

Justin Wood's Presentation

Because we've already had so much good and in-depth discussion of composting, recycling, waste reduction—all of this is built into the system of inequality in terms of where waste goes, which communities are burdened by it, obviously we're all here because of urgent concerns with climate change, I won't necessarily get into all of that but how many folks are aware that in New York City and in other cities as well, we have two parallel overlapping waste systems. I don't know how aware folks are, but since the 1950s, we've had the Department of Sanitation, which collects and disposes of waste from our homes. This is a public service paid through our general tax dollars. We don't get charged for it. There are debates about whether we should.

On the other hand, there's this enormous, sprawling private waste industry that private businesses have to contract with under New York City law to have their waste and recyclables carted away. That system has existed since the 1950s. I think that would be a great dissertation to look at why that happened in the archives of the 1950s. I suspect it was a retreat from public services and a move towards privatization, although not wholesale privatization as many, many other municipalities have with waste collection. So, New York Lawyers for the Public Interest—since I started there, we've been involved in a really broad, diverse coalition looking to fundamentally reform the private waste system and industry in New York City called “Transform Don't Trash New York City.”

We have labor in our coalition in the form of the Teamsters union, which represents workers in both the public and private sides of the industry. We have NRDC, which Ashley mentioned, New York City Environmental Justice Alliance—representing the communities unfairly burdened with a lot of our waste infrastructure. The Alliance for Greater New York, NELPI (where I work), and the many, many other allies that have joined along the way. Folks involved in waste at the local level, you mentioned BK Rot, they're a part of this, Safe Streets advocates like Transportation alternatives have joined this coalition. We were motivated by all of the interlocking irrational injustices of the way in which this waste system has operated since the 1950s. There's a sort of well-known connection to organized crime, which the city took on in the 1990s and started sort of investigating and regulating these private waste haulers that had engaged historical in cartel behavior, price fixing, anti-competitive practices, etc., but what the city never had the political will to look at was the environmental impact of the private waste system, the near-total lack of recycling of highly recyclable waste streams, the racial injustice of waste being trucked in and out of a few overburdened communities, and then the worker injustice, which is also largely racial injustice of the mostly black and Latino workers who work in the private side of the industry, mostly in the middle of the night.

This is a literally unseen industry in many ways, because these private trucks are out collecting from midnight to 6 AM, often out of sight of regulators and the general public and of course the workers who are working these night shifts. What's been really appealing about this campaign is that there's a very common-sense reform that we're on the verge of passing this year. You can take a really irrational system and, if it's done right, make it a win-win-win for workers, for communities, for greenhouse gas reduction, for green job creation, a green New Deal, so that's what's really exciting about this campaign. So to get into the way the existing system works a little bit, these are maps that the city just published as part of their plan. Under the current system, you have anywhere from 80-200 licensed private waste companies that every single business—about 200,000 businesses in New York have—have to contract with. I don't know what CUNY uses for waste. It might be public sanitation, but every other private university, bodega, office building, factory has to find a private company to pick up their

garbage. Because it's this really unregulated, capitalist, competitive system, for the private waste haulers to survive in some cases or to maximize their private, they pick up customers often wherever they can and cut corners whenever they can in order to charge lower prices and undermine their competition.

So, we've got about 90 of these private companies actively collecting garbage city-wide. This is an actual map of a customer spread for one of these 80 or 90 active companies. It's all over the city. It's not all collected by one truck, of course, but the routes these trucks follow end up being way longer than they need to be in order to get the waste from point A to point B. That means long routes, long overnight hours for the drivers, fatigued driving, and a really gross expenditure of diesel fuel that's not even necessary. This is the city's proposed reform that we've been pushing for a few years. It doesn't have a good catchy name yet, it's called the Zoned Waste System. So instead of having a free-for-all with overlapping, duplicative truck routes and incentives for cost-cutting and corner-cutting, the city wants to create about 20 geographic zones and put out a request for proposals, put them out to bid so that we only have one or two or three of these private waste companies collecting in each commercial district. This is an example of the efficiencies you get from this. If this were one of the 20 zones, all of this hauler's customers could fit in that one neighborhood, in what looks to be Astoria, Long Island City, Queens.

