ABC
Alliance for a
Better Community

Protecting Students From Our Changing Climate:

Equitable Strategies for Addressing Green Schools in the Los Angeles Unified School District

Developed for
Alliance for a Better Community

Authored by
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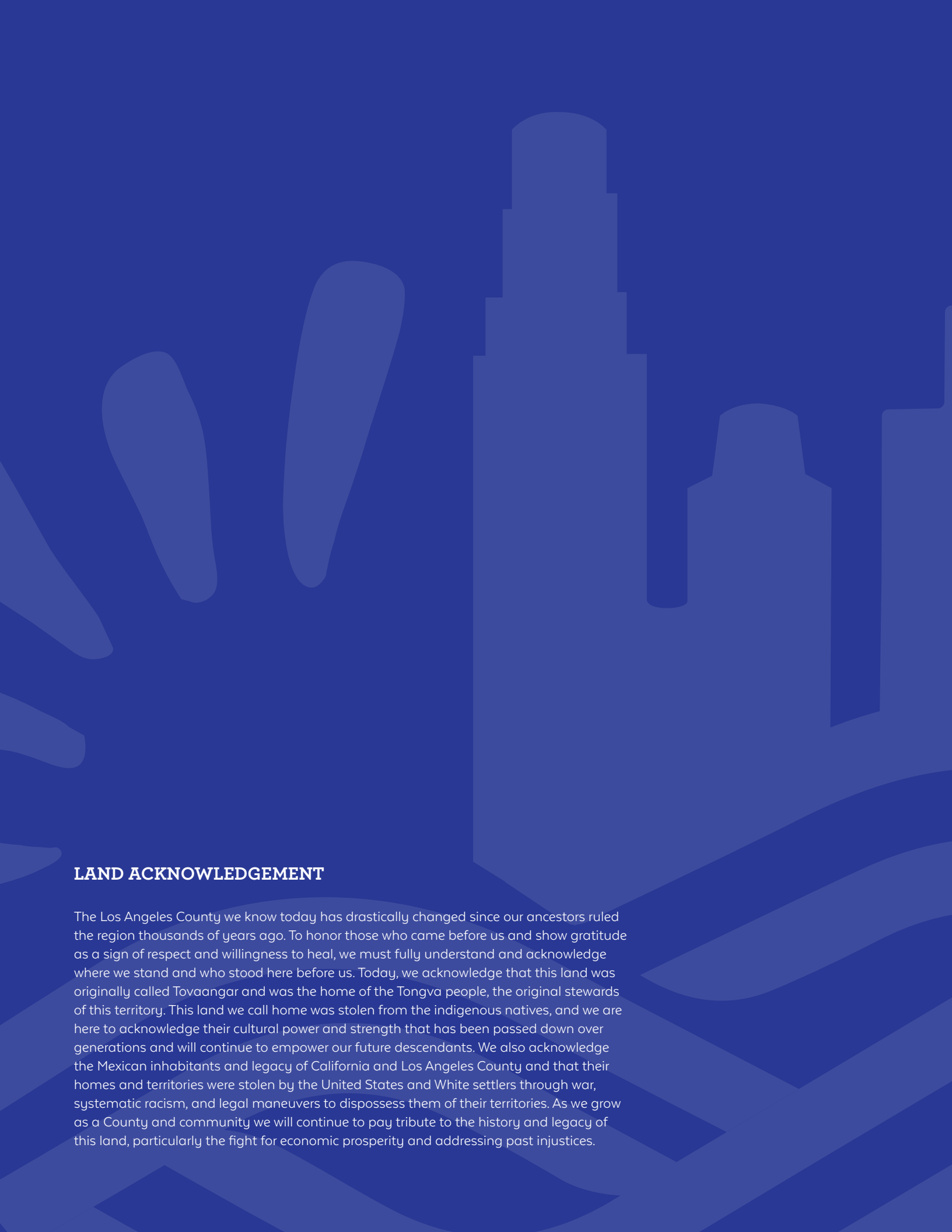

LAND ACKNOWLEDGEMENT

The Los Angeles County we know today has drastically changed since our ancestors ruled the region thousands of years ago. To honor those who came before us and show gratitude as a sign of respect and willingness to heal, we must fully understand and acknowledge where we stand and who stood here before us. Today, we acknowledge that this land was originally called Tovaangar and was the home of the Tongva people, the original stewards of this territory. This land we call home was stolen from the indigenous natives, and we are here to acknowledge their cultural power and strength that has been passed down over generations and will continue to empower our future descendants. We also acknowledge the Mexican inhabitants and legacy of California and Los Angeles County and that their homes and territories were stolen by the United States and White settlers through war, systematic racism, and legal maneuvers to dispossess them of their territories. As we grow as a County and community we will continue to pay tribute to the history and legacy of this land, particularly the fight for economic prosperity and addressing past injustices.

