments current plan on banning food waste from disposal sites, have centered organics management as a large component of TLTW (Toronto Environmental Alliance, 2016b). Being a municipal strategy, it is more detailed than the provincial policy and will be reviewed extensively throughout this essay. The TLTW was approved by city council before the 2018 release of Ontario's provincial policy; currently, some strategies in it are in conflict with the provincial policy and will need to be addressed.

Through both the OFOW policy and TLTW strategy, three key elements emerged: circular economies, zero waste, and multi-residential organics diversion. All three are key elements in community composting and will be defined and reviewed through that framework. Additionally, policy suggestions and incentives will be made to help guide best practices for Ontario and Toronto to meet their targets through focusing on the promotion of local, decentralized community compost initiatives.

Circular Economies

The term circular economy refers to ending 'cradle to grave' production, a linear process where an item's life "cradle" is its raw material extraction and its "grave" is the landfill. Ontario and Toronto are suggesting moving towards an economic structure that mimics natural ecosystems by producing zero waste through the consistent recycling of nutrients and carbon. A circular economy framework built on addressing climate change has three major principles as outlined by the Ellen MacArthur foundation: "1.) Design out waste and pollution 2.) Keep products and materials in use 3.) Regenerate natural systems." (Ellen MacArthur Foundation, 2019, p. 19)." These principles will be used to assess how-in line the provincial and municipal policies are with the frameworks they use. The TLTW strategy states, "A circular economy shifts

the way waste is viewed and requires a change in the way we think about waste, how products and packaging are designed, and how waste is managed to maximize resource recovery (City of Toronto, 2016, p. 10).” This definition is broad, covering a wide range of waste producing industries. The OFOW policy, being more organics focused, states “Waste reduction and resource recovery of food and organic waste will help improve environmental outcomes, reduce greenhouse gas emissions and recover valuable nutrients, thus fostering a circular economy. (Ontario Ministry of the Environment and Climate Change, 2018b, p. 4).”

The Community Compost Exchange (CCE) embodies both definitions of a circular economy, by recycling community organics as close to the source as possible, and then using the finished mature, stable, AA-grade compost to enrich the soil that will in turn grow more produce, capture more carbon, and incentivize a local market, re-ensuring the capturing of all organic waste produced on site. As noted by Vidoni and others, processing waste close to the source is essential to a circular economy that is looking to better environmental outcomes and reduce greenhouse emissions through waste collection (Rod MacRae et al., 2016; Vidoni, 2011). Table 4. highlights the carbon reduction possibilities through the CCE model, in contrast to the current organics stream in Toronto processing, conventional farming practices, and grocery store marketing practices.

Food waste managed by Toronto’s Solid Waste Management Services is anaerobically handled and produces a digestate that needs to be aerobically composted. Currently, from the Dufferin processing plant in Toronto, digestate is sent to All Treat farms in Arthur, Ontario where it is then aerobically composted, traveling 110 km (Logan, 2019). Toronto has contracts for up to 85,000 tonnes of organic waste to be processed by private sector processors, to help with any overflow unmanaged by the city (City of Toronto, 2016). One of those private processors, Orgaworld, is located in London, Ontario, almost 200 kilometers from Toronto. This is only one part of an extensive compost supply chain, which also includes city collection, transfer stations, warehouses, and retailers, all of which adds up to hundreds of kilometers of travel. Reducing greenhouse emissions by collecting and processing waste as close to source as possible is a key point from the OFOW policy (Ontario Ministry of the Environment and Climate Change, 2018b). In contrast, Community composting is an at source option that cuts down this distance to mere meters. Pact’s CCE survey from 2019 showed that over 76 percent of participants walked, biked, or took public transit to the garden to drop off their organics. And all participants paired their compost drop off with other errands or shopping for produce at the market.

If circular economics is to be employed as an organics recycling framework, making high quality, mature, stable and trusted compost must replace diversion as a top priority. However,

the OFOW policy statement lays out three methods of organics collection that will not count towards municipal organic diversion. By not allowing the methods listed below, Ontario has put an emphasis on nutrient recovery rather than diversion (Ontario Ministry of the Environment and Climate Change, 2018b)

1. “The use of food and organic waste to generate alternate fuels or energy from waste without the concurrent recovery of nutrients (Ontario Ministry of the Environment and Climate Change, 2018b, p. 12).”

This removes incinerating organics as a diversion strategy. While anaerobic composting (AC) is still a diversion-accepted method of management, more research needs to be done into the specifics of nutrient capture from AC operations. A recent study shows that sulfur is lost in biogas formation during AC (Fontaine et al., 2020), but a well aerated aerobic compost pile will capture hydrogen sulfide gas as sulfur, saving it from being released into the atmosphere (Graves, 2000). This will be an important nutrient recovery consideration because sulfur deficiency in soils around the country is becoming more common and is now a soil fertility consideration that many farmers did not formerly think about (Lucheta & Lambais, 2012). A circular economy needs to produce a compost with the nutrients farmers will want, anything else and it will be hard to justify the extra costs and labour associated with using it as a field fertilizer.

2. “The direct discharge of food waste or organic waste into a municipal sewer, including when facilitated by food waste disposer or other grinding devices (Ontario Ministry of the Environment and Climate Change, 2018b, p. 12).”

This policy is important because organic waste nutrients discharged into a municipal water supply are captured and must be treated as biosolids. Furthermore, there are more regulations for how farmers can add municipal biosolids onto fields creating another barrier to compost use in a circular economy (Lowman et al., 2013). In-sink disposal units cause organics to be contaminated with materials that get poured down drains such as antibiotics, solvents, and heavy metal contamination from piping infrastructure. Biosolids are also not certified for organic farming practices (Perkins, 2019).

3. “The use of recovered organic resources for landfill cover (Ontario Ministry of the Environment and Climate Change, 2018b, p. 12).”

Ontario has a compost quality standard that defines size and percentage of foreign material and levels of heavy metal contaminants in compost on a scale from AA, A, to B. Even the highest standard “AA” might not meet requirements of many end users. These standards look at heavy metals but do not take in account soluble salts which can keep seeds from sprouting and could not be used in greenhouse production and may impact farmers using a no-till method. while the degree of contamination between grades is quite drastic (Ontario Ministry of the Environment, 2012). This policy line will ensure that municipalities focus on increasing compost quality by removing the use of substandard compost as landfill cover. Currently, substandard or “Grade B” Compost is considered a waste product that has to be transported and treated as garbage (Ontario Ministry of the Environment, 2012). This policy line will emphasize organics end-market use within agriculture. Not allowing the production of grade B compost will hopefully increase compost quality standards, but more work needs to be done to win over end users.

The OFOW policy makes some great steps but more work will need to be done to promote finished compost as a main fertilizer option for farmers. On the other hand, TLTW strategy specifically looks to community composting as a way to bring high quality compost to animate growers and local growing projects (City of Toronto, 2016). If an organic circular economy is to work, equal energy and time needs to be spent on collection and processing as upon end-use application. The Province will need to offer incentives to farmers to increase compost use on their fields. More work needs to be done to better understand compost and carbon sequestration in soil. Composts impact on improving soil structure will be an important component of long term soil health for Ontario’s farms (Compost Council of Canada, 2019). Furthermore, Ontario will need to raise quality standards and continue to follow the advice of the Compost Council of Canada and the Compost Quality Assurance testing which has traditionally promoted the importance of an end-use focus on compost production (Ontario Ministry of the Environment, 2012).

Zero-Waste

The TLTW strategy lays out that a zero-waste goal “prioritizes waste prevention to minimize the amount of waste requiring disposal (City of Toronto, 2016, p. iv).” A zero-waste framework is meant to better incorporate the waste hierarchy into waste management decision frameworking. OFOW policy presents its food waste hierarchy as:

- i. Reduce: prevent or reduce food and organic waste at the source.
- ii. Feed People: safely rescue and redirect surplus food before it becomes waste.
- iii. Recover Resources: recover food and organic waste to develop end products for a beneficial use.” (Ontario Ministry of the Environment and Climate Change, 2018b, p. 9)

This three-tiered approach falls short of the recommended food waste hierarchies presented by MacRae et al. (2016), Toronto Environmental Alliance (2016b), and McSweeney (2019), which incorporate food waste to be used as animal feed and weigh the impacts of operational scale and location against collection costs and environmental outcomes (Rod MacRae et al., 2016; McSweeney, 2019; Toronto Environmental Alliance, 2016a). As the Province and Municipality design systems to create a zero-waste scenario, it is vital to look at the myriad ways that urban agriculture is connected to the municipal waste management system.