Here's a heat map of the inefficiency of the current system. The dark red is more than 20 private garbage trucks on a block. As you can see, it's a lot of garbage truck miles all over the city. Manhattan, where we are, fairs particularly badly, because it's obviously such a dense commercial district. This, again, with the proposed system of having one or two or three haulers in each zone, the truck miles just go down drastically, from an estimated 80,000 miles per night to about 30,000. So that's the reform that, thanks to the advocacy of a really broad coalition going on for years now that has focused on exposing all of the inefficiency and injustices of the current system. About two years ago, the commissioner of sanitation, Mayor De Blasio, and a key player in the city council Antonio Reynoso, who is the chair of sanitation committee and the representative of a district in North Brooklyn—the most overburdened district in terms of private waste facilities. They all agreed to take this reform up. In many ways we are following the footsteps of West coast cities that have done something similar. San Francisco has a version of this system. Seattle has a version of this system. Most recently, Los Angeles adopted something similar to what envision in New York. In some ways it's like healthcare. Often one of the first questions people ask when they're new to learning about the private waste system is, "Why don't we just have the city pick up all of it?" I think that's a great idea. We'd love to have a single-payer or national health system. What we're going to have to settle for politically is the waste version of Obamacare. It's going to have its problems, but it's going to be a whole better than what we have now. I am confident of that.

I will now walk through a few of the different goals we want to attach to this new system, and then we can do questions and discussion now or later, whatever makes sense. So, inequity in where the waste goes is a major feature of the private waste system. As Ashley mentioned, everything used to go to our local landfill on Staten Island called Fresh Kills. It was giant. It was undoubtedly churning out greenhouse gases as food wastes and other waste decomposed in what was at the time the world's biggest landfill. That ran out of space. Mayor Giuliani in the 1990s pledged to close it. There was a politics to that, of course, with wanting votes on Staten Island, and that was the coalition that elected him. It was a good thing to close it, I'm sure, in terms of local impacts, but what sprang up in its place with very little planning was a system of private waste transfer stations that used diesel trucks. This is one of the most

inequitable systems in New York City—and there are many. This is a map that Politico did of data we gave them. You can see the size that represents the tonnage. A huge amount waste going in and out of North Brooklyn and South Bronx, which, of course, has some of the highest asthma rates in the country. We have parts of eastern Queens. This, though, is not the biggest amount of trucks. In Jamaica, Queens—another community of color—is a really badly sited set of transfer stations, where you have schools and parks and private homes right across the street from one of the largest transfer stations. So, with no planning, this is what sprang up, and it's all connected because it is all private companies that are just making money exporting waste out-of-state landfills and some incinerators as cheaply as possible. So, one of our hopes is that...

Let me back up a little bit. There's a history of advocacy going back a couple decades in environmental justice communities to try to put some rules on the private transfer stations and get the city to commit to... if we're gonna export waste, doing it in a much more equitable way. A few of the victories we've had over the last couple of decades is that we're getting the city to build these giant marine transfer stations, which use rail and barge to export waste from New York City. There's one in the Upper East Side of Manhattan that was very hard fought. It's near one of the wealthiest communities in the city, and folks did not want it there. That was a huge battle. There are others in Queens and Brooklyn. Almost all of those are open. They're a huge public infrastructure investment in exporting waste and in a somewhat better environmental way. And I want to stress that. It might be a little bit like just rearranging deck chairs on the Titanic...with climate change. This is still just exporting waste to landfills but it is doubtlessly a more equitable way to do it. We are going to cut a lot of truck miles out by not trucking it up the highways to upstate, and we're going to cut a lot of trucks out of neighborhoods like in North Brooklyn and South Bronx with these facilities. These are city facilities, so one of our most ambitious goals with the Transform Don't Trash campaign is to try to get the commercial private haulers to start taking waste to these things at night, which is preferable to what they're doing. This was a waste equity bill that passed last summer, which is going to cut down on the amount of transfer station tons in North Brooklyn and South Bronx in parallel with those new facilities opening.