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The image of heat steaming from asphalt playgrounds is seared in our memories and of those who attended public schools in low-income communities during the 1980s. Smoggy skies from nearby polluting sources also exacerbated our classmates' asthma and required their parents to purchase expensive inhalers. These childhood memories of environmental injustices unfortunately are still the reality for many impoverished children attending public schools in Los Angeles County.

What is different from our experience and that of the children today? The changing climate. It is further compromising the environments in which our children learn, grow, and thrive. No one wants to send their children to a school with crumbling buildings, no greenspace or without air conditioning? Last year, students throughout the county were kept indoors for recess for over three weeks. This happened across school districts and for longer periods of time in some regions because of the extreme heat, lack of trees for shade, and in many low-income neighborhoods, campuses with over 85% of asphalt that makeup the school grounds. How can parents and caretakers expect their children to succeed when they are consistently at risk?

Recent years have shown the undeniable impact of climate change. Neighborhood temperatures are rising, with projections indicating a threefold increase in scorching days exceeding 95°F for even wealthy coastal areas. More alarming are the predictions for the San Fernando and San Gabriel Valleys, poised to endure even more intense heat (Smith, 2022). In the midst of this reality, our schools — often lacking green spaces and sustainable infrastructure — grapple with the repercussions.

The Los Angeles Unified School District provides a home to approximately 600,000 students in Los Angeles County. Of these students, 75% are Latino/a. These students often spend nearly every weekday on environmentally hostile school grounds and buildings. As California confronts the consequences of climate change, LA Unified buildings and campuses stand as symbols of potential change. The district must lead by example, for a more equitable and sustainable future.

Climate change and the current physical condition of school buildings and school grounds in low-income communities of color are further exacerbating environmental injustices. All students deserve not simply adequate learning environments but those that also allow them to be safe from the changing climate so that they can thrive academically.

Our intention in developing this report is two-fold: to elevate the voices of those most impacted, empowering them to collaborate with schools and the district, and advocate for the creation of safer, climate-resilient educational spaces. By harnessing our collective strength, we can create a brighter, healthier, and more equitable future for all our students and communities.

With determination,

Vanessa Aramayo and Dr. Michael Mendez

Acknowledgements

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DEVELOPED FOR

Alliance for a Better Community, a Los Angeles based Latino/a advocacy nonprofit organization.

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Cindy Montañez

This report is dedicated to Cindy Montañez, a fierce environmental advocate who has devoted her career to environmental sustainability, social justice, and public service.

Cindy was a lifelong advocate for her community, achieving remarkable milestones at a young age. At just 25 years old, she etched her name in history by becoming the youngest person ever elected to the San Fernando City Council. Her dedication persisted, and at the age of 27, she assumed the role of mayor. At 28, she again shattered records by becoming the youngest woman ever elected to the state Legislature. Her leadership journey continued to soar as she was chosen to chair the Assembly Rules Committee, marking another historic moment and becoming the youngest person and first Latina to hold this position.

