Tanya Domi: Hi, this is Tanya Domi. Welcome to The Thought Project, recorded at The Graduate Center of the City University of New York, fostering groundbreaking research and scholarship in the arts, social sciences, and sciences. In this space, we talk with faculty and doctoral students about the big thinking and big ideas generating cutting edge research, informing New Yorkers and the world.

Tanya Domi: Joining us today are professors Peter Groffman and Monica Trujillo. Groffman is a professor at Brooklyn College and with the Environmental Science Initiative at The Graduate Center's Advanced Science Research Center, where his research focuses on environmental biogeochemistry, including pollutant dynamics.

Tanya Domi: Trujillo is an associate professor in the Department of Biological Sciences and Geology at Queensborough Community College, where she recently led a team of students in testing wastewater samples for the virus that COVID-19 plays as a part of an early detection effort. They are now sequencing these samples to both understand the vaccination progress, and to detect the presence of variants. Each year the calendar hosts more than 50 environmental awareness days designed to highlight the now crisis level impact of human activities on the planet and our environment. The threat of this impact has become particularly clear in the face of the coronavirus pandemic and a recent study in nature climate change that suggests we may have already missed the opportunity to cap climate warming at a safe two degrees Celsius.

Tanya Domi: Today, we wrap up our series of interviews with some of the graduate center's faculty, students, and administrators, who are using their scholarship and expertise to address a variety of environmental and climate change issues, and arm New Yorkers with the information they need to take action. Groffman, Trujillo and Psychologist Erika Niwa are developing an emerging multi-disciplinary collaboration between a microbiologist, a psychologist, and a biogeochemist, that aims to carry out convergent research on links between ecological and community health, social processes in and around a highly contaminated, and former EPA declared Superfund site, Newtown Creek, a three and a half long tributary of the East river is an estuary that forms part of the border between the boroughs of Brooklyn and Queens in New York City. That is a high priority target for restoration. Welcome to The Thought Project, Professor Groffman and Professor Trujillo.

Shawn Rhea: Great to have you both here. I'm really excited to talk with you. I'd love to start this conversation with a question for Monica. Monica, so Newtown Creek is an estuary that is surrounded by communities bordering both Brooklyn and Queens and people who are familiar with it are probably aware of Newtown Creek's reputation is one of the most polluted waterways in the country. So can you give us a bit of history on how it got to be that way and what are some of the continuing problems? And I think most importantly is Newtown Creek unique in terms of what we see in urban ecosystems?

Monica Trujillo: Okay. Thank you so much for inviting us. It is really my pleasure to have the opportunity to talk about these projects and to answer your question, Newtown Creek is a disgrace, right? Because what happened was that from the very beginning it was always closely related to the history of New York. And as time went by, it became like the big dump for all the industries. There was no regulation, no government regulation, no real knowledge of what impact it will have in human health or development. And what's probably the worst is the oil spill where there are between 17 to 30, nobody really knows how many millions of gallons underground in an oil spill that is probably remember correcting the greatest one in the history of the United States.

Monica Trujillo: Topping that there is corporate contamination, there is hydrogen sulfide. Anything and everything that you can think of can be found there. What is very interesting is that recently it has been declared a super fund and the efforts to change this has started. Unfortunately, it's pretty common in urban waterways. It's something that we have just decided to address. And that's kind of why I think it's so important to be working on it. The Gowanus canal is connected to this and it's the same thing.

Shawn Rhea: Yeah. So these oil spills and my understanding is it's more than just oil as you mentioned, there's copper contamination. There are other kinds of deposits that are there. And so what is the effect of all this contamination?

Monica Trujillo: Yeah. Well, the effect has been the death of all forms of life, including, and the concentration or the enrichment in different bacteria that even without doing anything ourselves are trying to get rid of these contaminants. That is the interesting part because microbes are able to use as nutrients anything that is available. So bacteria are by far the most diverse organisms that are alive, especially in their metabolism. So if you can think of any compound that needs to be degraded, think of a bacteria, and you're going to find one. So this is being happened at the same time as we being polluted. Now [inaudible 00:06:44] things are changing. And it's absolutely true that this situation is not as hard or as terrible as, as I just described right now.