The second goal is to address the really low recycling rate in the private waste sector. This is one where the Green New Deal is really something we want to embrace and highlight here. So far in presenting this commercial waste zone plan, the city has rightly focused on the huge inefficiency of the current system and the reductions in truck miles and the unfortunate number of pedestrian and cyclist deaths we've had caused by private waste trucks. But from a greenhouse gas perspective, not burying food waste and plastics in landfills is probably the biggest thing, much bigger than the actual collection trucks. Currently, there's very little data on what happens in the private waste system, but what data we have suggests that there is only about a 20% recycling rate. And with China and other countries that have accepted a lot of recyclable waste from the US, sort of clamping down on quality standards, not wanting to take contaminated recyclables, etc., there's been a huge crisis in the markets for recyclable materials, and we're seeing that the private haulers and transfer stations are recycling even less in response to these market challenges.

Another ambitious thing we want to attach to this new system is high standards that these haulers have to meet in terms of proving that this stuff is getting recycled. I think waste reduction needs to be a much bigger feature. Again, we're talking about the commercial sector. So, it's every time we go to a restaurant, every time we're at work, it's everything we're throwing out. I'm don't know how things are here, but if my office building is any guide, we're

on our own. We don't even know what's getting recycled, and our private hauler and our landlord tell us that it's virtually nothing. There's a massive amount of customer education and incentives in terms of pricing that we think should be attached to this new system. It should cost more to put something in a landfill-bound waste bag than a recycling waste bag. And there should be some reward for customers that actually just cut down on their waste by, you know, not doing what we're all doing today, bringing their own cups, cutting down on takeout containers, composting their food waste, etc.

Safer streets, I mentioned, is another huge goal. Obviously, the fatigued driving due to the long shifts and the grossly irrational routes are increasing the risk on any given night of crashes involving these 30-ton waste trucks. That's the trend in federal data on the left in terms of serious and fatal crashes among the largest 20 haulers. It goes contrary to the general trend in reducing traffic deaths due to the city's Vision Zero program. So this has been one of the most politically powerful pieces that we've been advancing to push this new reform. And then finally, justice for the workers in the commercial waste industry is a really big part of our reform. As this private system was created and as unions...

Ironically, when there was sort of a cartel around these private waste haulers, it was probably better for the workers, in a way. There were instances in which, in the 1980s and 1970s, labor unions were negotiating with the cartel all at once, and wages were typically higher. That's been eroded significantly over the decades, so work in the private waste industry pays a lot less than it used to. The demographics of workers in that industry have changed. A lot of them are very vulnerable workers—recent immigrants, undocumented folks, formerly incarcerated folk—who are very vulnerable to exploitation. There's been a well publicized case in the Bronx. Pro Publica has done a fantastic investigative reporting series on how one of these immigrant workers actually died on the truck a year ago and his employer tried to cover it up and pretend he was a “crazed homeless man” who just threw himself in front of a trash truck. So, check that out, but this is really the lynchpin of reform is how do we build wage standards. Again, if we're going to have these private waste companies bidding for the right to collect waste in each district, we want to make sure that there is some sort of a living wage standard, benefit standards, and safety protections in terms of not having to work 16-hour overnight shifts and things like that.

So, this is a summary of all the transformational change that we're looking for. Just to quickly walk through where the policy is now and the politics of it. The basic concept has been embraced by the mayor's office, the commissioner of sanitation, and some key council members. Now we actually have to pass a policy. It can't all be done by the mayor. We have to have city legislation to create this new system. And as with many things, the devil is going to be in the details. Are we going to have a really ambitious transformative system that sets high recycling standards, where the city is doing everything possible to get these companies to invest in better recycling facilities, composting facilities, employing folks at the community level to help move things into compost? For example, BK Rot and others who actually have a vision of bicycle-powered waste transport doing things at the community level. We really want them to part of the new system, but how do we get these private waste haulers to make those investments and in those partnerships. So, we want to really load this RFP that the city's going to roll out with all of these social goals, environmental goals, business inclusion goals. We would really like this to be transformative.

