



The San Ysidro Land Port of Entry is the fourth busiest land port of entry in the world that processes between 70,000 and 90,000 automobiles, as well as about 20,000 pedestrians on foot, each day of the year. What happens when 15-20 million cars cross the same border in the same place each year? Orderly as it might be, it's a daily traffic jam that residents of San Ysidro, California, suspect is an untenable and unhealthy public health crisis. Courtesy of the Department of Homeland Security.

Fighting pollution by greening the community

AGU's Thriving Earth Exchange helps the San Ysidro community sequester carbon emissions by enhancing a county park with more trees

The San Ysidro Land Port of Entry is the fourth busiest land port of entry in the world that processes between 70,000 and 90,000 automobiles, as well as about 20,000 pedestrians on foot, each day of the year. A decade-long, \$741 million expansion project concluded in 2019 that effectively doubled the car capacity of the border station, but wait times can still be four or more hours at its busiest times. (Trucks cross at the Otay-Mesa Land Port of Entry about nine miles east of San Ysidro.) What happens when 15-20 million cars cross the same border in the same place each year? Orderly as it might be, it's a

daily traffic jam that residents of San Ysidro, California, suspect is an untenable public health crisis.

In 2015, the US Environmental Agency and the San Diego County Air Pollution Control District installed a refrigerator-sized air quality monitor at the border crossing. The \$124,000 project (in conjunction with the US General Services Administration and US Customs and Border Protection), intended to measure something that had never been measured before at the facility: how much air pollution was actually being produced there. The monitor, itself, was moved twice between 2015 and 2016 (owing to demolition related to the border crossing facility's planned expansion), but operational long enough to capture data about elevated average levels of pollution above the 12.5 micrograms per cubic meter of particulate matter that is considered healthy in a community where 25% of residents suffer from asthma, and who knew all too well that their air wasn't as clean as it should be. Idling for

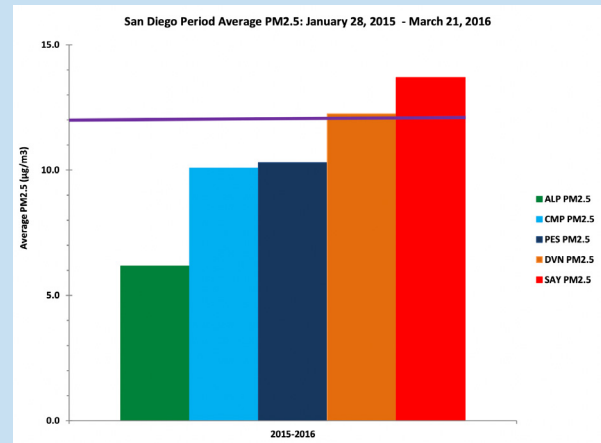


In 2015, the US Environmental Agency and the San Diego County Air Pollution Control District installed a refrigerator-sized air quality monitor at the border crossing. The \$124,000 project intended to measure something that had never been measured before at the facility: how much air pollution was actually being produced there. Courtesy San Diego Air Pollution Control District Monitoring and Technical Services Division.

an average 90-120 minutes, each of the 90,000 cars that cross at San Ysidro each day produces an average of four to six pounds of carbon dioxide during its journey along the approach roads and through the customs and border control checkpoints.

A 2017 report issued by the San Diego Air Pollution Control District for the Environmental Protection Agency on the monitor's results concluded that the San Ysidro Port of Entry's particulate matter levels were especially elevated at night and in the early morning hours when the atmosphere was most stable and winds were out of the southeast. Looking at data from both locations of the monitor before the initiative was scrapped in the wake of the facility's renovation and expansion, researchers also concluded that seasonal concentrations of particulate matter in winter and summer brought the average up at the site, as well as other aggregate emissions from the greater Tijuana metropolitan area across the border.

To find more data, Casa Familiar, a local non-profit community advocacy organization, began participating in the San Ysidro Community-Based Air Monitoring Study in 2018 with San Diego State University, the San Diego Air Pollution Control District, and the University of Washington. The consortium's goal was to design, deploy, and analyze the data collected from a network of low-cost air quality monitors for 12 months—ultimately finding in a



The San Ysidro Port of Entry monitor nicknamed "SAY" (in red, as compared to other area monitors) showed elevated levels of particulate matter above what's considered healthy at 12.5 micrograms per cubic meter. SAY was installed from January 2015 through March 2016, until it was moved to a second location (SAY2) before the initiative was scrapped in the wake of the border crossing facility's renovation and expansion.