Shawn Rhea: So things are getting a bit better.

Monica Trujillo: Yes. Things are getting better. Absolutely.

Shawn Rhea: Great. Well, now that we kind of have a lay of the land about what's going on at Newtown Creek and a bit of a history, I would love for both of you, Peter and Monica, to tell us a bit about the study that you're currently conducting there. How did it come about? And Peter, maybe you can start.

Peter Groffman: Sure. I work at the Advanced Science Research Center, which was created to catalyze cross disciplinary research within CUNY. And so studying these heavily human affected ecosystems like Newtown Creek, it's really hard and it requires cross disciplinary interactions. And Monica is interested in the microorganisms,

what bacteria type of live there. I'm interested in the biogeochemistry of these areas. Biogeochemistry is processes that go on in the soil and help plants grow, that help degrade pollutants, that clean the water and then clean the air. And you can't really understand the biogeochemistry unless you understand the microbiology and you can't really understand the microbiology unless you understand the biogeochemistry.

Peter Groffman: And so the ASRC created events to bring people together to address really hard problems. And so we've been working on this since 2015. And of course the other exciting thing about these environments like Newtown Creek is there's a very strong human dimension and a strong social context. And so our team also includes a social scientist, Erika Niwa at Brooklyn College. And so our project has aspects of microbiology, biogeochemistry and social science. And I feel like we're doing what we really hope for it to be at the Advanced Science Research Center is catalyzing these cross disciplinary interactions to address really hard problems.

Shawn Rhea: Monica. What's your take on how things came together?

Monica Trujillo: Yeah, so the connection between Peter and me is pretty straightforward. Because I want to know who's there and I want to know what they are doing. What microbes are there and what they're doing. And I cannot learn about it unless Peter kind of enlightens me about what's happening in the soil. So that connection is pretty easy.

Monica Trujillo: But what I thought it was really interesting in our project is that as we learn about urban settings, including urban polluted sites, it's pretty clear that it is going to be human decisions, the ones that are going to drive what we're going to do with those polluted sites. And I'm not saying anything new, but everybody knows that it is difficult to communicate what we scientists find in a way that can contribute positively to make decisions.

Monica Trujillo: And I think from the very beginning, Peter and I were kind of impressed by how little did we know about how to give our side of the story to the people who were making decisions. We are somehow okay sharing our findings that we see in the scientific community, but it's not the scientific community the one that makes the decisions about the greening processes. And it is important to get people to talk about it. So the best decisions can be made.

Shawn Rhea: Right. It's the policymakers. And it's how that information filters out of the laboratory into the general public.

Monica Trujillo: Exactly.

Shawn Rhea: Yeah. Yeah. That's great that you guys are thinking about this as you are doing the research and not waiting until you actually have the information in hand and then saying, "So now what do we do with this?"

Monica Trujillo: No, no, because I think that one thing that we discover kind of early on, and I think that's a huge contribution that the ASRC made just by bringing scientists from different disciplines together to think about problems, it was very clear that we saw things differently and it wasn't that easy to ... [inaudible 00:10:55] the scientific community to see this other component. And if you move one step further back and you realize that you are talking at policy makers, that's even a bigger gap. So I am extremely grateful to have been part of these conversations that started at ASRC in 2015, because they've proven to be extremely helpful. And in particular, I think I cannot not mention this because of my work right now with COVID-19, it require collaboration. And I have to give the credit to ASRC to have prepared me to be able to do that work. I cannot be thankful enough for those conversations that were also extremely pleasant.

Shawn Rhea: That's fantastic. And that's what we love to hear, that kind of collaboration. Obviously that's what the ASRC was created for, was to bring together all of these across CUNY, all the research and to kind of help people have these conversations. So that's great to know that it's going on. So Peter, one of the things that I think we're all really curious to know is, so what are the key questions that you guys are asking about Newtown Creek with this study and what are you hoping to learn with this work?