On the other side, we have very well-financed opponents, who don't want any of this reform to happen, and if it's got to happen, they want it to be as watered down as possible. Again, the

Obamacare analogy is probably pretty good. So the Real Estate Board of New York, the same folks who don't want you to have rent-controlled apartments, hate this policy. We're actually working with Pro Publica to uncover the ways in which REBNY has probably been secretly bankrolling the private waste industry's lobbying efforts against this. The private waste industry itself, as some of them have seen the writing on the wall and that there's a lot of support for reform, some of them have chosen to remain neutral and see where this ends up. But some of them are very vocally opposed to it and have put in quite a shocking amount of money into lobbying. And I'm sure we'll see TV ads and all of the rest of it hammering the mayor within the next six months around this policy.

So, we're excited about it but have a big battle coming up in 2019 in the city council, particularly, where we need to get a strong majority of council members to support this. And they're going to be facing a lot of opposition from donors and moneyed interest to not do this. And we need everyone on board. I guess I'll end with an appeal. There's the first public hearing for the commercial waste zone plan that the city has is actually in a couple of weeks. We're trying to turn a lot of people out to offer some public comments in support of the plan and specifically in support of the strongest possible plan that sets really ambitious goals. So if any of you would like to join or come testify on your own or your community's behalf, please come see me after, and we'll all be there.

Brooke Singer's Presentation

It was great to be led through that information, some of which is new to me, other of which I'm familiar with because a lot of this type of research is what inspires the art and activism that I'm doing. I just put up "Art, Inquiry, Action." What I'm doing is research-based art. It is often collaborative. It's interdisciplinary, and it's goal oriented. I am going to start with this project Excedentes/Excess, which is from 2011. It was commissioned by Matadero, which is in Madrid. It was an interesting call. The premise was to bring in international artists. My collaborator Ricardo Miranda and I were asked to collaborate with two local artists in Madrid, Jose Bongore and Beatriz Marcos. in Madrid. It was like match.com. We didn't know these artists. The curators were like, "You all have kind of a similar groove going on. We think you'll relate to each other and make an interesting mix." So, we did Skype sessions for six months before we landed in Madrid. There was an old butcher shop, believe it or not, and this long nave-like space. Each bay had a different team of artist-collaborators, and it was focused on social practice, activism, work-in-progress, and it was really like an open-studio environment.

And so, in the beginning of our conversation, we said, "We're coming to your city; tell us what we should be working on?" They said, "Food rescue." I said this was 2011. It might have been 2010. There was an economic downturn. They were seeing people of all types, all ages, races, from all walks of life taking food out of the garbage and eating it. We said, "Oh people are dumpster diving in Madrid." They said, "Well, there's not that kind of culture, where it's this positive kind of anarchist way of reusing and disturbing the systems in the city. It's deeply humiliating for the Spanish people. So, what we set out to do is to look at this phenomenon and tried to create new systems and flows for the food and to connect edible food with people who are hungry. And so we took these structure—they're used often for holding chemicals and other commercial liquids. We took the interior out, which is plastic, used that grid-like seal on the outside to make a cart. The cart transforms into a display unit. We worked with this traditional mercado, which were kind of going extinct in place of the supermarkets, more American style.