Urban farms integrated into a community are able to respond to food needs of a smaller and more specific base. Growing specialized produce and adjusting crop plans based on community suggestions leads to less food wasted in the fields. Growing culturally relevant produce to meet specific neighbourhood demographics also decreases the amount of imports and packaging associated with grocery stores selling similar items. Shifting production of these items to a neighbourhood level means they are traveling substantially less and will have a longer shelf-life at home, decreasing food spoilage³⁴. Through conversation and surveying, I identified that CCE participants were interested in plastic-less greens. A simple shift in how I timed crop maturity and choice varieties meant we could forgo clam shell packaging or plastic bags to instead shift to bunched or full-head greens. Last season, in 4 months, FoodShare’s CCE program was able to reduce giving out 13,515 single-use bags by making a simple community informed shift (FoodShare, 2019).

Multi-Unit Residential Buildings

A Toronto Environmental Alliance report to the City of Toronto outlined the pillars of building a zero-waste future. One of these pillars is to “ensure equal access for everyone to the

³⁴ A recent food waste report by Gooch et al., shows that at home (consumer) contribution to food loss waste is lower than many previous reports. This report particularly distinguished between avoidable and unavoidable food waste which is what accounts for these differences. This means creating more direct farmer-to-consumer models like the CCE could have greater impact by removing the IC&I sector (Gooch et al., 2019a)

tools and programs to reduce, reuse and recycle (Toronto Environmental Alliance, 2016b, p. 6).” Even though Toronto was the first major city in North America to offer curbside collection of organics, 18 years later many of the city's multi-unit residential buildings (MURBS) do not compost or have equal access to organics management (Toronto Environmental Alliance, 2016b). Section 4.9 of the OFOW policy says that all MURBS must offer organics collection to residents and recommends source separation of organic materials as the preferred collection method. The OFOW policy suggests a minimum 50 percent diversion rate for MURBS by 2025. The TLTW strategy was put into action before the provincial policy statement and the two are currently in conflict; Toronto will need to review its strategies for organic diversion for MURBS. Both Ontario and Toronto have recognized that organics collection in the Multi-Residential sector holds the greatest opportunity to get increased participation and decreased contamination. Of the three considered strategies for MURBS organics collection in the TLTW strategy, all but community composting come into conflict with the OFOW policy. This further shows how important community composting and a program like the CCE are to complement MURB organics collection. The three strategies are discussed below.

1. Building a Mixed Waste Processing Facility with Organics Recovery

A mixed waste processing facility with organics recovery is the largest and most expensive option laid out in TLTW strategy. Single source collection of materials would be brought to a processing plant and materials would be mechanically diverted into green bin, recyclables, and landfill. Toronto reports that up to a 65 percent diversion of organics is possible from this process but realizes that if the compost produced does not meet CCME standards then they expect a sub 30 percent diversion increase (City of Toronto, 2016). The city has 28.8 million allocated for detailed studies, reports and development plans of the project but has not secured funding for the estimated \$310 million cost of this facility. An updated study report on the mixed waste facilities feasibility was released in February 2020 by Solid Waste Management. Mechanically separating organics waste from garbage will likely cause an increase in contamination, causing all the recovered organics to be landfilled or used for landfill cover³⁵. The report also lists the numerous countries that have a ban or restrictions on the land use of facility-sorted organics, meaning that through a mixed waste processing facility, most organics recovered will need to be landfilled (Solid Waste Management, 2020). This option will

³⁵ Contamination would mean the compost produced would be ungraded or at best grade B and would still need to be treated as waste. The provincial policy does not count diversion for processed organics that are landfilled.

conflict with Ontario and Toronto's circular economy and zero waste goals while further eroding the trust farmers and growers have in municipally made compost.

2. In-Sink disposal units

As an organic's management strategy for MURB the city proposed the option of in-sink disposal units which would send organics to the wastewater treatment plants to be processed with biosolids. Since the Provincial strategy will not consider food waste diverted this way, it is unlikely the city will pursue it. Removing In-Sink disposal units as a MURB strategy will better preserve nutrients from organics recycling and increase end use options. Issues with organics in wastewater was discussed previously.

3. Community Composting

Community composting is directly addressed in both the provincial policy and Toronto's long term waste strategy. The OFOW states in policy 4.6:

Where collection of food and organic waste is not provided to policies 4.1-4.5 municipalities shall provide for the resource recovery of food and organic waste through means such as home composting, community composting, and local event days (Ontario Ministry of the Environment and Climate Change, 2018b, p. 18)

In the TLTW strategy, community composting was supported through public consultation and is emphasized as an educational and engagement tool for composting and organics. The city has allocated yearly funding of \$415,000 from 2018-2026 for planning, implementation, and project maintenance. The city expects minimal waste to be diverted through community composting and has projected at maximum to divert 20 tons in 2024, 40 tons in 2025 and 60 tons in 2026 (City of Toronto, 2016). It's possible for these numbers to be much higher. In 2019, FoodShare and PACT, through their CCE programs and composting at community gardens, diverted 57 tons of organics waste; also three times this amount of carbon materials was saved from the landfill through the composting process.³⁶ If the TLTW strategy's community compost diversion goals are already being met 6 years ahead of schedule, imagine what the next 5 years could look like. The success of the CCE, to already have met Toronto's diversion goals six years early with very little funding, showcases the importance of having a direct connection between a

³⁶ O. Lopez, personal communication, January 16, 2021

growing site and a community compost operation; they are inherently more successful together. The success of the CCE should demonstrate that funding allocated for community composting in the TLTW strategy should directly fund growing operations to implement community compost programming and workshops.

Opening up decentralized options for organics processing will create more opportunities for unique programming that would be adaptive to diverse populations and buildings types that make up the Multi-Residential sector. Hitting Toronto's ambitious zero waste goal will require a shift from one solution fits all diversion tactics, especially considering that the term MURB' applies to 70 storey million dollar downtown condos, an older 1960's apartment tower along the electric corridor, a 3 storey brick building on college street, or a co-op of townhouses. The massive differences in location, ownership, and building architecture highlight some of the complexities of diverting organics in these structures. Work will need to be done by Ontario to better align OFOW and TLTW community composting policy with current regulations and legislation.

Regulation 347 of the Environmental Protection act regulates how organics is handled and requires compost facilities to have a Certificate of Approval. The regulations are improperly scaled and do not consider community composting. The smallest facility approval is for a site collecting 100 tonnes daily (Vidoni, 2011); this is almost a 1000 times more than the largest CCE operation in Toronto (FoodShare, 2019). Creating a new tiered system factoring in community composting and micro haulers needs to be put in place to align the policy with regulation. The direct farm to waste model that is used for the CCE may already be in a regulation grey zone. The CCE incentivizes farmer market participants to bring their food waste back to the farm. By doing this, participants are bringing back farm-produced waste to be processed on site, possibly making it exempt as an agricultural operation from article 5 of the EPA regulation 347³⁷. This type of incentivization was mentioned by the TLTW strategy and in the pillars of zero waste by Toronto Environmental Alliance (City of Toronto, 2016; Toronto Environmental Alliance, 2016b). Incentivization such as bottle deposits is used by many plastic and aluminum bottles and can producers to recapture the valuable resources they produce much like the CCE. Toronto also has the power under article 5. Reg. 234/11, s. 4 of EPA regulation 347 to create a municipal waste pilot project to test out new systems. By using this the city could get community composting off the ground before current regulations are changed.

³⁷ From definitions of Regulation 347 "farm operation means an agricultural, aquacultural or horticultural operation, other than a race track or a zoo, that is engaged in any or all of the following... 2. The production of agricultural crops, including greenhouse crops, maple syrup, mushrooms, nursery stock, tobacco, trees and turf grass.."

In 2016, the Ontario Municipal Board approved new zoning for Toronto's apartment building properties, rezoning them as Residential Apartment Commercial (RAC). This removes a huge hurdle for both community composting and urban agriculture to flourish on MURB grounds and will make it much easier for the Toronto Solid waste management to implement a community composting pilot project. The zoning allows for market gardening, and farmers markets making the spaces perfect for Community Compost Exchange programs.

CONCLUSION

After thoroughly reviewing *Ontario's Food and Organic Waste Policy* and *Toronto's Long Term Waste Strategy* it is clear that alternative waste diversion strategies, such as the Community Compost Exchange, are necessary to building a more expansive version of a circular economy, establish a zero-waste future, and increase diversion opportunities in the multi-residential sector. The provincial and municipal policy statements are bold and ambitious but as this analysis illustrates, there is a need to revisit the concepts of *circular economy* and *zero waste* in order to develop more realistic and holistic waste strategies. A clear path to realizing this vision lies in greater emphasis upon decentralized organics management. Community composting can play a vital role in Ontario's future organics management strategies, increasing their effectiveness particularly at the urban level. If food waste can be understood as a community resource rather than a municipal waste byproduct, a good to be recycled rather than diverted, then there exists a possible future in which these policies and actions may bring about real change. This transformation will rely on connecting food to waste, through increasing the agency of community-based composting programs and their co-adjacencies with municipal and provincial strategies.