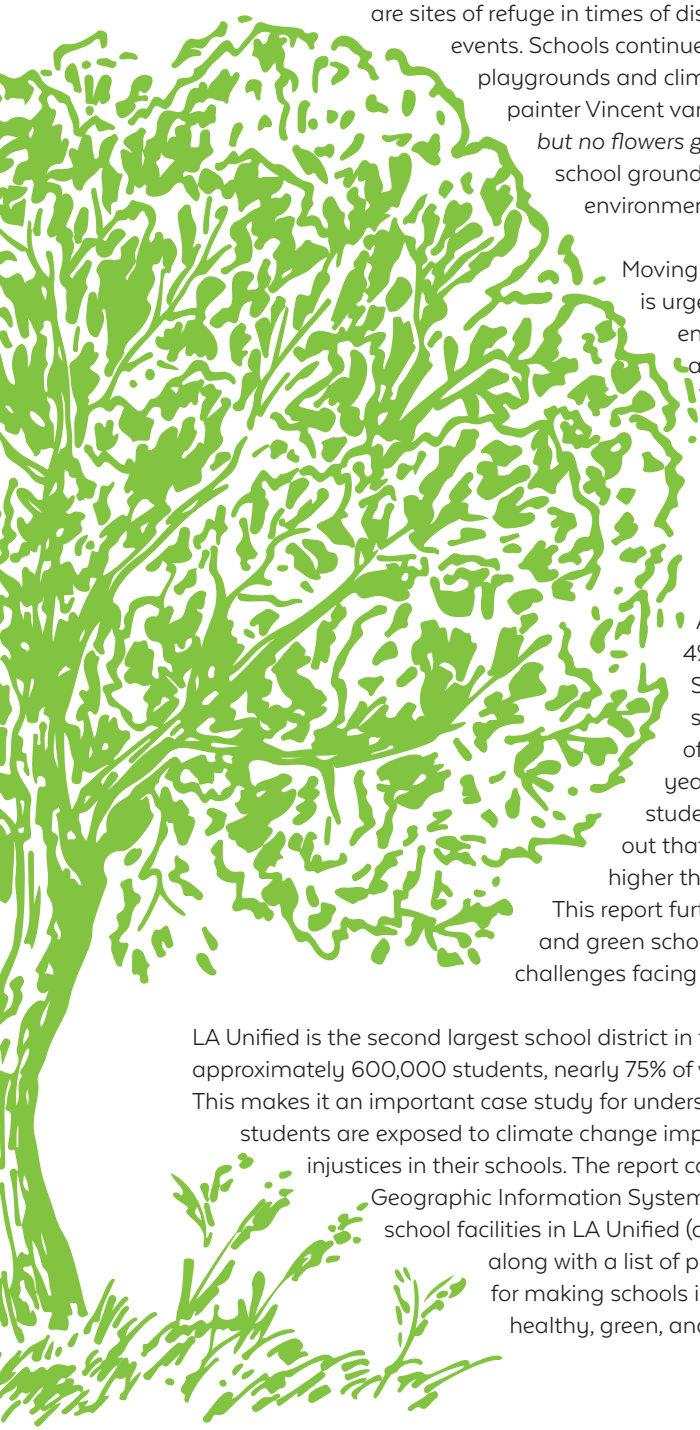
After serving over 17 years in public service roles, Cindy's journey led her to serve as the CEO of TreePeople, the largest environmental movement headquartered in Southern California that has empowered over three million community members to contribute to a more climate-resilient and water-secure Los Angeles.

In addition to her public service, Cindy demonstrated her unwavering commitment to the elevation of the Latino/a community and advocacy for issues directly impacting it. Cindy's track record of breaking barriers and tireless advocacy for her community showcases her selfless dedication to making a profound difference.

In recognition of her outstanding contributions and relentless pursuit of a greener, more equitable Los Angeles, we dedicate this report to Cindy Montañez with deep gratitude and admiration. May her legacy serve as a source of inspiration for us all.

Executive Summary

Creating sustainable school buildings and playgrounds that adapt to our changing climate is imperative if we are committed to student well-being and academic success. Research shows that dilapidated and hazardous facilities negatively impact the respiratory and physical health, cognitive development, academic performance, behavioral and emotional regulation, and self-esteem of students. They also generate disproportionately large carbon footprints that fuel climate change. Schoolyards made of concrete and asphalt exacerbate the heat island effect. Heat islands occur when urbanized areas have less green space, less tree canopy (area shaded by trees), and more hard surfaces like asphalt, producing higher temperatures than surrounding areas. They also increase the risk of heat-related, cardiovascular, and diabetes-related illnesses and reduce physical activity among students. Moreover, schools are sites of refuge in times of disaster, but they are often not built to withstand extreme weather events. Schools continue to be constructed and maintained toward the status quo—concrete playgrounds and climate-inefficient buildings. In this context, our report is inspired by painter Vincent van Gogh's quote, *"Normality is a paved road: It's comfortable to walk but no flowers grow."* Seldom are there opportunities to enable asphalt-paved school grounds to flourish sustainably and protect students from the changing environment.