Peter Groffman: So in modern environmental science, we are faced with studying these novel ecosystems, which I think is a nice way of referring to heavily degraded, heavily impacted ecosystems, such as Newtown Creek. And they are novel ecosystems with very unique conditions, very unique chemical, physical, and biological conditions. And it is just a fundamental question in environmental sciences, how did these novel ecosystems function? And how do they function in terms of their ability to support plant life, their ability to provide clean water, their ability to provide clean air, their ability to decontaminate themselves? And so the fundamental overarching question is what is the structure and function of these novel ecosystems along Newtown Creek?

Peter Groffman: But again, my specific interests are in these biogeochemical processes related to the dynamics of carbon and nitrogen in soil. Those processes are again super important to the ability of the soil to support plant life, the ability of the plant life to clean the air and to clean the water and to support, to provide habitat for biodiversity. So I'm interested in those biochemical functions and I want to quantify how they're occurring in this novel ecosystem. And again, I get very interested in collaborating with Monica because those processes that I study are carried out by microorganisms. And her ability to characterize what organisms are there and they're novel organisms. So she's asked me fundamental questions about what organisms are there, how do they live? And that is a super interesting question for her and it's very relevant to my question.

Shawn Rhea: So is the idea that once you're able to kind of figure out the interplay between, you said soil and the water systems, and then what are the organisms that are

facilitating the cleanup, is the idea to boost, to give it a lift so that it can carry out this process more effectively? Or what's the idea there?

Peter Groffman: The people who live around Newtown Creek have a pretty ambitious goals for Newtown Creek. They would like to green it up. They would like to create ecological amenities. They would like to interact with ecosystems in the area. And so one sense is the area clean and safe and is it becoming increasingly clean and increasingly safe is very important for their plans to interact with the area. The ability of the area to support the growth of plants and the habitat for organisms is fundamental to goals for improving the ... for ecological revitalization of the area. So, the information that we're producing is very broadly defined from the people on the ground to the policy makers can achieve their goals for a safe, healthy environment that provides lots of, lots of ecological amenities. And a fundamental component of that research then is just interaction with the community.

Peter Groffman: And so we've learned in modern environmental science, addressing these novel ecosystems is that we need to engage with the people in the system at all levels. Again, the people who live there, the people who manage the area, the people who make policy, what do they perceive in these areas? What do they value in these areas? How would their perceptions and values influence their action? And as you noted, if we have that discussion at the beginning of the research, and we make people kind of a part of the research going forward, the scientific communication becomes a much, much more meaningful and much, much more effective. And scientists will talk forever about detailed questions about biogeochemical processes and microbial communities. In these types of ecosystems the questions about the human perceptions values and actions are just as fundamental as the straight science.

Tanya Domi: I have a question that's really off what we planned, but I think it dovetails. One of the most notorious polluted areas in the United States was called Love Canal. And the superfund cleanup that was initiated by the EPA, is this situation that you're studying, is it akin to, did it have superfund status at one point?

Peter Groffman: It does now.

Tanya Domi: Oh, it does now. Okay.

Peter Groffman: Newtown Creek was designated a Superfund site. And I like to talk about the great success of environmental science and it's earth day this week. And I'm very proud to be in environmental science because over the last 50 or 60 years, our ability to diagnose problems, to propose solution to those problems, to work with policy makers, to have those solutions implemented has been pretty impressive. The air is cleaner than it was. The water is cleaner than it was. We've made great efforts to conserve species and our approach to these contaminated environments is one of those great successes.

Peter Groffman: So the superfund site catalyzed by a horrible tragedy, but we now deal with these sites in a much more aggressive way. And so clearly the idea of superfund sites originally was to identify and avoid the hazards, the direct hazards to help. But now the question is, what are we going to do with those sites and the whole field of brownfield revitalization?