2020 report significant links between border wait times and air pollutant levels at nearby sites. A decrease in idling times—despite the facility's post-renovation capacity—seemed worse than unlikely; given the economic activity these border crossings represent, that sort of decrease seemed impossible.

Building on the momentum of these findings, Casa Familiar applied to AGU's Thriving Earth Exchange in 2020 with an innovative solution: if you can't yet reduce the traffic, you have increase the capacity of the community to capture, or sequester, carbon in the atmosphere by planting more trees. Casa Familiar identified the city of San Diego's planned construction of Beyer Park as the pretext to increase the amount of trees in the area that could effectively capture carbon dioxide emitted by border crossing cars and transform it into biomass through photosynthesis. Known as "carbon sequestration," the process unfolds over many years as a tree grows. The larger it gets, the more carbon it is able to store, some of which is converted into energy that sprouts more branches and roots, some of which decomposes with its fallen leaves, and some of which remains within the tree. (A byproduct of this energy conversion also happens to be the creation of oxygen.)

Casa Familiar's strategy was simple: petition San Diego of the park's potential to solve the air quality problem its residents knew existed but couldn't prove, and help the city complete, and partner with landscape architects from the University of Southern California to maximize the native tree coverage (thereby maximizing the carbon sequestration possible). Working with AGU's Thriving Earth Exchange, Casa Familiar was

able to assemble a project team and successfully make the case that not only should Beyer Park be the product of community input, but it should also be enhanced and designed to accommodate more trees to fight carbon, as well as educate the community about the science behind sequestration.

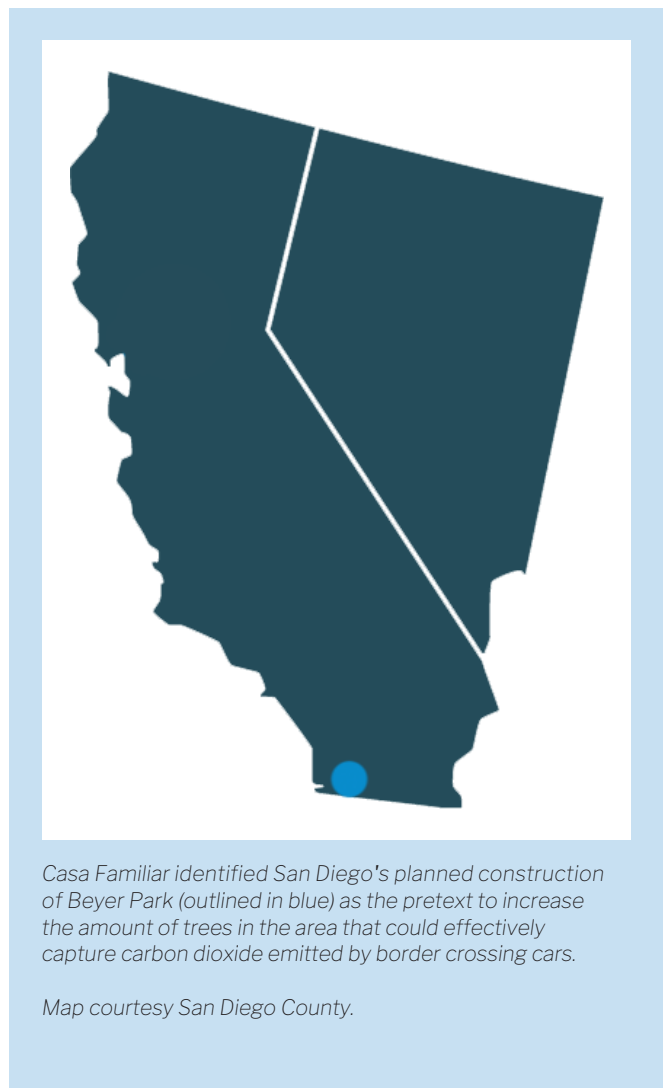
At San Ysidro and in dozens of communities around the country, AGU's Thriving Earth Exchange serves as a connector and facilitator to bring together communities who have self-identified concerns, fellows who organize and administer community-based projects that address those concerns, and experts who can address the specific scientific issues that come to bear on the projects. The Thriving Earth Exchange trains and convenes fellows during the course of their projects, offers limited monetary support, and provides opportunities for fellows to create awareness of the scientific challenges that projects raise and, ideally, help solve, as well as opportunities for fellows to share their work.