Moving towards more equitable strategies for addressing green schools is urgent. More than half of all schools in the U.S. are affected by environmental hazards, such as toxic mold, contaminated drinking water, and extreme weather events. These effects are also inequitable. Non-White Latino/a, low-income, and rural students are disproportionately likely to experience the negative impacts associated with these hazards. It is crucial to address environmental hazards in schools, as children are especially vulnerable to them. In addition to physical health impacts, there is a growing literature documenting the effects of environmental hazards on other areas, such as academic performance and mental health. According to the U.S. Environmental Protection Agency, climate change-driven extreme temperatures may cause a 4% to 7% drop in annual academic achievement per child (EPA, 2023). Similarly, scholars at Harvard University studied 10 million high school students that took the PSAT exam over a thirteen year period. Results of the study showed that the students scored lower during hot school years as compared to cool school years. Latino/a, low-income, and Black students were found to be more affected by the heat. Researchers pointed out that the impact of heat on Black and Latino/a students was three times higher than on their Non-Latino/a White counterparts (Goodman et al. 2018). This report further provides a critical synthesis of existing research on facilities and green schools through the context of the environmental and climate change challenges facing the Los Angeles Unified School District (LA Unified).

LA Unified is the second largest school district in the country, serving approximately 600,000 students, nearly 75% of whom are Latino/a. This makes it an important case study for understanding how Latino/a students are exposed to climate change impacts and environmental injustices in their schools. The report contains archival and Geographic Information Systems (GIS) analyses of school facilities in LA Unified (available online here), along with a list of policy recommendations for making schools in the district more healthy, green, and climate resilient.

"Normality is a paved road: It's comfortable to walk but no flowers grow."

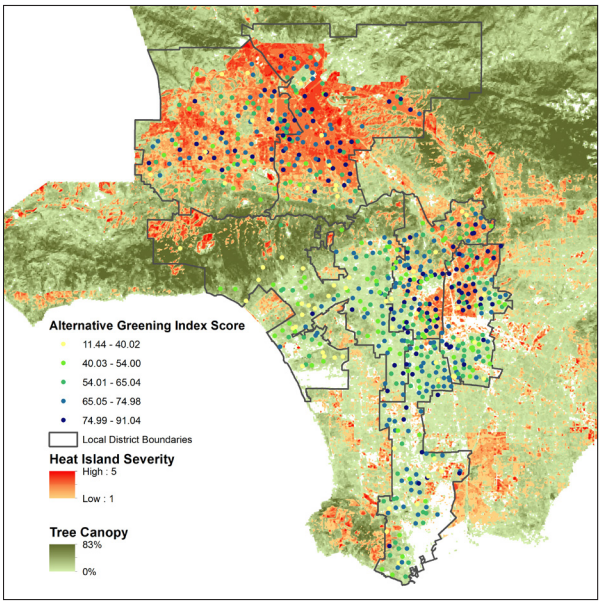


Figure 1 - An alternative greening index based on a unique combination of urban heat island data, tree canopy data, and data about green space on school grounds better balances prioritizing schools in areas with low green space and schools that are expected to experience the most extreme temperatures. Figure created by Margaret Tebbe. Data sources: LA Unified, Trust for Public Land, U.S. Forest Service.

Key Findings

- As of September 2022, the total cost to repair all existing LA Unified buildings and facilities, some of which are 100 years old and older, is estimated to be $4.5 billion. This estimation is inclusive of all maintenance needs, including school greening. (LAUSD 2022).
- The majority of the students attending LA Unified schools with little to no green space are Latino/a.
- LA Unified's existing Greening Index prioritizes schools in neighborhoods with low green space, but disadvantages some of the schools that are exposed to the most extreme temperatures by failing to consider smaller-scale indicators of extreme heat, including tree canopy and urban heat islands .
- An alternative greening index was developed taking into account heat islands and absence of tree canopy and green spaces. The highest priority schools under this alternative index are located in the northeastern San Fernando Valley, Downtown LA, and Northeast LA, with some schools throughout South LA, the harbor cities, and the western San Fernando Valley.