Peter Groffman: So we have many sites that are contaminated. Many of them are in the middle of cities. There are many in underserved neighborhoods in cities. And efforts like what they're doing at Newtown Creek to make those sites safe and to redevelop them in ways that are value to the community, the real frontier topic, and in many ways a great success in environmental science. But we like to think that we've learned. Love Canal to me is an example of, there was a disaster, we looked at it, we said, " We shouldn't do this anymore." And I think now we're doing much better.

Tanya Domi: Okay. Monica, Did you have any thoughts on that?

Monica Trujillo: I just agree, a hundred percent. I think that one of the problems that I see we have is that we don't have the luxury of not fixing the mess that we have made. Because we as humans have kind of run out of places to go and mess up. So we need to face fixing. And we do know that a lot happens underground in soil and that's where the microbes played this important role.

Monica Trujillo: So I think that for a long time, microbiologists tend to focus on health. And we do know ... And that is extremely important. And we also know the connection between a healthy environment and a healthy human. But this is a good example of a collaborative project where if you don't take care of the environment it will end up being detrimental for everybody. And obviously in urban terms, it's always associated with underserved communities. So these key concepts of equity and fairness and even more important. And I think that that's the part that attracted me very much to these projects, that it was to know that there was no governmental organization that was integrated by people from the community. And they were the ones who were trying to make this [crosstalk 00:19:42]

Tanya Domi: As a response as a response to addressing it. So it's our understanding ... That's very interesting conversation. It's our understanding that your study is actually a step beyond interdisciplinary in terms of its team model and how you were looking at the problem and potential solutions. And we've already heard some elaborations on this, I think. Your model is what the National Science Foundation refers to as convergence research. Can you explain this concept, particularly as it relates to dynamics of your team's diverse areas of expertise and how you are each exploring Newtown Creek at this juncture? Do you want to start Peter?

Peter Groffman: Sure. So the National Science Foundation defines convergence research as research that addresses a critically important question that requires a multi-

disciplinary approach. And so the work that we're doing in the heavily impacted areas, such as Newtown Creek very clearly falls under that definition. We really want to know what are the ecological prospects and safety for an environment like this? And you just can't address that question unless you have someone from the microbiological side, from the biogeochemical side, and then from the social science side as well. And so we're clearly in that convergence space.

Peter Groffman: The thing that I think is interesting is that the scope of the questions continues to grow and become more complex as we go along. For example, as we spend more time studying how people interact with urban environments, we learn more and more about the importance of interaction with nature, for human physical, and mental health. We learn more and more about environmental justice. We learned more and more about effects of greening on real estate values and social issues related to gentrification and displacement. And I think that what we started was with an amazingly complex question that has just gotten more amazingly complex over time. And it kind of motivates someone to get up in the morning and get to work because these are clearly important questions that require a multidisciplinary approach. And the complexity is just growing over time.

Tanya Domi: So, Monica, what are your thoughts about this approach? Convergence research.

Monica Trujillo: I think that it is great that the National Science Foundation has identified that some problems cannot be solved by one or two or three disciplines. But that is also a big challenge because we scientists are used to a metric to measure outcomes. And if you want to have a grant that is funded, you need to provide outcomes that that scientific community, that part will value. And this supports of bringing more people into the collaboration makes it harder to come up with outcomes that are valued for each one of the different communities.

Monica Trujillo: So I think that was ASRC saw very clearly from the beginning was that the only way that we could learn how to be successful to apply to these kinds of grants and to address these kinds of questions was to start working. And it was interesting just to write these proposals was very difficult because how do we even share this space in terms that it wasn't three grants together, one region by a microbiologist, another region by biogeochemistry and another one written by a social scientist.

Monica Trujillo: So for me, even though Newtown Creek is a problem that is, let's call it small, it's a perfect example to learn the tricks to be able to answer to these type of calls. So I think it's a very rational approach to try to learn to work together.

Shawn Rhea: The seed funding that the proposal received through the ASRC, the whole idea is these three areas of science to figure out how do you write a bigger proposal that had much more substantial funding to really begin to dig deep into some of these questions.