Table 4. shows a table highlighting the carbon reduction possible through the CCE and the three key areas it impacts 1) produce production and marketing 2) Organics recycling 3) soil health and fertilizer needs.

Markets CCE	Grocery Stores	Organics Recycling CCE	Municipal Collection	Soil Health CCE	Conventional Agriculture
Organically grown	Conventionally Grown	CCE participants divert food waste from landfill	Methane production from food waste in landfill	Soil Compost is used in organic growing on 2 acres/	replaces fertilizer need and nutrient needs
Produce sold onsite	Average Food KMS 4,500 km (MacRae, Et. al, 2010)	Current programs diversion can saves the need for new trucks to be build and digesters to be build	City would need to spend more on infrastructure	Soil health eliminates pests and disease/compost tea	need for fungicides and fertilizers
From harvest to consumer in 24-36 hours-less than 1.5 days of refrigeration	Air Conditioner needs from field equipment, trucking, and retailers.	Organics are walked or public transit to farm-brought during trip to market	Organics travel X KM's per tonne from source- transfer station- landfill	Soil sponge has carbon holding capacity when practiced no tills	Vs traditional tilling models Info available from soil workshop with CCC
Market is designed around a zero waste framework	Traditional grocery store bagging and packaging of produce	Processing of waste is done on site using volunteers and no machinery	Machinery used for processing onsite in landfill		
Less consumer waste generated. Growing culturally significant foods in relevant communities	Supermarket models such as BOGO, produce rotation, methods of sales (Gooch, et al. 2019)				

Summary of Findings: next steps and recommendations

The collection of essays in this manual has shown the positive impact a decentralized organics program like the *Community Compost Exchange* (CCE) can have on municipal waste collection, particularly within the multi-residential sector. Key findings and recommendations on how to reconnect municipal organic waste and soil management were developed through interviews with current community composters, site visits of resource recovery operations, policy and literature reviews, and identification of best practices for Toronto composters. The following recommendations fall under 4 major topics: 1) Incentivization as long-term investment; 2) Organics as a resource to be protected and managed, not waste to be discarded; 3) Compost as a community enterprise and resource; and 4) policy adaptations. Each of these are listed with a combination of action items and key findings to support the recommendations.

1. Compost is for Community

- a. **Nutrient Sovereignty.** In 2019, the *Food Policy of Canada* was released pairing the right to food with the right to produce food, especially culturally significant and relevant food which some Canadians have limited access to. To strengthen this policy, the right to produce food, especially in an urban neoliberal city, must include communities' access to urban metabolism and in turn nutrient sovereignty, described by Tornaghi (2016) as “the right to cultivate, harvest water and recycle nutrients for growing food sustainably (Tornaghi, 2016, p. 792).” Current waste management strategies in Toronto do not fully realize these rights. Current legislation limits urban agriculture's sovereignty to create ideal soil conditions for food production. The City of Toronto holds a responsibility to have community compost demonstration sites around the city as educational hubs to ensure equal and fair access to compost and education that allows growers to build nutrient sovereignty.
- b. **Scaling up access to urban agriculture for food waste source reduction.** Urban growers identified soil safety and access to trusted compost as one of the main barriers to urban agriculture in Toronto (Nasr et al., 2010). As shown in the section *Food Waste Reduction Hierarchy: Toronto's current practices* urban agriculture has a strong connection to municipal waste management and organics recycling. A community-based waste management program such as the

Community Compost Exchange gives growers access to trusted compost, an important element in scaling up urban agriculture. The section *Using it All* shows that intercultural and intergenerational food knowledge, re-incorporated into gardens and urban farms, may influence the percentage of edible plant material available for consumption and increase the amount of harvestable produce per bed, all while working towards decreasing on-farm food loss and waste.

- c. **Support community composting for multi residential buildings-** After reviewing the three strategies in Toronto's long term waste strategy, community composting is the only strategy that fully aligns with the Ontario food and organic waste policy. Processing organic waste close to the source will take hundreds of kilometers off the transportation footprint of Toronto's current management strategies. The 2016 rezoning for some of Toronto's older multi-residential, the *Residential Apartment Commercial* zoning, makes it possible for market gardening and community composting to happen on building grounds.

2. Incentivization as long term investment

- a. **Incentivizing community participation in organics recycling is habit forming.** Participants in Community Compost Exchange programs and at a waste exchange program in New Britain Connecticut showed that even though the exchange system for kitchen waste may have gotten them started composting they would continue to do so without incentives. This could be seen in how participants of PACT's CCE would bring food scraps during the winter even without receiving market dollars, and how program participation did not decrease as incentives were lowered from five market dollars to one market dollar per bin. This makes the program more financially sustainable long term to manage and suggests initial investments over a few years will have long term impacts. Creative ways of building new waste habits with the community is important to achieve a zero-waste future.
- b. **Investments in backyard and community composting have long term diversion benefits.** Numerous years after financially supporting or subsidizing backyard composting, the City of Toronto still diverts a lot of organic waste through that avenue. Investments at the Bain Coop for community composting in 1989 are still bearing fruit today because even with the green bin program in

place at the buildings, composters and gardeners are processing up to 25 percent of the Co-Op's organic waste onsite.

- c. Incentivizing compost's end use in agricultural soils.** Supporting the creation of new markets for municipal compost will strengthen its growth and possibly offset some of the associated costs. Considering the projected increases of organics management across Ontario, scaling up end use to support ecological nutrient management will be important. This will also build the structure and resilience of Ontario's agricultural soils, both urban and rural, and be a long-term investment in the province's top soils and ability to produce food. For this to happen, compost quality must be addressed and paired with long-term plans to prohibit synthetic fertilizers and regulations stipulating that city parks, highway medians, and new construction must utilize a certain amount of compost to better manage urban stormwater runoff.

3. Discarded organics are a resource to be protected and managed and not waste to be discarded

- a. Compost quality prioritized over diversion-** In a circular economy, end use of compost is prioritized over diversion. This can be achieved through setting high quality finished compost standards and utilizing composting methods that capture the most nutrients, Toronto's current list of acceptable items in the green bin, meant to make it "easier" to compost, are a source of end contamination. Though necessary, an Ontario wide organics landfill ban without proper infrastructure in place would be detrimental to compost quality, leaving us with piles of oxygenated waste that food growers will not want to use.
- b. Use the waste reduction hierarchy to prioritize diversion programs.** The City of Toronto needs to utilize community programs to divert as much waste as possible through source reduction, edible rescue and community composting. This includes allocating more money to support community initiatives currently doing this and creating the needed framework to determine a successful diversion program that is not focused solely on collection numbers. Toronto's diversion expectations from community composting in its waste projections are much lower than what is possible. A Toronto specific feasibility report looking at

utilizing decentralized composting methods scaled up and across the city would help guide these changes.

4. Policy changes

a. **Changes to the Environmental Protection Act.** Allow urban farms to collect inputs needed to manage their own soils. The *Ontario's Food and Organic Waste Framework: Action Plan* specifically calls for updating legislation impacting resource recovery facilities. With this act, changes in standards will be adopted for community composting and other smaller low risk organic processing sites. These new standards must be developed in consultation with current community composters and involve changes to waste hauling laws to accommodate micro haulers. Recommendations should include those established by MacRae et al., (2016):

- The facility only receives residential food scraps and yard waste (with potentially very select addition of nitrogenous or carbonaceous material to obtain proper C:N ratios for composting quality). Québec allows up to 150m³ of off-site waste to community sites at any time provided it does not contain any problematic material (e.g., meat, industrial waste).
 - Aerobic composting only.
 - The operation composts less than 14 tonnes per week.
 - In urban areas, minimum distances of 10 m exist to the nearest property line, water body, road or pedestrian walkway.
 - A leachate mitigation plan is in place.
 - The facility meets the "A" compost quality standards.
- (MacRae et al., 2016, p. 176)

b. **Pilot programs-** Utilize article 5 Reg. 234/11, S. 4 of EPA regulation 347 to create a municipal waste pilot project to test out new systems. This would support the scaling up of the Community Compost Exchange.