RECOMMENDATIONS

1. LA Unified has committed to reaching 30% green space on all campuses by 2035. These efforts to implement green schoolyards should include removing asphalt, concrete, and artificial turf; collecting stormwater; partnering with community members for planning and maintenance; and sharing maintenance costs with government, community-based organizations, and/or business. This report defines green schoolyards as park-like green spaces that improve children's well-being, learning, and play while contributing to their communities' ecological health and climate resilience.
    a. LA Unified has partnered with the Los Angeles Department of Water and Power and the Metropolitan Water District of Southern California to identify opportunities for stormwater capture projects in the San Fernando Valley. LA Unified should continue to work closely with these local and regional partnerships to identify priority campuses to develop green schoolyards that incorporate sustainable stormwater infrastructure to collect runoff from schools and surrounding sites. These projects could be partially funded from the 2018 Los Angeles County voter-approved Measure W, a special parcel tax funding the Safe, Clean Water Program (SCWP).
2. Although most of the green schools conversation in California is currently focused on schoolyards, there are still many toxic, dilapidated, and energy inefficient buildings in LA Unified. **All green school building projects** should be based on publicly available facilities condition assessment reports. These reports should include sustainability and resiliency measures that evaluate whether school buildings are energy efficient and can adapt to withstand increasingly frequent extreme weather events. These reports should also be validated by data collected by community members.
    a. The LA Unified school board has signed a resolution that aims to implement 100% clean and renewable energy in all schools in the district by 2040. These green school building projects should not only include renewable energy sources to ensure greenhouse gas emissions and co-pollutant reductions, increased energy efficiency cost-savings, but also plan to authentically

This report defines green schoolyards as park-like green spaces that improve children's well-being, learning, and play while contributing to their communities' ecological health and climate resilience.

engage students, parents, and the community on the importance and urgency of the transition to renewable energy.

3. The newly established Eco-Sustainability Office at LA Unified will be led by a Chief Eco-Sustainability Officer who will oversee the District's eco-sustainability and greening developments to combat the negative effects of climate change. Ensuring a centralized and equitable process that prioritizes environmental solutions for all schools should be an established approach to ensure equitable practices by the Eco-Sustainability Office. The superintendent should also establish a community and green equity taskforce to advise the office. .
4. **Community engagement campaigns** should focus on educating parents, children, and other community members about school facilities issues and opportunities to meaningfully participate in green facilities design and planning processes.
5. The LA Unified Greening Index determining the prioritization of schools for new greening projects should be regularly updated with socio-economic factors and scientific methods that contextualize the green index scores based on those schools with the highest need and who will be the most impacted..

a. New greening indexes should be developed through equitable, participatory processes with community members and should be made available for everyone to view, download, validate, and reuse.

More information on each of the recommendations is located on page 34.

Extreme weather events and conditions negatively affect all students but especially those living in lower socioeconomic communities where Latino/a students represent the majority population. Many school facilities are inefficient, in disrepair, and located on toxic sites or in the path of climate-related disasters. These schools disproportionately serve students of color, especially Latino/a youth, and low-income students. It is therefore critical to direct resources and attention toward rebuilding schools that keep children safe and support global efforts to reduce pollution and adapt to the effects of climate change. This report will highlight impacts to student mental stamina and cognitive abilities, as well as impacts to the performance and efficiency of teachers. It will also include key recommendations, benefits of improving school facilities, and the importance of engaging communities most impacted.

[1] *A Greening Index is a measure of a school's outdoor environmental amenities and community needs and is used to determine which schools receive greening projects.*

Introduction:

Understanding School in the Context of Climate Change and Environmental Justice

Schools are one of the most significant arenas in which people are affected by environmental injustice. These impacts are often underreported in mainstream debates about environmental protection and climate action. More than one sixth of the total population of the United States, including more than 50 million students and 6 million teachers and staff members, spend every weekday inside one of the country's 100,000 school buildings (Eitland et al., 2017; Filardo, 2016). Of these schools, roughly 50% have some kind of environmental hazards, such as lead in the water or exposed asbestos, either inside the building or on school grounds (Eitland et al., 2017; U.S. Government Accountability Office, 1995, 2020). Many of these schools are also located in the paths of increasingly frequent extreme weather events caused by anthropogenic climate change and are not designed to withstand these disasters (Filardo, 2021).