Increasing tree coverage by 295%

While many San Diego County communities saw improvements in air quality during the lockdowns and limited travel of 2020 and 2021's coronavirus pandemic, San Ysidro actually recorded an increase in pollutant levels such as black carbon—emitted by fossil-fuel burning engines (not to mention coal-fired power plants) and containing particulate matter.

“It’s a predominantly Latino community at the port of entry, triangulated by all these roads, and there’s a lot of traffic and a lot of idling traffic because of long wait times,” says Estenia Ortiz Carabantes, a community science fellow who worked with Casa Familiar through Thriving Earth Exchange. “Latinos in the US are disproportionately affected by air pollution and the respiratory health problems that come with that, so I got involved with Thriving Earth Exchange and they paired me with Casa Familiar.”

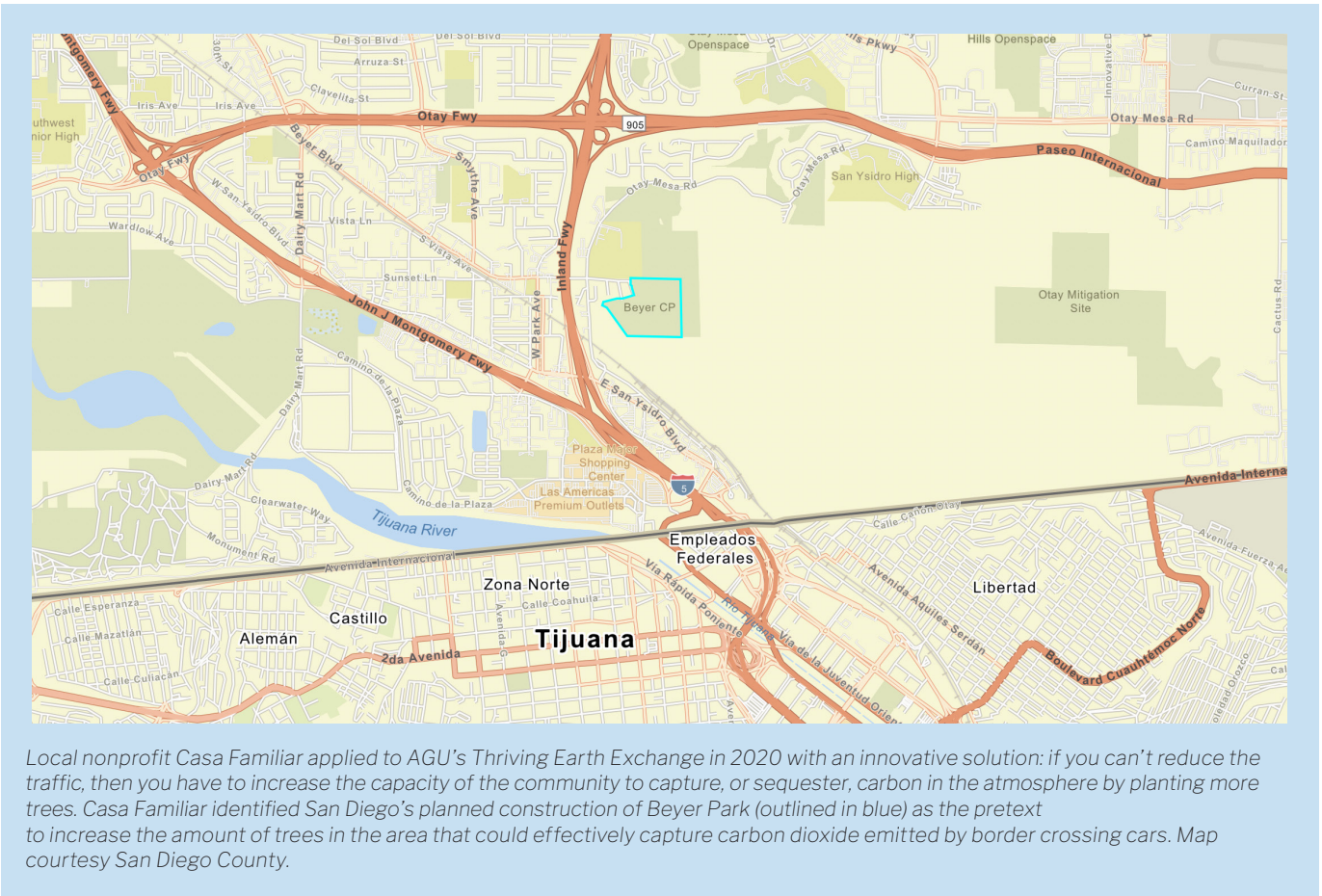
Casa Familiar was founded in 1973 (a reincarnation of Trabajadores de la Raza, founded in 1968) to help South San Diego County residents with immigration challenges and has since grown into a multifaceted advocacy nonprofit that helps low-income residents navigate the exigencies of life on both sides of the border. Environmental justice, says the organization, is critical to address the impacts of climate change in the most vulnerable and disenfranchised communities—requiring engagement and data to improve things such as air quality and environmental education along the border. Carbon sequestration, then, is a proactive strategy for Casa Familiar’s environmental justice initiative. Their thinking was that Beyer Park could be a highly visible public statement about the interests of the community in light of the economic interests of the region.