- c. **Harmonized policies between City of Toronto Divisions.** *The Parks, Forestry, and Recreation* division needs to allow community gardens and park spaces to be used for composting and should also allow community gardens to sell produce grown onsite. *Municipal Licensing and Services* should work with *Solid Waste Management Services* to determine how allowing an Urban Hen bylaw could increase food waste reduction and diversion.
- d. **Create an organics circular economy working group.** Bring together businesses, community groups, individuals, not-for-profits, and any interested parties currently working within the organics circular economy. Toronto formed a Circular Economy & Innovation Unit that is currently running a circular economy working group. With the extremely wide range of products that make up the waste stream, it would be beneficial to have sub-groups made up of individuals working towards zero waste in specific waste streams. These more specific working groups would allow for targeted goals and more impactful policy suggestions to be made.

Resources

To dig deeper into the *Soil Acknowledgement* that opened this book an Indigenous led collaborative post asks us “ to go deeper and encourage [our] peers to go deeper—to not just ‘take’ practices from Indigenous cultures without their context, but to also encompass the deeper Indigenous worldviews... inspiring a consciousness shift that hopefully will support us to go from a dominant culture of supremacy and domination to one founded on reciprocity, respect, and interrelations with all beings—including, of course, among all humans.” (Authors and Contributors are shared at the end of this open-source document)

Whitewashed Hope

A message from 10+ Indigenous leaders and organizations

Regenerative Agriculture & Permaculture offer narrow solutions to the climate crisis

Introduction

Regenerative agriculture and permaculture claim to be the solutions to our ecological crises. While they both borrow practices from Indigenous cultures, critically, they leave out our worldviews and continue the pattern of erasing our history and contributions to the modern world.

While the practices 'sustainable farming' promote are important, they do not encompass the deep cultural and relational changes needed to realize our collective healing.

Where is 'Nature'?

Regen Ag & Permaculture often talk about what's happening 'in nature': "In nature, soil is always covered." "In nature, there are no monocultures." Nature is viewed as separate, outside, ideal, perfect. Human beings must practice “biomimicry” (the mimicking of life) because we exist outside of the life of Nature.

Indigenous peoples speak of our role AS Nature. (Actually, Indigenous languages often don't have a word for Nature, only a name for Earth and our Universe.) As cells and organs of Earth, we strive to fulfill our roles as her caregivers and caretakers. We often describe ourselves as "weavers", strengthening the bonds between all beings.

Death Doesn't Mean Dead

Regen Ag & Permaculture often maintain the "dead" worldview of Western culture and science: Rocks, mountains, soil, water, wind, and light all start as "dead". (E.g., "Let's bring life back to the soil!" — implying soil, without microbes, is dead.) This worldview believes that life only happens when these elements are brought together in some specific and special way.

Indigenous cultures view the Earth as a communion of beings and not objects: All matter and energy is alive and conscious. Mountains, stones, water, and air are relatives and ancestors. Earth is a living being whose body we are all a part of. Life does not only occur when these elements are brought together; Life always is. No “thing” is ever dead; Life forms and transforms.

From Judgemental to Relational

Regen Ag & Permaculture maintain overly simplistic binaries through subscribing to good and bad. Tilling is bad; not tilling is good. Mulch is good; not mulching is bad. We must do only the ‘good’ things to reach the idealized, 99.9% biomimicked farm/garden, though we will never be as pure or good “as Nature”, because we are separate from her.

Indigenous cultures often share the view that there is no good, bad, or ideal—it is not our role to judge. Our role is to tend, care, and weave to maintain relationships of balance. We give ourselves to the land: Our breath and hands uplift her gardens, binding our life force together. No one is tainted by our touch, and we have the ability to heal as much as any other lifeform.

Our Words Shape Us

Regen Ag & Permaculture use English as their preferred language no matter the geography or culture: You must first learn English to learn from the godFATHERS of this movement. The English language judges and objectifies, including words most Indigenous languages do not: ‘natural, criminal, waste, dead, wild, pure...’ English also utilizes language like “things” and “its” when referring to “non-living, subhuman entities”.

Among Indigenous cultures, every language emerges from and is therefore intricately tied to place. Inuit people have dozens of words for snow and her movement; Polynesian languages have dozens of words for water’s ripples. To know a place, you must speak her language. There is no one-size-fits-all, and no words for non-living or sub-human beings, because all life has equal value.

People are land. Holistic includes History.

Regen Ag and Permaculture claim to be holistic in approach. When regenerating a landscape, ‘everything’ is considered: soil health, water cycles, local ‘wildlife’, income & profit. ‘Everything’, however, tends to EXCLUDE history: Why were Indigenous homelands steal-able and why were our peoples & lands rape-able? Why were our cultures erased? Why does our knowledge need to be validated by ‘Science’? Why are we still excluded from your ‘healing’ of our land?

Among Indigenous cultures, people belong to land rather than land belonging to people. Healing of land MUST include healing of people and vice versa. Recognizing and processing the emotional traumas held in our bodies as descendants of assaulted, enslaved, and displaced peoples is necessary to the healing of land. Returning our rights to care for, harvest from, and relate to the land that birthed us is part of this recognition.

Composting

Regen Ag & Permaculture often share the environmentalist message that the world is dying and we must “save” it. Humans are toxic, but if we try, we can create a "new Nature" of harmony, though one that is not as harmonious as the "old Nature" that existed before humanity. Towards this mission, we must put Nature first and sacrifice ourselves for “the cause”.

Indigenous cultures often see Earth as going through cycles of continuous transition. We currently find ourselves in a cycle of great decomposition. Like in any process of composting there is discomfort and a knowing that death always brings us into rebirth. Within this great cycle, we all have a role to play. Recognizing and healing all of our own traumas IS healing Earth's traumas, because we are ONE.

Where to go from here?

Making up only 6.2% of our global population, Indigenous peoples steward 80% of Earth's biodiversity while managing over 25% of her land. Indigenous worldviews are the bedrocks that our agricultural practices & lifeways arise from. We invite you to ground your daily practices in these ancestral ways, as we jointly work towards collective healing.

- Learn whose lands you live on (native-land.ca), their history, and how you can support their causes and cultural revitalization.
- Watch [@gatherfilm](#) and Aluna documentary.
- Amplify the voices and stories of Indigenous peoples and organizations.
- Follow, support, donate to, and learn from the contributors to this post.
- Help republish this open-source post: <https://bit.ly/IndigenousWorldViews>

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Recipes

This section includes recipes that utilize a diverse range of plant parts. They were shared with me for this section by friends and community members, and many of them were passed down intergenerationally. They are all absolutely delicious!

Tinola

by Micahela Cruz

Recipe for medicinal chicken soup (Tinola) as taught by my mama

Ingredients:

- A good couple handfuls of pepper leaves (best when harvested at a young age so that they are not bitter) (usually from hot peppers like these ones: <https://www.pepperscale.com/siling-labuyo/>) - no stems attached
- A 3-4 inch nub of ginger
- 1 medium onion diced
- 3 garlic cloves minced
- Green papaya (can be substituted with chayote) - peeled, seeded and cut into 2-inch cubes *has to be a non-ripened papaya*
- Chicken (8 legs or 8 thighs or a whole chicken broken down)
- 1-2 stalks Lemongrass
- Fish sauce to taste
- Salt to taste
- A pinch of black pepper
- Water
- 1 Tablespoon oil

For vegetarians who want to taste the yum and get the medicinal benefits - omit chicken and use vegan fish sauce sub

Directions:

1. Preheat large soup pot with a tablespoon of oil (canola, sunflower, or veg) then saute garlic, ginger, onion until translucent
2. Throw in chicken and toss it in the pot a bit
3. Add lemongrass
4. Add enough water to the pot to cover the chicken
5. Let it boil until the chicken is cooked (to check cut a slit in the chunkiest piece and see if the juices run clear)
6. Throw in green papaya and let it boil until the green papaya is tender and translucent
7. Add pepper leaves
8. Add fish sauce to taste
9. Add salt to taste
10. Add black pepper
11. Serve and enjoy with steamed jasmine rice and a dipping sauce of fish sauce with a chili in it :) aka "sawsawan"

Carrot, Sweet Potato, and Ginger Soup

By Bashir Muayne

Ingredients

- 4 cups carrot, peeled (or scrubbed) and diced
- 1 cup sweet potato, peeled and diced
- 1/2 cup white onion, peeled and diced
- 1 clove garlic, minced
- 1" ginger, peeled (or scrubbed) and sliced thinly
- 2 sprigs thyme
- 1 L vegetable stock (or water)
- 2 tbsp aka miso (red miso)
- 2 tbsp unsalted butter
- salt and pepper

Directions

1. Over medium heat, sauté onions in unsalted butter until translucent.
2. Then add in carrots, sweet potatoes and ginger and roast lightly to develop natural sugars.
3. Add all remaining ingredients except miso, salt and black pepper.
4. Cook out on low simmer for approximately 35 minutes until all vegetables are tender.
5. Remove thyme stems. Stir in miso.
6. Puree with blender until silky smooth.
7. Season to taste with salt and black pepper.
8. Garnish with carrot top pesto.