So there's that conversation, too. We asked the merchants to set aside their edible food at the end of the day and we would come by with the cart and pick it up. We would then wheel it across the city to public place and display the food with shopping bags and some encouraging banner to take what you need. So the interesting thing about this from my perspective and Ricardo's perspective... We're used to doing interventionist work, work within communities. And Jose and Beatriz were really adamant that we don't involve ourselves, that we put the cart there and step away. So there weren't really interactions and conversations, which I think I would have naturally done as part of my practice. So we just stepped back to see what happened. This is another public place where we left the cart. At the end of our six-month residency within Matadero, what was really obvious to us was that if we want this to be more than just a prototype or some sort of provocation, we needed to deal with the legal system, because while the merchants were fine with setting aside the food as part of this art exhibition, we had this institution, which was prestigious and it kind of allayed fears. But this wouldn't be possible because if someone got sick, they would be sued. There was no kind of security. They felt like they'd be liable. This was after I left Madrid, Jose and Beatriz continued and brought in legal scholars, law students, and local politicians to say. "What would this look like if we drafted a policy so that a system like this could continue and protect the merchants?"

When we got back to New York City, the curators—there was extra money from our commission—said, "Go home, and devise what Excedentes would look like in New York City. What would this project look like where you're from?"

So Ricardo and I did a lot of research. That's the farmer's market at the head of Prospect Park at Grand Army Plaza. City Harvest, as many of you probably know, is a huge organization that does food rescue and quite successfully. It's really amazing. So we're seeing that food rescue, those cracks were kind of, not totally, but they were being addressed by respectful organizations. There's also Food Not Bombs and other groups more informally dealing with food rescue. There's also Good Samaritan Act under Clinton, which did exactly what they were looking at in Madrid in terms of if organizations, markets donate food that is destined for the garbage but still edible, they are not liable. So that's not a concern in the United States, which is pretty amazing. We also did research taking trash from bodegas and small markets. We brought it back to our home and opened it up. It was like opening up a present, not know what's inside. We wanted to see how much organics were in these garbage bags. We found that this was true, that t about 30-50% of these bags from the bodegas—this wasn't residential; these was commercial— were full of food. We talked to a lot of experts and people involved in the food industry, making films about food waste. Then we did this informal survey, where we went and talked to a bunch of small markets and bodegas and asked questions about what happens to the food you don't sell. A lot of it is sent back to distributors. But the part that really got us was that most of these organizations, most of these businesses threw food away, and there was very little composting. At different places we've been, there are different dumpster diving hotspots and some of the gourmet bodegas. They are kind of proud of it, like, "We're a dumpster diving hotspot." So it's all understood, and there're these unspoken rules. It kind of gave use more insight into what was happening at the small business commercial level.

So then we were mapping out where all the food was going—from the farms to the market to the garbage to dumpster divers. There are all these kinds of new technologies like waste-to-energy adjustments, talking about these ways of pulverizing the organics of food and turning it into liquid and pouring it down the drains. It's just the most ridiculous thing that you'd be sending nutrients down the drain to then be deal with by water treatment plants. But it was high tech and a lot of people who genuinely want to do the right thing saw the flashy advertising and the plug-and-play kind of system. I was like, "Don't do this, please!" The statistics that

were really getting us were that for the US, the biggest export is garbage. Recycling to China in particular, which has kind of taken a downturn as Justin was talking about. But at least when we were doing this a few years ago, we came up with the number of \$1 million a day is the cost to cart waste out of the city. If you think of that waste as being at least a third food, how much, then, is reduced, saved if you're composting that. You're not sending a third or up to half of that. This is what I've seen at community composting sites. People come in and are so jubilant about how small their trash bag is now. That's the first catch.

The second is when they see their waste turn into this gorgeous, chocolate soil. It's like magic. So this question of how much savings—from money to emissions to congestion—would we create if we set up a community composting microsites to recycle food and produce new soil? And these sites can be set up—and I've done this—pretty cheaply with volunteer labor. So we're not talking about a big investment. Or you could, if you want to do these anaerobic digester kind of route. So Excedentes became Excess NYC. We built this silly-looking bodega quad cycle, where the front is for collecting edible food to recirculate. In the back is a tumbler you can actually spin. You can sit back there and pedal it and spin it as you take it to a compost site. So we're both doing the edible and the inedible waste food scrap collection. We were looking at lots to create a compost site, doing workshops, building out, and redesigning composters. And also looking at the quality of soil. This is, in the end, what Excess NYC looks like when it hits the street. Total spectacle, kind of ridiculous, makes people stop and ask a lot of questions. And for me, that is a big part of it. In our neighborhood in Crown Heights, we have access to this guerrilla compost site. We collected scraps from our neighborhood, got a bunch of volunteers in our neighborhood, and we composted a ton of waste in a couple of month, just to say this is possible, can be fun, and engage as many people locally as possible. My friend allowed us to come in and guerrilla garden with him, and we filled out our compost site there, and that was the website at the time.