“We chose this project because we wanted environmental justice reflected in the park’s design. We have about five parks in our community, which are sub-par in quality and recreational value, and it’s an marginalized community—so a new park could really make a big difference,” says Alejandro Amador, Community Air Program Supervisor with Casa Familiar.

The organization struggled with the scale of their intervention initially, eager to tackle the regional effects of air pollution, but limited in its resources and time. Tackle the problem too broadly from a geographical point of view, and risk having an imperceptible impact. Tackle the problem in a way that was too focused, and risk having a community-scale impact.

“We were in between two strategies: create a broad case study with potential greening projects for the whole area or create a single case study focused on Beyer Park,” reports Estenia Ortiz, who says they chose Beyer Park because of the city’s newfound interest in reviving its plans, wanting to capitalize on that interest.



Local nonprofit Casa Familiar applied to AGU's Thriving Earth Exchange in 2020 with an innovative solution: if you can't reduce the traffic, then you have to increase the capacity of the community to capture, or sequester, carbon in the atmosphere by planting more trees. Casa Familiar identified San Diego's planned construction of Beyer Park (outlined in blue) as the pretext to increase the amount of trees in the area that could effectively capture carbon dioxide emitted by border crossing cars. Map courtesy San Diego County.

Ortiz explains that it was because of a series of conversations—and one lucky break—that the project developed. “In the beginning we went back and forth—brainstorming—and then the CEO of Casa Familiar, Lisa Cuestas, mentioned that the city was doing some listening sessions and talking to the skater kids in San Ysidro and the local councilwoman was getting involved through her coffee chats with residents,” she says. “We saw all that activity as an opportunity to participate in the process of greening and help focus the outcomes.”