Carrot Top Pesto

By Bashir Munye

Ingredients

- 2 cups carrot greens (tops), picked, blanched in boiling water for 1 min and cooled in cold (ice) water
- 24 pc smoked almonds
- 2 tbsp red wine vinegar
- 1 clove garlic
- 1/2 cup canola oil (or other neutral tasting oil)
- salt and pepper to taste

Directions

1. Cook carrot tops in a pot of boiling water for one minute. Cool quickly by placing in ice bath or running under cold water. Remove greens from ice bath and squeeze out excess water.
2. Put carrot tops, garlic, almonds and red wine vinegar in the blender.
3. With the blender running add a slow stream of oil until mixture is fluid. Blend on high for 10 seconds or until pesto has a creamy texture.
4. Season to taste with salt and pepper.

Carrot Facts:

- grow tender carrot greens by placing top in water
- easy to grow from commercial seed
- have a long natural fresh storage life
- carrots (root) are very suitable for cellaring and longer cold storage (see the Japanese yukinoshita)
- if blanched first, carrots (root) store well frozen
- root is very versatile and can be prepared in a variety of ways (carrot cake, stocks, puree, chips, roasted, glazed, salads)
- very tasty and popular juice which is very high in vitamins and minerals
- good source of vitamin A, vitamin B6, vitamin C and vitamin K
- good source of potassium and contains an array of other micronutrients
- carrot tops (greens) are edible and also high in vitamins and minerals

Sweet Potato Facts:

- very easy to re-grow fruit bearing plants from trimmings
- young leaves and stems are edible raw with a subtle grassy flavour
- mature leaves can be stewed or sauteed just like spinach and other tender greens
- leaves are a popular ornamental house plant and sometimes used in aquariums
- when cooked very high in vitamin C and Vitamin A
- moderate amounts of calcium, potassium, sodium
- extremely versatile in recipes (savoury and pastry)
- well-loved and popular in many cuisines worldwide
- available in many cultivars (colours) and heritage varieties

Luul's baamiye (Luul's okra salad)

By Bashir Munye

Ingredients

- 2 cups okra (sliced lengthwise)
- 1 cup ripe tomatoes (sliced)
- 1 onion (finely sliced)
- ¼ cup peanuts (toasted)
- 6 to 8 sprigs of cilantro (roughly chopped)
- 6 to 8 sprigs of basil (roughly chopped)
- 6 to 8 sprigs of mint (roughly chopped)
- 2 preserved lemons plus 2 tablespoons of the brine (outside skin only, finely minced)
- ¼ cup olive oil
- 2 bird eye chili peppers (finely minced)
- Salt

Optional ingredients:

- Nasturtium flowers, arugula (bitter component)
- Injera crisp

Directions

1. Add a few tablespoons of olive oil in a skillet (or roasting pan), rest the okra seeds down and roast in a high heat (425degrees) for 8 to 10 minutes.
2. Meantime add all the other ingredients in a bowl and mix well.
3. Cool the okra for 5 minutes and then add with all the other ingredients.
4. It can be consumed cold, at room temperature or warm.
5. A meal on its own or a side dish.

Where to find those ingredients:

You will find Okra and most of those ingredients in most southeast Asian and Caribbean shops Preserved lemon in most North African and Middle Eastern stores.

Did you Know:

All the ingredients in this recipe are grown in Ontario. (except for the lemon)

70% of the world crops can grow in Ontario at optimum season

Ontario is the largest farming producer of peanuts.

Okra's Versatility

- Okra roots and stems can be used as oil (second to sunflower per yield)
- The stems when dried can be used as straws, heats (seniors and children activities)
- Stems can also be used to make paper (activity for seniors and children)
- The seeds can be dried and used as substitute for coffee(does not taste anything like coffee and does not have any of the caffeine)
- The seeds(and the overgrown fibrous pods can also be dried and grounded and used as a substitute to corn or arrowroot starch)

- The leaves(young) can be treated like spinach or collard greens
- The flower can be consumed raw to add into a salad
- The fruit can be seasoned and oven dried as chips
- Pickled
- Fermentation
- Smoked

Siragi-Dried Radish Greens

Recipe by Patricia Youn

Ingredients:

- 3 stalks of dried daikon radish greens (Siraegi) - drying directions below
- 5 cups of shitake, kombu, anchovy broth
- 2 Tablespoons of soybean paste
- 1 block of tofu firm
- 2 cloves of minced garlic
- Spring or green onion - 2 Tablespoons
- 1 teaspoon soy sauce

Directions

1. Take dried radish green and soak fully submerged in lukewarm water overnight, change the water in the morning and resoak- can soak for up to 24 hours.
2. Blanche radish greens in water for 2-3 mins, add to strainer rinse under cold water then cut into bite size pieces and set aside.
3. Make broth by adding 6 cups of water, a handful of anchovies, a small piece of kombu (kelp), and three dried shiitake mushrooms to boil for 5-10 mins.
4. Strain out broth materials, add 2 tablespoons of soybean paste, radish greens, and cubed tofu. Boil for 10 minutes
5. Chop garlic add to broth and continue cooking for 1-2 minutes.
6. Serve warm with chopped green onions sprinkled on top, add red pepper flakes and salt to taste.

How to dry daikon radish leaves-

- Take the daikon and slice the very top so that all the leaves are still connected.
- Leaves are best harvested after a light frost or when very green.
- Hang in a cool, dry, dark place to preserve color by running a string and suspending the greens upside down.
- Spread the leaves out so that they can evenly dry.
- Dried leaves are good for upto 2-3 years.

Simple Sauerkraut Recipe
How to use the outer leaf of cabbage to make better ferments!
By Audrey Snyder

Ingredients

- 1 quart glass jar with a lid
- 1 medium head of green or red cabbage with outer leaves intact
- Kosher salt or fine sea salt

Directions

1. Peel the outermost 4-5 layers of cabbage and set aside. Using a mandolin or a knife, slice the entire head of cabbage.
2. Weigh the cabbage, add 2 tsp of salt for every pound/500 grams of cabbage. Or 2 percent of the weight of the cabbage.
3. Using clean hands squeeze and mix the salt into the cabbage.
4. Continue massaging the cabbage until it releases water forming a salty brine.
5. Pack the cabbage into the cleaned glass jar, pressing to make sure there are no air pockets. Cut and fold the reserved cabbage leaves into a rough circle slightly wider than the mouth of your jar.
6. Fold it in half and press it into contact with the top of the shredded and salted cabbage, tucking the ends into the “shoulder” of the jar and below the brine.
7. Add any leftover brine from the cabbage pressing to top up the jar. Put the lid on the jar without fully tightening it.
8. Let the cabbage ferment at room temperature for 3-4 days or longer to taste. Periodically release pressure from the lid and check that the cabbage is submerged under the brine.
9. Refrigerate the sauerkraut once it has fermented to taste.

Variations

- Add tsp caraway seeds and 1/2 a fresh grated beet with the skin on
- Add citrus peel and sliced fennel stalks you would normally compost

Mineral-rich Vegetable Broth

using food scraps/leaves

By Audrey Snyder

As you cook and generate food scraps gather up:

(put into a ziploc bag in the freezer)

- Celery leaves and stem ends
- Mushroom stems/caps
- Parsley stems
- Cilantro stems
- Carrot peels and ends
- Sweet potato peels
- White or yellow Onion ends and skins
- Dried out thyme, rosemary or sage
- Leaves and stems from weeds like nettles, chickweed, or mallow
- Ginger
- Garlic, leeks or green onion
- X** Avoid brassicas such as broccoli and kale because they make the broth bitter

Directions

1. Once you have a large amount of scraps it's time to make broth
2. Add scraps to your largest pot and fill with order
3. Add in whole black peppercorn, bay leaf, a whole onion, kombu, and salt to taste
4. Bring to boil and simmer for one hour.
5. Strain the broth and compost the used veggie scraps.
6. Can be frozen in ziploc containers and last for 4-6 months or but in the fridge and used within a week.

Cilantro Root Paste Noodle Soup

By Audrey Snyder

Cilantro root paste:

- 5 medium sized Cilantro/coriander roots, cleaned and chopped
- 15 cloves fresh garlic
- 1 tablespoon White pepper

Directions

1. Start with the white pepper - grind well in a spice grinder or a mortar and pestle until powdered. Add garlic and crush into a paste.
2. Chop cleaned cilantro roots into small pieces and add to the garlic-white pepper mixture.
3. Continue processing or grinding until a smooth paste forms.