We also went around the New York City tristate area—I think this was Stamford—and did events on their Art Walk Day. We went around to local restaurants. They were told in advance to put food aside. We did this, which was totally gorgeous. This is what we picked up and had picnics as part of our walk. Leaving from that project, I really got interested in creating a more permanent compost site. One that we would be kicked out from in a moment's notice. With a collaborator, we answered a Cff under Bloomberg, with his obesity task force, where they listed a ton of different empty lots that they said would... to write a proposal to create a garden in one of these lots. We were given keys to this corner in South Williamsburg.

There was no lot on the list that was either on my neighborhood or Stephanie's neighborhood, but Stephanie's studio was nearby, and I used to live in Williamsburg, so we were really excited to be there. Bedford and Division—it's a very visible corner. And there were already people organizing the neighborhood for this lot, and they were not able to get keys, so we were able to team up with them. From two people initiating, we became six leaders really quickly. Out of those six, three of us are still involved, and this is four years later. That's what it looked like on Day 1 when we got the keys. And that was last summer after hauling in 20 dump trucks of soil from Sanitation, from Fresh Kills, from the construction of Brooklyn Bridge Park. I happened to know one of the landscapers who was designing the park. He was like, "Great! Instead of taking our truck out of the city and dumping this in a landfill, we'll just take it over to your corner." So we put on yellow vests, we tore down the fence, and he sent the trucks over to us. I don't know how this happened, but it happened. The reason we need this is because the lot was not graded, and there's a huge dip in it, so we wanted to grade it.

We also did lead tests. New York City soil is very high in lead. We capped it with six inches to a foot—all over 5000 square feet. Everyone in the neighborhood who was observing was very angry about the cardboard. They thought it looked very ugly. This had been a derelict lot for 40 years, dumping, you know the stuff we found in here—cars, all kinds of stuff in this lot. But the car port—which was exposed for a couple of days in advance of the... which we used to cap another layer... people did not take that very well. Also, we weren't growing food right away. So the question, "Okay, you're a garden. Where's the food?" So there was a big conversation about, "Okay, we're actually going to grow soil for several years, and then we're going to grow food." When we grow food, that's when the interest boosted in terms of a lot more people wanting to get involved, because this kind of work is not very attractive to many people. It's very attractive to some people, but not to most. This is a big pile from Fresh Kills. We found it to be of great quality. We've done testing on it. It depends on when you get your shipment from Sanitation, compost from different sites has different qualities. But we've had a very good experience with Sanitation.

And we did a lot of group research and developing, thinking about ways of making composting as easy and fast as possible. We had meetings where we researched various systems from industrial to DIY composters to more commercial grade and designed our own system based on community sites with the three bins. We made it look bigger and made it into an ASP, which is blasting air into the bays. That's what the PVC pipes are for. That's like a bouncy-house air blower. There's the timer—every 30 minutes for 30 seconds. It's solar powered, which means that you can put the scraps into the composter without having to turn the pile. It really reduces the labor, which comes at the end when you have to shovel, sift, and screen it. Those are pretty big bays, so it generates a fair amount of soil every six weeks during the warmer months. And there's an inside look. We use wood chips instead of leaves because that'll create air pockets so it can circulate. We're creating our own soil for our beds, and members take soil home for potting their plants. That was a couple years ago.