Environmental injustice on school grounds comes from four sources: dilapidated buildings, climate change vulnerabilities, toxic properties, and external hazards. Although this report focuses primarily on the first three sources, it is important to note that external hazards must be addressed in order to create environmentally safe schools. Schools do not exist in isolation from their environments, and many of the schools facing internal environmental hazards are also challenged by external hazards (Eitland et al., 2017).

Low-income school districts, rural districts, and districts with high percentages of students of color are significantly more likely to have aging buildings, schools built on toxic sites, and facilities that are unprepared for climate-induced disasters (Eppley, 2017; Filardo, 2006, 2021; U.S. Government Accountability Office, 1995). This is a direct result of inequitable funding structures for school facilities. School facilities are considered capital projects, which receive limited state funding and federal funding. This means that facilities improvements are dependent on the ability of the local tax base to bear the costs of these projects, disadvantaging smaller and lower-income districts (Filardo, 2021). Some of the more widely-known effects of school facility hazards include exacerbated asthma, from poor ventilation and extreme heat; cognitive and developmental delays, due to lead exposure; and cancer, due to asbestos exposure (Eitland et al., 2017; Filardo, 2016; Gostin, 2016). It is particularly important to address these hazards in schools because children are uniquely vulnerable to many of them. In addition to these physical health effects, there is a growing body of literature documenting their impacts on other areas, including student academic performance and mental health, community cohesion, resiliency, and neighborhood economies (Filardo, 2021; The Trust for Public Land, 2021b). A recent report from the U.S. Environmental Protection Agency (EPA) found that climate change-driven extreme temperatures may lead to a 4% to 7% reduction in annual academic achievement per child (EPA, 2023). Similarly, scholars at Harvard University studied 10 million high school students from the classes of 2001 to 2014 that took the PSAT exam. Results of the study showed that the students scored lower during hot school years as compared to cool school years. Low-income and Black and Latino students were found to be more affected by the heat. Researchers pointed out that the impact of heat on Black and Latino/a students was three times higher than on Non-Latino/a White students (Goodman et al. 2018).

Schools are one of the most significant arenas in which people are affected by environmental injustice.

Some districts—like LA Unified—are beginning to take the first steps to address these issues in their schools. In September of 2022, following their commitment of $58 million for the creation of green schoolyards, LA Unified set a goal of reaching

30% green space at all schools by 2035 (LA Unified, 2022; Stone, 2022). In August of 2023, the district committed a further $78 million to develop green space at seven schools (LA Unified, 2023). Several LA-based nonprofits, including Alliance for a Better Community, TreePeople, and The Trust for Public Land, are committed to working with the district to improve equitable access to safe green school facilities and ensuring students, their families, and local communities are part of conversations that identify solutions.

There are also a significant number of initiatives at the state level supporting the development of safe, green, and resilient schools. However, the scale of the issue remains daunting: As of September 2022, the district estimated that it would cost $4.5 billion to address all existing facility issues (LAUSD 2022). This estimate does not include improvements to facilities like green schoolyards.

This report first begins with an overview of what researchers across the nation know about the scale, impacts, and causes of inadequate facilities and environmental/climatic hazards in schools. Second, the report provides a synthesis of the literature on green schools and schoolyards. Finally, LA Unified's Greening Index is examined and an alternative greening index is proposed that contextualizes the green index scores based on those schools with the highest need. The report concludes with a list of policy recommendations to help address environmental justice in Los Angeles Unified school facilities.

A recent report from the U.S. Environmental Protection Agency (EPA) found that climate change-driven extreme temperatures may lead to a 4% to 7% reduction in annual academic achievement per child.

Background:

Health Impacts of Unsustainable Schools

In Los Angeles, climate change is subjecting more students to rising temperatures and extreme heat. The World Health Organization (2018) identifies the direct impacts of heat on health, which include dehydration, intensified risk of heat-related diseases, and increased risk of cardiovascular and diabetes-related illnesses. Children, however, are particularly vulnerable to extreme heat. This is because their bodies are less able to regulate their internal temperature, they take longer to sweat, and water makes up a higher percentage of their body weight, making them more vulnerable to dehydration. (Huetteman, 2022).

