

Phoenix Plants Hedges to Reduce Kids' Exposure to Pollution



Many schoolyards are underutilized spaces and have much more to offer our children through natural experiences, learning, and revitalization. Phoenix City staff, Arizona State University (ASU) researchers, and school leaders started a green infrastructure project by planting “vegetative barriers”—otherwise known as trees and shrubs—at a childcare center and K-8 school in South Phoenix. The goal was to reduce exposures to traffic-related air pollution, toxics, and other ambient hazards like extreme heat.

Trees and hedges [reduce air pollution levels](#) through interception of airborne particles or through uptake of gaseous air pollution.

This project builds on an initiative promoting children’s healthy play and learning environments at Paideia Academies in South Phoenix, as well as initiatives within the City of Phoenix, specifically the [Sustainability Goals](#) and [Tree and Shade Master Plan](#), that aim to increase plants and shade in heavily used outdoor spaces.

“Schools play an important role in the City’s tree and shade goals,” said Jennifer Vanos, the lead researcher working with Paideia from ASU. “School grounds are also spaces where we encourage physical activity. To do so safely, we strive to minimize air pollution and extreme heat exposures, two factors often overlooked in playground safety.”

The school partner—Paideia Academies—serves 840 students ages 2–14 years. Eighty-four percent of the students are on the free/reduced lunch program, which is largely minority students from Hispanic/Latino (67%) and Black/African American (20%) backgrounds.

Environmental inequities from segregationist planning and zoning practices in the early 20th century placed industrial facilities in minority-dominated neighborhoods in South Phoenix, which led to economic, health, and quality of life challenges that are still present today.

BRIGHT CITY: PHOENIX, AZ

CONCERNS:

- Hot playspaces with traffic-related air pollution

PROJECT OUTPUT:

- Welcoming outdoor space – the Whole-Person Sanctuary – created in Paideia Academies’ schoolyard (#TakeltOutside@Paideia)
- 840 students served by the Whole-Person Sanctuary with shade trees and surrounding bushes to mitigate traffic noise and pollution
- Urban forester created public list of effective and safe plants to use as vegetative barriers

KIDS POTENTIALLY IMPACTED:

- More than 121,000 kids under 5 years old live in Phoenix



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Respiratory illness in children tracks closely with variations in local traffic patterns, which is concerning given that many playgrounds are sited near heavily-trafficked roads. **For example, nearly 8,000 U.S. public schools are within 500 feet of highways, truck routes, and other roads with significant traffic.** Coupled with the fact that exercise can increase breathing rates in children by 17-fold, these factors have the potential to harm school children.

Roadway pollutants include carbon monoxide, nitrogen dioxide (NO₂), PM, and polycyclic aromatic hydrocarbon (PAH), among others, with PAHs being known neurotoxins.

The City of Phoenix partnered with Paideia Academies to promote this example in other schools and parks. ASU worked with Phoenix's urban forester to generate a list of plants that can act as effective vegetative barriers that also meet Phoenix's safety criteria.

In addition to grant funding, support for this project came from ASU and community fundraising by Paideia Academies.

How Did This Project Start?

The seed for this project was planted in 2018 when Dr. Jenni Vanos from ASU contacted Paideia Academies founder Dr. Brian Winsor—out of the blue—with her “wild idea.” Eventually, more ASU professors got involved, lending their expertise in weather and atmosphere, landscape design, sustainability, education and curriculum design, and social impact research. As the project evolved, Phoenix's Mayor Gallego lifted up Paideia's Whole-Person Sanctuary as a tangible way to build a more sustainable Phoenix with opportunities for healthier kids and families.

“Building a more sustainable city is crucial to the health of residents. Children are especially susceptible to hazards such as poor air quality and extreme heat, and efforts to improve school and playground environments are incredibly important in improving health outcomes for our kids. This collaboration among Bright Cities, the Mayors Innovation Project, Arizona State University, Paideia Academies, and the City of Phoenix drives the development of tangible solutions to complex problems, and I am proud that this project will result in healthier, happier playtime.”

Mayor Kate Gallego, Phoenix, Arizona



Brian Winsor, Paideia Academies Director, works with teachers to plant new shade trees within the school's Whole Person Sanctuary during Earth Month, 2021. Numerous trees were planted by students, teachers, and volunteers.



ASU professor Dr. Jenni Vanos explains how the air quality monitors work to students at Paideia Academies.



Measurable Outcomes

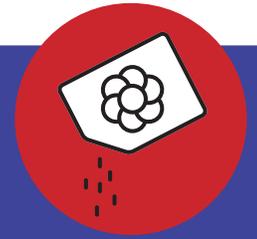
Seven Clarity air quality monitors were installed inside and outside the schoolyard to measure long term concentrations of two air pollutants—PM_{2.5} and NO₂—before and after the new green schoolyard and sanctuary installation. The team hypothesizes that PM_{2.5} and NO₂ concentrations will decrease in the schoolyard after hedge and tree planting and maturity as compared to the parking lot and road concentrations. The team expects safer conditions to be present for outdoor play and learning for the scholars and teachers.