We also have a community. This is Santiago, one of the original founders. He's on the steering committee with me. He and some other people are taking... We don't do bikes but we take the cart around and pick up compost from a couple of residents and small business and cafes. We charge \$20 a month per bucket. There's this one cafe that has three buckets a month, so we're given \$60, which is great for funding this volunteer garden. I was really interested in the quality of the compost we were making, so not only testing for levels of lead but also looking at the microbiology and the makeup of the microbial communities. This is a bacteria-feeding nematode eating some plant cellulose. I was really interested in how to visualize the life in the soil and the vitality of the soil. For me, the microscope is really the way. There's an amoeba. Talking about what grows in the soil and that there's more life in a handful of soil than there are humans on the globe, what does that mean? And what is this life, and what is it doing exactly. So that has been part of our conversation. We're called La Casita Verde. We built La Casita, which is in the background in the upper-left corner. That's an indoor-outdoor space for meetings, workshops, planning, and all kinds of things. This is kind of fun. A man came by a couple of summers ago. The lot used to have an apartment building that built down, and he grew up in that building. He now lives in New Jersey, and he comes back and is very excited that after 40 years or something is something positive and pretty. He's a great artist and has helped out with some murals that we've made.

There are a lot of artists involved. A lot of what we do is campaigns to communicate things. This is Marina Zurkow, who worked with us to create these pro-composting posters, which we hung on the fence our first season to better publicize what we were doing and why. There's

one of the posters. This is more recent. There's one of the murals that we did this past summer. And a greenhouse that we built. I also wanted to talk about a current project. This is really from 2018 that started in 2017.

One thing I was really interested in is the testing that was happening in the community gardens and growing spaces is all about lead and the toxins, which is extremely important knowledge. But I was interested in thinking about what other testing and data collection we do in these spaces to represent the positive ecosystem services that land stewards are providing. One aspect I kept reading about carbon sequestration and soil. A lot of the attention and action has been out west on cattle ranchers where there are big swathes of land and prairie grasses. But the idea here is how to use or to help encourage nature's system of bringing carbon out of the atmosphere through photosynthesis so that the carbon dioxide being breathed in by plants and with light is transformed into liquid carbon or sugars, which is plant food—so plants make their own food—but some of that liquid carbon goes through plant roots, which I didn't know before all of this before. There's this amazing symbiotic relationship between the microbes and the plants. If you can bring in more of the carbon through photosynthesis and bury it, then it's allowed to respire out so the carbon can—through decomposition—come out of the soil and when mixed with oxygen again, it can become carbon dioxide.

So, if you can create a system where you're having more inputs than outputs, there are capabilities of reducing carbon dioxide in the air. You can actually see over a year the earth breathing. In warmer months, you can see carbon dioxide levels decrease because of photosynthesis, and you can see them increase again as leaves die off and trees are bare. So there are all kinds of ways of applying compost, using cover crops, rotating crops, and bolstering microbial community to tie up that carbon and basically fossilize and become protected in the soil, buried deep, where it can stay for many, many years. I was thinking that we could do this in the city. Why are only rural areas doing this? City soil is very different. There are many types. It's a technosoil, which means it's engineered. What would it look like and how could you also record that process? So I got really excited by all of this. This is a New York Times article "Can Dirt Save the Earth?" No, soil can't save the earth, but it can be part of the solution. This article is actually really great. It's from April if you're interested in learning more.

The same landscaper who brought the soil to help with the foundation for La Casita Verde is a big composting person and regenerative agriculture person. He was giving a talk and there was a microbiologist in the audience. He was saying, "Wouldn't be great to go out in the field and get a quick look without a microscope—just a quick test—to see what the biomass of the microbes are?" And she said, "I can do that!" She had all these patents in the pharmaceutical industry, and she figured out she could retool some of the tests she'd already done on human blood, which could be used to look at the biomass levels. So there's this test, and when he showed me this, I was like, "This is the way of looking into carbon sequestration." Because if you look at biomass in the soil and you're able to increase and sustain it, that become a proxy for this much longer carbon sequestration process. The question is how good is this test. They've done their own comparisons to lab techniques like carbon communication and have found it to be very reliable. Looking at plant root depth and spread is another indication of carbon sequestration. These are other cover crops I was testing on my balcony.