Use this delicious paste as a base for stir fry! Add it by the tablespoon to hot water or broth to make a clear soup. Use it to marinate fish or vegetables before cooking or grilling.

To make the glass noodle soup:

- 2 tbs neutral oil
- 3 tbs cilantro root paste
- 1 cup Celery, large dice
- 1 cup green or napa cabbage leaves, sliced thinly
- 1 quart light broth or filtered water
- 1 package glass noodles
- 1/2 cup diced soft Tofu or ground protein of your choice
- 3 tbs chopped spring onions
- 1 tbs Coconut aminos or soy sauce, more to taste
- Salt
- Herbs for garnishing, cilantro or thai basil,
- fresh jalapeno or chilis and lime to serve

Directions

1. Soak the noodles in cold water to soften for 10 minutes.
2. Heat the oil in a saucepan over medium heat.
3. Add Cilantro root paste and cook while stirring until very fragrant.
4. Add celery and cabbage and continue to cook for 5 minutes.
5. Add broth or filtered water and bring to a boil.
6. Add tofu and/or ground meat and bring back up to a gentle simmer until tofu is heated through or protein is fully cooked, 10 minutes.
7. Add chopped spring onions, softened glass noodles and coconut aminos or soy sauce.
8. Add salt to taste.
9. Serve into bowls and garnish with herbs, sliced chilis and a squeeze of lime.

References

- Abrams, M. D., & Nowacki, G. J. (2008). Native Americans as active and passive promoters of mast and fruit trees in the eastern USA. *Holocene*, 18(7), 1123–1137.
<https://doi.org/10.1177/0959683608095581>
- Albert, A. (2018, January 8). *Oneida Nation of the Thames says Toronto's landfill is not a good neighbour* | CBC News. CBC. <https://www.cbc.ca/news/canada/london/green-lane-landfill-oneida-nation-smells-1.4567724>
- Baker, G. A., Gray, L. C., Harwood, M. J., Osland, T. J., & Tooley, J. B. C. (2019). On-farm food loss in northern and central California: Results of field survey measurements. *Resources, Conservation and Recycling*, 541–549. <https://doi.org/10.1016/j.resconrec.2019.03.022>
- Barker, D. (2012). *History of Seed in the U.S.: The Untold American Revolution*. Center for Food Safety. www.centerforfoodsafety.org
- Barndt, D. (2002). Across Space and through Time: Tomatl Meets the Corporate Tomato. In *Tangled Routes: Women, Work and Globalization on the Tomato Trail* (pp. 7–30). Rowman & LittleField Publishers.
- Blum, B. (1992). Composting and the roots of sustainable agriculture. *Agricultural History*, 66(2), 171–188. <https://about.jstor.org/terms>
- Breen, M. (2020). *Economics Of Backyard Chickens*. BioCycle.
<https://www.biocycle.net/economics-backyard-chickens/>
- Brown, C. (2015). *Evaluation of Greenbin Derived Municipal Compost to Improve Soil Health on Agricultural Cropland*.
- CEC. (2017). *Characterization and Management of Food Loss and Waste in North America*. Commission for Environmental Cooperation.
- City of Toronto. (2015). Technical Memorandum No. 1 Current System Summary. In *City of Toronto*. [http://files/72/Technical Memorandum No. 1 Current System Summary.pdf](http://files/72/Technical%20Memorandum%20No.%201%20Current%20System%20Summary.pdf)
- City of Toronto. (2016). *Waste Strategy Highlights Attachment 1-Final Long Term Waste Management Strategy Waste Strategy Highlights*.
- City of Toronto. (2020). *LANDSCAPE ANALYSIS BASELINING FOR A CIRCULAR TORONTO Technical Memorandum #1*.
- City of Toronto. (2021a). *Community Reduce & Reuse Programs – City of Toronto*.
<https://www.toronto.ca/services-payments/recycling-organics-garbage/long-term-waste-strategy/waste-reduction/community-reduce-reuse-programs/>
- City of Toronto. (2021b). *Solid Waste Reports & Diversion Rates*. City of Toronto.

- <https://www.toronto.ca/services-payments/recycling-organics-garbage/solid-waste-reports/>
City of Toronto. (2021c). *Waste Reduction Community Grants*. City of Toronto.
<https://www.toronto.ca/services-payments/water-environment/environmental-grants-incentives/waste-reduction-community-grants/>
- City of Toronto. (2021d). *What Goes in the Green Bin (Organics)?*
<https://www.toronto.ca/services-payments/recycling-organics-garbage/houses/what-goes-in-my-green-bin/>
- Coleman, E. (2018). *The New Organic Grower: A Master's Manual of Tools and Techniques for the Home and Market Gardener* (3rd ed.). Chelsea Green Publishing.
<https://books.google.com/books?id=zmJVIBrLtO8C&pgis=1>
- Compost Council of Canada. (2019). *Soils at Work: The Biology of Soil Health* (First). Compost Council of Canada.
- Daily Bread Food Bank. (2021). *Daily Bread's Summer Produce Markets*.
<https://www.dailybread.ca/summermarkets/>
- Draaisma, M. (2019). *Toronto "greener, cleaner" because of Community Environment Days, Tory says*. CBC News. <https://www.cbc.ca/news/canada/toronto/community-environment-day-ward-15-program-starts-mayor-john-tory-1.5087816>
- Duggan, T. (2013). *Root-to-Stalk Cooking THE ART OF USING THE WHOLE VEGETABLE* (1st ed.). Ten Speed Press.
- Ellen MacArthur Foundation. (2019). *COMPLETING THE PICTURE HOW THE CIRCULAR ECONOMY TACKLES CLIMATE CHANGE* (Issue September).
www.ellenmacarthurfoundation.org/publications
- Environment and Climate Change Canada. (2020). *Food loss and waste - Canada.ca*.
<https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/food-loss-waste.html>
- European Commission. (2020). *Farm to Fork Strategy. DG SANTE/Unit 'Food Information and Composition, Food Waste', 'DG SANTE/Unit 'Food Inf. Compos. food waste', ' 23*.
https://ec.europa.eu/food/farm2fork_en
- Fabrizio, L. E. (2015). *Exploring the Domestic Ideology of the Postwar Era through Cookbooks. Exploring the Domestic Ideology of the Postwar Era through Cookbooks*, 3(1), 14–20.
<https://doi.org/10.18113/P8ne3159811>
- Feed It Forward. (2021). *Feed it Forward DAP*. <https://feeditforward.ca/more-about-us/>
- Fontaine, D., Feng, L., Labouriau, R., Møller, H. B., Eriksen, J., & Sørensen, P. (2020). *Nitrogen and Sulfur Availability in Digestates from Anaerobic Co-digestion of Cover Crops, Straw*

- and Cattle Manure. *Journal of Soil Science and Plant Nutrition*, 20(2), 621–636.
<https://doi.org/10.1007/s42729-019-00151-7>
- FoodShare. (2019). *Community Compost Exchange and School Grown Markets 2019 Report*.
- FoodShare. (2021). *Land Acknowledgement | FoodShare*. <https://foodshare.net/about/land-acknowledgement/>
- Foster, J. B. (1999). Marx's theory of metabolic rift: Classical foundations for environmental sociology. *American Journal of Sociology*, 105(2), 366–405. <https://doi.org/10.1086/210315>
- Gaharwar, A. M., & Ughade, J. D. (2017). Effect of plant spacing on marketable yield of table beet (*Beta vulgaris* L.). *INTERNATIONAL RESEARCH JOURNAL OF AGRICULTURAL ECONOMICS AND STATISTICS*, 8(1), 51–55. <https://doi.org/10.15740/has/irjaes/8.1/51-55>
- Gershuny, G. (2004). *Compost, Vermicompost, and Compost Tea*. Chelsea Green Publishing.
- Gliessman, S. (2016). Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems*, 40(3), 187–189.
<https://doi.org/10.1080/21683565.2015.1130765>
- Gooch, M., Bucknell, D., LaPlain, D., Dent, B., Whitehead, P., Felfel, A., Nikkel, L., & Maguire, M. (2019a). *The Avoidable Crisis of Food Waste: Roadmap*. www.SecondHarvest.ca
- Gooch, M., Bucknell, D., LaPlain, D., Dent, B., Whitehead, P., Felfel, A., Nikkel, L., & Maguire, M. (2019b). *The Avoidable Crisis of Food Waste: Technical Report*. In *Value Chain Management International and Second Harves*. www.SecondHarvest.ca/Research
- Gooch, M., Felfel, A., & Marenick, N. (2010). *Food waste in Canada: Opportunities to increase the competitiveness of Canada's agri-food sector, while simultaneously improving the environment*.
- Gorrie, P. (2015a). *Compost Use Trials On Ontario Farms*. BioCycle.
<https://www.biocycle.net/compost-use-trials-on-ontario-farms/>
- Gorrie, P. (2015b). *Pioneering An Organics Disposal Ban*. BioCycle.
<https://www.biocycle.net/pioneering-an-organics-disposal-ban/>
- Gorrie, P. (2017). *Residential Organics Diversion In Toronto*. BioCycle.
<https://www.biocycle.net/residential-organics-diversion-toronto/>
- Government of Alberta. (2020). *Wheat stem sawfly*. <https://www.alberta.ca/wheat-stem-sawfly-overview.aspx>
- Gowriluk, C. (2021). *After last spring's gardening boom, greenhouses prepared for another — but had no idea what was coming*. CBC News.
<https://www.cbc.ca/news/canada/manitoba/gardening-seeds-shortages-pandemic-boom->