Monica Trujillo: Yeah. Exactly. Exactly. And just the writing exercise of this small proposal was, at least for me, was extremely interesting and I learned a lot from it. And it was very clear that we do have some interesting and challenging problems that we need to solve in order to be good at getting funding for this.

Shawn Rhea: No, that's fantastic. It's a research as you learn, learn as you research.

Monica Trujillo: Yeah.

Shawn Rhea: So on that note, Monica, you guys have talked quite a bit about the role of the social science, and I know that Erika who really handles that piece is not here with us today, but I do think that that's kind of a natural entry point to talk about the role of the community, the Newtown Creek community. What role are they playing in helping you all with this research?

Monica Trujillo: So this was another reason why Newtown Creek is a good example. And the initial goal of this grant was to work with the Newtown Creek Alliance. But because of everything that happened, we also thought that there was another community that we wanted to think about that it was the CUNY students that we're working with. Not going to dedicate much time to that, but I just want to show you how even in the process of working with this, we learned that there were other people that would also be impacted, and it would be interesting to study what effect they had in that.

Monica Trujillo: But the Newtown Creek passed the Newtown Creek Alliance organization that has been working with people who live there since a long time, and the work is amazing. I mean, I'm a follower of their Facebook page, and it's really nice to see what they do in the community. The kind of people that show up to work there, the director is somebody who is really dedicated to it and who has been extremely helpful.

Monica Trujillo: If you go to the website, they have developed educational pieces that they share with the schools, the public schools who are there. It's really a very, very, very interesting organization. And it's easy for people to see the [inaudible 00:26:26] coming or to see this plan coming. But what we do know is that the foundation of all of that is clean soil and clean water. So sometimes people hear the word microbe, immediately they think about diseases. It's very hard to get anybody like excited about the chemical reactions that are happening. But they are the fundamental building blocks in which all the other things are happening. So they were very interested in us presenting our research within the community. They would have a meeting and we would present our results and we would be open for questions. And that will also give room for them to tell us things that they were worried about.

Tanya Domi: That's great. So this is a combination of three major sciences, quite complex. Peter, it sounds like the real aim here is to break down silos between these sciences and to make sure that we understand the cause and effect links

between various kingdoms. As a team, how do you connect the dots between the findings in your various areas of expertise? How do you connect that and how do you communicate that, as well?

Peter Groffman: So the key to convergence research in my opinion, is the ability to stop and listen and develop an understanding of what your collaborators from other disciplines are talking about. And that's really what the seed grant from the ASRC did for us. It gave us some time and space to sit down and listen to each other and learn about our different types of research.

Peter Groffman: And you listen and you learn and you develop some enthusiasm and real interest in topics that the researchers are doing. And once you develop that kind of interaction, where I can ask intelligent questions about the details of Monica's search and vice versa, you really start to connect the dots and start to make true integrative progress. And so if we really want to understand how the soil characteristics are influencing the microbial communities, which are in turn influencing the ability of the soil to support plant growth into clean up the soil and the water and the air, that's when we start to make that real progress.

Peter Groffman: And if we involve the community from the beginning, and if we explain our research to the community and we understand what the community's goals are, that really helps to connect the dots between all the different areas. And a big part of that is communication skills. And so we like to think that there are two kinds of science communicators. They are really horrible ones who speak only in multi-syllable words. And then there are the terrible ones who are everyone else in the group. And so events like this, I think are kind of fundamental for helping us to connect the dots in convergence research.

Tanya Domi: Thank you. I think that you both have been illustrating not only your science and your research, but the interaction between those in the Newtown Creek situation. And a fascinating part is the community, which is always a really big driver in environmental crises around the country. You see a reaction from the community, but more importantly, we are a university and each of you have students, and I'd like to hear your thoughts about, if you could talk a bit about your students and how they're helping advance your research and work on this project. If you could, Monica, I'd love to hear about your thoughts on your community college students. It would be a very exciting project, I would think.