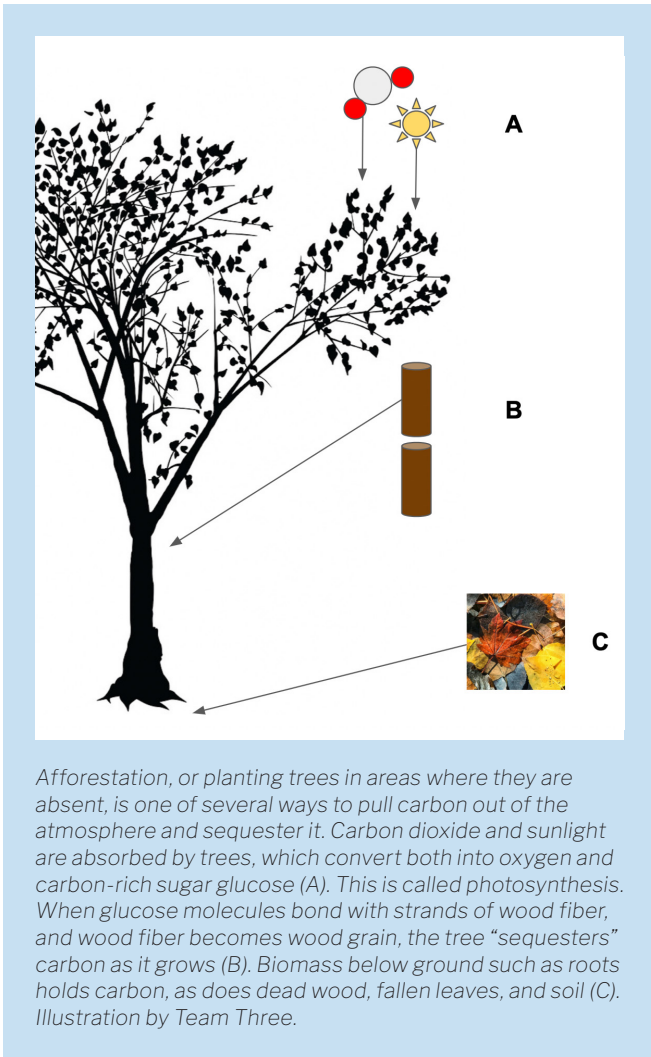
Beyer Park had been part of San Diego's master plan since 1984, but never fully fleshed-out or executed—the very definition of kicking the proverbial can down the road. Through political will and financing, it became possible—and desirable—to finally construct an eight-acre park that the city says will be used by San Ysidro and Otay Mesa communities and will include ball fields, playgrounds, picnic areas, walking trails, a dog park, and the all-important skate park. Amador says that his organization's work, in conjunction with the Thriving Earth Exchange, led to a dramatic increase in the amount of trees planned for the site, from 70 to 277, or a 295% increase.

“They were open to our ideas because we talked about carbon sequestration and the larger benefits of having to do more for the community and the environment,”

he says, “and we also talked about the public education aspect of the project, partnering with San Diego Coast Keeper to produce signage.”

Project participants said community engagement accomplished three broad goals—understand constituencies and their needs, educate the community about carbon sequestration, and tie the park project to long-standing environmental justice initiatives. “We really wanted to engage the community, so we had greening workshops,” says Amador. “One addressed indoor air quality, one was about greening public space through private investment along a commercial corridor, and one was about food security. It wasn't just about our efforts at the future park, it was about a broader strategy to green and improve the well being of the community.”

To date, site preparations for the park have begun and the total \$18.5 million cost of the design-bid-build project is partially funded, through an \$8.5 million state grant according to the City of San Diego. This is the most progress San Diego has made on Beyer Park since it was first proposed nearly 40 years ago, but there is a lot of progress yet to be made on its construction. Success isn't solely tied to the park's realization, says Ortiz, because Casa Familiar was able to use the carbon sequestration project as a vehicle to expand its community outreach efforts—effectively making environmental justice a cause much bigger than a single park.



Afforestation, or planting trees in areas where they are absent, is one of several ways to pull carbon out of the atmosphere and sequester it. Carbon dioxide and sunlight are absorbed by trees, which convert both into oxygen and carbon-rich sugar glucose (A). This is called photosynthesis. When glucose molecules bond with strands of wood fiber, and wood fiber becomes wood grain, the tree “sequesters” carbon as it grows (B). Biomass below ground such as roots holds carbon, as does dead wood, fallen leaves, and soil (C). Illustration by Team Three.

“A great thing about this project is it led to other greening projects in the community,” says Ortiz, “and Casa Familiar led additional greening workshops this past year that got a lot of people involved because of this project. They educated a lot of people about environmental justice and transportation justice—and so for other communities out there that are struggling to get more green space for their lower income and underserved groups, San Ysidro and this park are a great example of what’s possible.”

“Designing public green spaces for carbon sequestration and environmental justice,” is a project of AGU’s Thriving Earth Exchange, which advances community solutions to some of the most vexing environmental challenges. Thriving Earth Exchange helps scientists, community leads and sponsors work together to conserve natural resources, mitigate climate change and create awareness of natural hazards and their impacts on communities.

Learn more at thrivingearthexchange.org.