manitoba-1.5912322

- Grant, C. (2020). *Extending the UrbanHensTO Backyard Hens Pilot*.
- Graves, R. E. (2000). Chapter 2 Composting. *Environmental Engineering, Part 637*(February), 88.
- Gustavsson, J., Cederberg, C., & Sonesson, U. (2011). Global Food Losses and Food Waste. *Unep, May*, 1. <https://doi.org/10.1098/rstb.2010.0126>
- Hanson, C., Lipinski, B., Robertson, K., Dias, D., Gavilan, I., Gréverath, P., Ritter, S., Fonseca, J., van Otterdijk, R., Dawe, A., Berger, V., Reddy, M., Tran, B., Leach, B., & Quedsted, T. (2016). FLW Protocol Steering Committee and Authors Other Contributing Authors. In *Food and Agriculture Organization of the United Nations*. http://flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdfhttp://www.wri.org/sites/default/files/FLW_Standard_Exec_Summary_final_2016.pdf
- Jaffe, J. A., & Gertler, M. (2006). Victual vicissitudes: Consumer deskilling and the (gendered) transformation of food systems. *Agriculture and Human Values*, 23(2), 143–162. <https://doi.org/10.1007/s10460-005-6098-1>
- Johnson, L. K., Dunning, R. D., Bloom, J. D., Gunter, C. C., Boyette, M. D., & Creamer, N. G. (2018). Estimating on-farm food loss at the field level: A methodology and applied case study on a North Carolina farm. *Resources, Conservation and Recycling*, 137, 243–250. <https://doi.org/10.1016/j.resconrec.2018.05.017>
- Kinach, L., Parizeau, K., & Fraser, E. D. G. (2020). Do food donation tax credits for farmers address food loss/waste and food insecurity? A case study from Ontario. *Agriculture and Human Values*, 37, 383–396. <https://doi.org/10.1007/s10460-019-09995-2>
- Lang, R. (2016). *The Southern VegetableBook A ROOT-TO-STALK GUIDE TO THE SOUTH'S FAVORITE PRODUCE*. TI Inc. Books.
- Lim, V., Funk, M., Marcenaro, L., Regazzoni, C., & Rauterberg, M. (2017). Designing for action: An evaluation of Social Recipes in reducing food waste. *International Journal of Human Computer Studies*, 100(December 2015), 18–32. <https://doi.org/10.1016/j.ijhcs.2016.12.005>
- Logan, T. (2017, October 8). *Ontario considers ban on throwing organic waste into the trash* | CBC News. CBC. <https://www.cbc.ca/news/canada/toronto/ontario-organic-waste-ban-1.4315688>
- Logan, T. (2019, January 8). *What really happens to the organic waste you put in your compost bin* | CBC News. CBC. <https://www.cbc.ca/news/technology/organic-waste-composting-1.5291132>

- Lovins, A. B. (2018). *How big is the energy efficiency resource?* <https://doi.org/10.1088/1748-9326/aad965>
- Lowenfels, J., & Lewis, W. (2010). *Teaming with Microbes-The Organic Gardeners Guide to the Soil Food Web* (1st ed.). Timber Press Inc.
- Lowman, A., McDonald, M. A., Wing, S., & Muhammad, N. (2013). Land application of treated sewage sludge: Community health and environmental justice. *Environmental Health Perspectives*, 121(5), 537–542. <https://doi.org/10.1289/ehp.1205470>
- Lucheta, A. R., & Lambais, M. R. (2012). Sulfur in agriculture. *Revista Brasileira de Ciência Do Solo*, 36(5), 1369–1379. <https://doi.org/10.1590/s0100-06832012000500001>
- MacRae, Rod, Gallant, E., Patel, S., Michalak, M., Bunch, M., & Schaffner, S. (2010). Could Toronto provide 10% of its fresh vegetable requirements from within its own boundaries? Matching consumption requirements with growing spaces. In *Journal of Agriculture, Food Systems, and Community Development*. <https://doi.org/10.5304/jafscd.2010.012.008>
- MacRae, Rod, Siu, A., Kohn, M., Matsubuchi-Shaw, M., McCallum, D., Hernandez Cervantes, T., & Perreault, D. (2016). Making better use of what we have: Strategies to minimize food waste and resource inefficiency in Canada. *Canadian Food Studies / La Revue Canadienne Des Études Sur l'alimentation*, 3(2), 145. <https://doi.org/10.15353/cfs-rcea.v3i2.143>
- MacRae, Roderick. (2021). Fertilizer. In *Food Policy for Canada: joined up food policy to create a just, health promoting and sustainable food system*. <http://foodpolicyforcanada.info.yorku.ca>
- Martin, D., & Gershuny, G. (1992). *The Rodale Book of Composting* (2nd ed.). Rodale Press Inc.
- Mausser, W., Klepper, G., Zabel, F., Delzeit, R., Hank, T., Putzenlechner, B., & Calzadilla, A. (2015). Global biomass production potentials exceed expected future demand without the need for cropland expansion. *Nature Communications*, 6. <https://doi.org/10.1038/ncomms9946>
- McClintock, N., & Cooper, J. (2009). Cultivating the Commons ? An Assessment of the Potential for Urban Agriculture on Public Land in Oakland , California. *Review Literature And Arts Of The Americas*, 1(June), 1–61. http://pdxscholar.library.pdx.edu/usp_facwww.urbanfood.org
- McKay, J. (2018). *Green Bin Organic Waste Processing and Capacity in the Province of Ontario*. 1–13. <http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2017.PW25.9>
- McSweeney, J. (2019). *Community Scale Composting Systems:a comprehensive practical guide for closing the food system loop and solving our waste crisis* (1st ed.). Chelsea

Green Publishing.

- Minister of Agriculture and Agri-Food. (2019). *Food policy for Canada: Everyone at the table*.
<https://www.canada.ca/content/dam/aafc-aac/documents/20190614-en.pdf>
- Mintz, S. (2006). *Food at Moderate Speeds* (R. Wilk (ed.)). AltaMira Press.
- Nasr, J., Macrae, R., Kuhns, J., Danyluk, M., Kaill-vinish, P., Michalak, M., & Snider, A. (2010).
Scaling up Urban Agriculture in Toronto (Issue June). <https://metcalffoundation.com/wp-content/uploads/2011/05/scaling-urban-agriculture.pdf>
- National Zero Waste Council. (2021). *Love Food Hate Waste Canada*. Love Food Hate Waste Canada. <https://lovefoodhatewaste.ca/>
- Niemann, M. (2020). Composting 's Colonial Roots and Microbial Offshoots What Is Composting? *Edge Effects*, 1–11. <https://edgeeffects.net/composting-colonial-roots/>
- Not Farm From the Tree. (2021). *Our Impact – Not Far From the Tree*.
<https://notfarfromthetree.org/our-impact/>
- Ogburn, S. (2010). The dark side of nitrogen. *Grist Magazine*, 1–11.
<https://grist.org/article/2009-11-11-the-dark-side-of-nitrogen/>
- Ontario Ministry of the Environment. (2012). Ontario Compost Quality Standards. *Ministry of the Environment*, 347, 45.
- Ontario Ministry of the Environment and Climate Change. (2017). *Ontario Ministry of the Environment and Climate Change DISCUSSION PAPER: ADDRESSING FOOD AND ORGANIC WASTE IN ONTARIO*.
http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2017/013-0094_DiscussionPaper.pdf
- Ontario Ministry of the Environment and Climate Change. (2018a). *ONTARIO'S FOOD AND ORGANIC WASTE FRAMEWORK: Action Plan*. <https://doi.org/10.7748/ns.17.19.22.s36>
- Ontario Ministry of the Environment and Climate Change. (2018b). Ontario's Food and Organic Waste Recovery Policy Statement. *Resource Recovery and Circular Economy Act, 2016*.
<https://doi.org/10.1080/00913367.1975.10672600>
- Ospina, D., Benavides, J., Zúñiga, O., & Muñoz, C. (2018). *Photosynthesis and biomass yield in Tabasco pepper, radish and maize subjected to magnetically treated water Fotosíntesis y rendimiento de biomasa en ají Tabasco, rábano y maíz sometidos a agua tratada magnéticamente*. 19(2), 307–321.
- PACT. (2020, April 27). *PACT Urban Peace Program » Grow-to-Learn Emergency Fresh Food Box: Our Covid-19 response*. <https://pactprogram.ca/blog/grow-to-learn-emergency-fresh-food-box-our-covid-19-response/>