Besides collecting air pollution data, ASU researchers and school staff are evaluating if exposure to urban nature has a positive impact on physical activity, social connectedness, academic engagement, and overall sense of wellbeing. To measure this, the team surveys students weekly at the school and collects feedback from community stakeholders each year.

Unexpected Outcomes

Paideia Academies' goal is to create cultural change to be able to change existing ineffective and inequitable paradigms, practices, and education systems.

One of the project's first changes was moving student breakfast and lunch from the indoor lunchroom outside into the Whole-Person Sanctuary. The cafeteria is loud, like an echo chamber, with bright glaring lights. When the children went outside there was an immediate change; making it safe with shade trees and surrounding bushes to mitigate traffic noise made an immediate impact on breakfast and lunch. While the noise produced from the children was the same, it was absorbed by the trees and nature. The light was natural sunlight. Staff noticed an immediate calming in the students and adult workers, along with more socializing during lunch!



Three Steps to Seed a Healthy Outdoor Space

1 Engage the school community to educate on the health hazards of being outside in our swiftly changing nature scape.

Schools play an important role in a city's tree and shade goals. School grounds are also spaces where physical activity is encouraged! To do so safely, air pollution and extreme heat exposures must be minimized. Watch this video to learn more.

2 Engage the broader community on nature scape design for the elementary school.

The elementary school is a natural community center. Families of Paideia students and community members were invited to build the inaugural school garden and plant trees. These activities were fun and helped build a sense of ownership and engagement among the school community.

3 Engage stakeholders who control funding to educate on the benefits of “exposure to nature”—simply meaning spending daily time in nature—for everyone in the community.

Share photos, student/staff/family quotes, and data about students' experiences with local foundations with programs focused on connecting children to nature, environmental health, and/or resilience planning, and invite potential funders to visit. These practices helped Phoenix engage stakeholders. Their next phase is to build a connected nature-walk for community families to enjoy.



“This space has become a place of whole-person learning – body, mind, heart, spirit. Our students find a deep level of peace in this quiet space.”

Dr. Brian Winsor,
Paideia Academies founder

What's Next?

In the short-term, these outdoor spaces will directly support the health of children with the provision of much needed outdoor spaces. Long-term, the project aims to reduce health disparities and support the City's Sustainability goals by promoting tree planting at Paideia and in other playspaces to help reach a 25% canopy cover across the city. Project partners will also launch a longitudinal study in 2022 to measure the impact of time in nature on physical health, academic engagement, social connectedness, and overall sense of wellbeing for our community.



Students at lunch the Whole Person Sanctuary at Paideia Academies.

What Have Other Cities Done to Reduce Air Pollution at Playgrounds?

Tempe, AZ, has [a similar project underway](#). City and ASU staff generated [a list of effective and geographically appropriate vegetative barriers](#).

Questions for Project Staff?

Contact Paideia Academies' Founder Dr. Brian Winsor at bwinsor@paideiamail.com and/or Dr. Jenni Vanos, assistant professor in the School of Sustainability at Arizona State University, at jvanos@asu.edu.



The Bright Cities program provides up to \$35,000 in grant funding for US cities and community based partner organizations to reduce exposures — in pregnant women and children under 2 years — to the nine neurotoxins with the strongest associations to developmental delay.¹ These neurotoxins are arsenic, flame retardants, lead, mercury, combustion byproducts called PAHs, banned industrial chemicals PCBs, organophosphate pesticides, a rocket fuel component and fertilizer contaminant called perchlorate, and plastic additives called phthalates.

Curious about funding and technical support to reduce neurotoxic exposures in your city? Contact **Kyra Naumoff Shields**, Bright Cities Program Director, at knaumoff@hbbf.org



The Mayors Innovation Project is a national learning network for mayors committed to shared prosperity, environmental sustainability, and efficient democratic government. Around the country, mayors are taking the lead on pressing issues— climate change, racial equity, economic revitalization, housing, and more. The Mayors Innovation Project supports mayors by providing cutting-edge thinking and concrete examples that mayors can implement.

Looking for peer networking and best practices for city leaders focused on equity, sustainability, and democracy? Contact **Katya Spear**, Mayors Innovation Project Managing Director, knspear@mayorsinnovation.org.

ENDNOTES

- 1 Bennett D, Bellinger DC, Birnbaum LS, et al. Project TENDR: Targeting Environmental Neuro-Developmental Risks The TENDR Consensus Statement. Environ Health Perspect. 2016; 124(7):A118-A122.