Monica Trujillo: Yeah, so I am lucky enough to teach a general microbiology course at Queensborough Community College. I was able to develop it and I decided that I wanted to teach microbiology through a research project. So I wanted to ... In an introductory microbiology course, you need to teach them how to use the microscope, how to identify bacteria. But I thought, instead of using a collection that has been there forever, let's start from the very beginning going and collecting microbes and growing them and learning about once that you know exactly what they are.

Monica Trujillo: And it was a unique opportunity when I was teaching that course, because early in the spring of 2019 with this grant, I had enough money that would allow me to then do the sequencing that was needed. So it was a really nice thing. It wasn't a very big group. We were 14 and we drove and met at Newtown Creek. It was a very cold day at the beginning of 2020. And we took the samples and we came back with all the soil, we processed.

Monica Trujillo: So it had a very positive impact in the students because immediately they looked at where they had gone. They search about the Newtown Creek Alliance. Some of them live close by. A whole conversation where the microbes were an important part. I am a microbiologist. What I wanted was to know who was there, but they were seeing them in context, they were seeing the microbes from the soil, not from the plate that I will bring. And they were like, okay, are they producing them in the lab? These kind of questions are good ones. The reality is that we do have some pure cultures that we microbiologist use to teach, but microbes are all over the place.

Shawn Rhea: They were immediately in the field? Your students were immediately in the field?

Monica Trujillo: Yeah. And it gave me a unique opportunity also to teach them some molecular biology tools because they learn how to isolate DNA. But instead of learning to isolate from a pure culture, it was from this microbes that were present in the soil. So it was really a wonderful experience that unfortunately it was cut short by the transfer to online. It had many, many beneficial effects, including having created a stronger community with my students before the pandemic hit.

Tanya Domi: Have you been able to work with them at all, given the condition to the pandemic?

Monica Trujillo: No.

Tanya Domi: You haven't resumed, yet?

Monica Trujillo: No. So they did isolate the DNA, but there was too much time between me being able to submit the sequences. So I'm reisolating the DNA and send it to sequence. But what I'm going to do is next spring, when I teach this courses again, then you cohort students are the ones who are going to do the bioinformatic work to identify those microbes that we have. So it is not going to be done by the same group of students, but it's going to again, give me what I think is a wonderful tool that is to present them with a real world problem where they can apply a particular method that it can be applied to anything, but if it's something that relates to your life, it does make a difference.

Tanya Domi: Thank you. Peter, what about your students? How have they contributed to your research?

Peter Groffman: So students are really attracted to these novel ecosystems where you have real challenges in contamination and degradation in a strong social context. And so right now I'm super proud of, we have one master student, she's conducting her master's thesis research on these created salt marshes in Newtown Creek. And this is to me is a great CUNY story because she was involved at LaGuardia Community College. And there's a professor there, Sarah Grant, who's been involved in Newtown Creek for a long time. And the student became very interested in the work that Sarah was doing, became involved in the Newtown Creek Alliance, took my biogeochemistry class at Brooklyn College and then said, okay, this is what I want to do for my master's thesis.

Peter Groffman: These salt marshes, they're amazing to see because, so here's this highly industrialized water body we're creating these super rich and dynamic wetlands in the Creek. And so now we're seeing how did they function compared to more natural wetlands say out in Jamaica Bay? And so the student was able to do her work during the pandemic. She did some sampling and she's got an access into the lab of the ASRC and she's writing her thesis now.

Peter Groffman: So they were lucky at CUNY in that we have research opportunities like this really challenging, novel questions, and the students are drawn to them. And so I think it's good for our research. I think it's good for the students. I think it's good for our community.

Tanya Domi: Wonderful. It's a great story. Well, thank you. Both of you. This has been a wonderful conversation. And of course we always learn when we talk to the scientists. So thank you both so very much. Thanks for tuning into The Thought Project and thanks to our guests, Professor Peter Groffman of the Advanced Science Research Center Environmental Science Initiative at The Graduate Center and Professor Monica Trujillo of the Department of Biological Sciences and Geology at Queensborough Community College.

Tanya Domi: The Thought Project is brought to you with production engineering and technical assistance by Kevin Wolf of CUNY TV. I'm Tanya Domi tune in next week.