- Pai, S., Ai, N., & Zheng, J. (2019). Decentralized community composting feasibility analysis for residential food waste: A Chicago case study. *Sustainable Cities and Society*, 50, 101683. <https://doi.org/10.1016/j.scs.2019.101683>
- Penniman, L. (2018). *Farming While Black: Soul Fire Farm's practical guide to liberation on the land*. Chelsea Green Publishing.
- Perkins, T. (2019). *Biosolids: mix human waste with toxic chemicals, then spread on crops*. Guardian. <https://www.theguardian.com/environment/2019/oct/05/biosolids-toxic-chemicals-pollution>
- Platt, B. (2017). *Hierarchy to Reduce Food Waste & Grow Community - Institute for Local Self-Reliance*. <https://ilsr.org/food-waste-hierarchy/>
- Platt, B., McSweeney, J., & Davis, J. (2014). *GUIDE TO COMMUNITY COMPOSTING GROWING LOCAL FERTILITY: A GUIDE TO COMMUNITY COMPOSTING*. Institute for Local Self-Reliance and Highfields Center for Composting. www.ilsr.org
- Porat, R., Lichter, A., Terry, L. A., Harker, R., & Buzby, J. (2018). Postharvest losses of fruit and vegetables during retail and in consumers' homes: Quantifications, causes, and means of prevention. *Postharvest Biology and Technology*, 139(September 2017), 135–149. <https://doi.org/10.1016/j.postharvbio.2017.11.019>
- Ramírez, M. M. (2015). *The Elusive Inclusive: Black Food Geographies and Racialized Food Spaces*. <https://doi.org/10.1111/anti.12131>
- Romeo-Beehler, B. A. (2018). *AUDITOR GENERAL'S REPORT Review of the Green Lane Landfill Operations Management of Contracts Needs Improvement*.
- Rossier, C., & Lake, F. (2014). Indigenous traditional ecological knowledge in agroforestry. *Agroforestry Notes*, 44(May), 1–8. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1045244.pdf
- Sawyer, J., Gee, B., & Harwood, E. (2015). Agriculture demand for compost in metro Portland region. *BioCycle*, 56(3), 57–62. <https://www.biocycle.net/agricultural-demand-for-compost-in-metro-portland-region/>
- Schneider, M., & McMichael, P. (2010). Deepening, and repairing, the metabolic rift. *Journal of Peasant Studies*, 37(3), 461–484. <https://doi.org/10.1080/03066150.2010.494371>
- Second Harvest. (2021). *About Food Rescue by Second Harvest*. <https://www.foodrescue.ca/public/about-food-rescue>
- Seeds of Diversity. (2020). *Why is Biodiversity Important?* Seeds of Diversity. <https://seeds.ca/sw8/web/diversity/biodiversity-is-important>
- Sidder, A. (2016). The Green, Brown, and Beautiful Story of Compost. *National Geographic*,

- 2015–2017. <https://www.nationalgeographic.com/people-and-culture/food/the-plate/2016/09/compost--a-history-in-green-and-brown/>
- Siegner, A. B., Acey, C., & Sowerwine, J. (2020). Producing urban agroecology in the East Bay: from soil health to community empowerment. *Agroecology and Sustainable Food Systems*, 44(5), 566–593. <https://doi.org/10.1080/21683565.2019.1690615>
- Slocum, R. (2006). Anti-racist Practice and the Work of Community Food Organizations. *Antipode*.
- Solid Waste Management. (2020). *Mixed Waste Processing Study Update*. 1–14.
- Solid Waste Management Services. (2019). 2019 Operating Budget & 2019-2028 Capital Plan. In *City of Toronto*. <https://www.toronto.ca/wp-content/uploads/2018/11/90d8-SWMS-Overview-AODA.pdf>
- Stamets, P. (2005). *Mycelium running: How mushrooms can help save the world*. Ten Speed Press.
- Staranchuk, T. (2018). *Backgrounder: City of Toronto's waste-to-renewable-natural-gas project*. City of Toronto. <https://www.toronto.ca/home/media-room/backgrounders-other-resources/backgrounder-waste-to-renewable-natural-gas-project/>
- Stephens, M. (2005). "Secondary Edible Parts of Vegetables." University of Florida. https://aggie-horticulture.tamu.edu/newsletters/hortupdate/hortupdate_archives/2005/may05/SecVeget.html
- Tarasuk, V. (2015). Donating "edible waste" to food banks in exchange for tax credit? Now that's a rubbish idea. *The Globe and Mail*. <https://www.theglobeandmail.com/opinion/donating-edible-waste-to-food-banks-in-exchange-for-tax-credit-now-thats-a-rubbish-idea/article27064689/>
- Tasker, J. P. (2020). *Ottawa to hike federal carbon tax to \$170 a tonne by 2030*. CBC News. <https://www.cbc.ca/news/politics/carbon-tax-hike-new-climate-plan-1.5837709>
- Thomas, J., & Bradshaw, J. (2018). *Increased Wheat Stem Sawfly Populations In 2018*. University of Nebraska-Lincoln. <https://cropwatch.unl.edu/2018/increased-wheat-stem-sawfly-populations-2018>
- Tornaghi, C. (2016). *Urban Agriculture in the Food-Disabling City: (Re)defining Urban Food Justice, Reimagining a Politics of Empowerment*. <https://doi.org/10.1111/anti.12291>
- Toronto Environmental Alliance. (2016a). *Organics First: Setting Toronto on the Zero Waste Path*. <https://d3n8a8pro7vhmx.cloudfront.net/toenviro/pages/1775/attachments/original/14658513>

- 65/Organics_First_-_TEA_Report_-_June_2016.pdf?14658513659rENDeport
Toronto Environmental Alliance. (2016b). *Zero Waste Toronto: A vision for our city*.
Toronto Food Policy Council. (2012). *Grow TO: an urban agriculture action plan for Toronto*.
United States Environment Protection Agency. (2021). *Food Recovery Hierarchy*.
<https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy>
- Unwin, S. (2007). *From mountain to molehill*. The Guardian.
<https://www.theguardian.com/society/2007/sep/26/guardiansocietysupplement.publicservicesawards>
- Vergauwen, D., & De Smet, I. (2017). From early farmers to Norman Borlaug — the making of modern wheat. *Current Biology*, 27(17), R858–R862.
<https://doi.org/10.1016/j.cub.2017.06.061>
- Vidoni, M. (2011). *Community Composting in Toronto: Closing the food-waste loop*.
<http://tfpc.to/resources/agency/composting-in-toronto-closing-the-urban-food-waste-loop>
- Watteau, F., Dignac, M. F., Bouchard, A., Revallier, A., & Houot, S. (2018). Microplastic Detection in Soil Amended With Municipal Solid Waste Composts as Revealed by Transmission Electronic Microscopy and Pyrolysis/GC/MS. *Frontiers in Sustainable Food Systems*, 2(December). <https://doi.org/10.3389/fsufs.2018.00081>
- Weithmann, N., Möller, J. N., Löder, M. G. J., Piehl, S., Laforsch, C., & Freitag, R. (2018). Organic fertilizer as a vehicle for the entry of microplastic into the environment. *Science Advances*, 4(4), eaap8060. <https://doi.org/10.1126/sciadv.aap8060>
- White, M. M. (2018). *Freedom Farmers: Agricultural Resistance and the Black Freedom Movement*. The University of North Carolina Press.
- Wilson, M. (2012). *Infographic: In 80 Years, We Lost 93% Of Variety In Our Food Seeds*. Fast Company. <https://www.fastcompany.com/1669753/infographic-in-80-years-we-lost-93-of-variety-in-our-food-seeds>
- Winson, A. (2013). *The Industrial diet: The degradation of food and the struggle for healthy eating*. UBC Press.
- WRAP. (2018). *Courtauld Commitment 2025 food waste baseline for 2015* (Issue May).
www.wrap.org.uk