This is backyard—the Billie Jean King Stadium is in the distance—of the New York Hall of Science, and I propose creating a pilot to look at the ability to carbon sequester urban soils as part of their designer-in-residence program. And this happened in 2018. There are 24 beds.

This is the lower site. I guess there are 12. And there're basically different planting combinations in these beds. In science, you need to replicate, so there are there are three beds that are planted in exactly the same way. I have cover crops growing. I have edibles growing. I have sunflowers growing, and then I have a combination of all those different things. Then I have a set of three there as a control. I designed this with a team of scientists at Brooklyn Collage Urban Soils Institute, who are partnering on this and are also CUNY Graduate Center's Advanced Scientific Research Center, where we're doing all of the lab testing. The idea here is over the course of the year—and has been extended another year and will probably be extended a third year—to look at many different variables like biomass to see which planting varieties and which ways of cultivating the soil produce the highest biomass and sustained biomass over time.

Our first round of tests are coming back soon. We have some kits that we put in the beds that are doing remote sensing of temperature and soil moisture, which, again, are really good parameters to look at for being in that sweet spot for carbon sequestration. That's the kit. We teamed up with the Mayor's Office of Environmental Remediation, and they've created this new program called the PUREsoil bank. What they do is find construction sites across the city. This is Jamaica, Queens and they're building a hotel here. When they excavate for the foundation, they typically send the soil outside the city to a landfill, and they're paying huge shipping fees. It's a gross amount of money and emissions and diesel fuel. So the Office of Environmental Remediation says, "There are so many parks and gardens in need of soil—and clean soil." This is from 50 feet under the ground, and it's glacial soil created like 20,000 years ago. It's actually not soil. It's sediment. Basically it's 100% sand, and it's not so easy to grow in sand. But what they did is that they brought two dump trucks of sediment from this site and then we mixed it at a ratio of 2:1 with New York City-made compost.

I love to say, "This is all made in New York City." On the left, it's a year old, and on the right, it's 20,000 years old. And that's our grow medium. We planted sorghum grass as part of our cover mix, and it was 8 feet tall. It looks like corn. It was amazing. When I set out to do this, I knew I couldn't do it alone, but I didn't know who would be interested and who would want to spend the time and resources to develop this platform with me. But at the end of the year, we have a partnership with the Brooklyn College Urban Soils Institute, CUNY's Advanced Scientific Research Center. We have another plot of carbon sponge test beds at a NYCHA site at Ravenwoods, Queens, the New York State Compost Project, Big Reuse donated soil, as did Sanitation. Obviously with the help of the New York City Mayor's Office of Environmental Remediation for the sediment. NYSCI—the New York Hall of Science—has funded and given us land for this for two or three years now. Patagonia has given funding.

The other exciting thing is when my collaborators at Brooklyn College and the Grad Center have been in the labs and talking to their colleagues, there's now a research scientist in Italy. We're sending our soil to him because he has equipment to look at carbon content in a whole different kind of way. A researcher who got his PhD in the same program and is now part of a startup looking at DNA testing of microbiome in the gut as well as the soil, which is fascinating, because not many people are making a connection between the two, and this company is doing testing to look at the DNA and know specifically beyond the microscope, to a next-level microscope to know specifically what bacterial and fungal communities are in the soil and what their functions are related to the other tests.

The end goal here is not only for my collaborators to publish white papers in terms of this discussion and looking at results from carbon sequestration in urban soils but while they're

doing that work and we're collecting data, I'm also collecting data with a microbiometer. I'm using a refractometer, which is like \$100. Looking at pH levels in very easy DIY methods, soil temperature, and moisture, so that there can be some sort of kit and protocol for urban gardeners to use to get some sort of indication to see where they are in the spectrum, and kind of planting and cultivating recommendations. So, it's a very big, ambitious platform that is really in its nascent stages at this point.