Higher temperatures are also associated with increased ozone pollution (Schwarz et al., 2021). Ozone has a variety of negative health impacts, including aggravation of existing respiratory illnesses (like asthma, as discussed above) and permanent lung damage (U.S. EPA, 2015). All these impacts can arise quickly, especially when athletic activity is involved (Huetteman, 2022), which often occurs in the hottest parts of school campuses, for example, asphalt schoolyards, turf fields, and gyms without air conditioning. Latino/as have the second highest rate of childhood asthma in Los Angeles County at 8% of children between the ages of 0 and 17 (Los Angeles County Department of Public Health, 2014). Heat also negatively impacts the mental stamina, cognitive abilities, and test scores of students and the performance and efficiency of teachers (Baker & Bernstein, 2012; Eitland et al., 2017; Filardo, 2021). More research is needed on climate impacts on children in schools. However, schools will not be able to effectively encourage students to live a healthy life if, for example, there is no space within the school for children to exercise safely and comfortably, or if the building is actively making them sick. It is critical to understand both the negative impacts of hazards in schools and the potential benefits of improvements to school facilities.

The presence of environmental hazards is particularly problematic in schools because the majority of those exposed are children who are uniquely vulnerable to many hazards. Eitland et al. (2017, pp. 6, 11, 20, 25) provide an overview of how various hazards impact children more severely than adults:

- Children breathe more air relative to their body size, increasing the severity of the effects of air pollution, poor Indoor Air Quality (IAQ), and poor ventilation.
- Children's developing brains are more extensively affected by some toxic chemicals, like lead.

- Children are less able to regulate their body temperature, making it harder to tolerate extreme heat or cold.
- Children's melatonin cycles are more easily disrupted than those of adults, particularly by a lack of natural light.
- Children are more sensitive to difficult listening conditions caused by noise pollution and poor acoustics because they are still developing their language skills.

The effects of IAQ, which encompass ventilation, airborne toxics (like asbestos or PM2.5), and temperature, are well studied. Poor IAQ is associated with increases in respiratory illness incidence of up to 370%, as well as more suspensions, slower task completion, and less learning (Baker & Bernstein, 2012; Filardo, 2006, 2016; Fisk et al., 2016). The prevalence of respiratory illness is primarily driven by an increase in the frequency and severity of asthma attacks, which often results in absences that lower daily attendance, which leads to in reductions to both the school's funding and student graduation rates (Filardo, 2016; Johnson et al., 2019; The Trust for Public Land, 2021b). Studies have shown that asthma is responsible for 13.8 million missed school days per year nationwide (Eitland et al., 2017). Within LA Unified alone, 63,000 students have asthma, and the condition is responsible for 18% of chronic absenteeism (The Trust for Public Land, 2021b).

Outside of IAQ, the effects of toxins like lead and asbestos on students and teachers are also well-documented. Lead is extremely detrimental to children's cognitive development, ability to regulate their emotions and behavior, and physical health; **there is no safe level of exposure** (Mayo Clinic, 2022). Exposure to asbestos in schools has caused an increased rate of mesothelioma among teachers (Ruderman & Graham, 2019; B. Walker, 2015). Poor quality school facilities in general increase the number of sick days taken by teachers, which reduces instructional quality and increases teacher attrition (J. Buckley et al., 2004; Filardo, 2006, 2021).

Beyond Health and Learning

It is important to recognize that the above hazard impacts do not capture the full extent of the consequences of unsustainable schools. National and state data snapshots are used in the following points to illustrate the health impacts of unsustainable schools and the hazardous effects they have on members of school communities.A significant but relatively recent body of literature details the impacts of school facilities on a wide range of outcomes for students, teachers, schools, and communities that go far beyond simple physical health and achievement on standardized testing. In examining school closures in Ghosts in the Schoolyard (2018), Eve Ewing writes that public discourse asks: "What kind of person goes to a failing school?" (p. 138). The same question could be asked about members of school communities with failing facilities: What kind of person goes to (or works at, or sends their child to) a school with lead in the water (or with asbestos in the walls, or without air conditioning, or with only asphalt to play on)? In this context, the physical conditions of schools in low-income communities of color reflect broader injustices in society. Moreover, Jonathan Kozol argues that poor school infrastructure can damage students' sense of self-worth when they perceive the government's failure to see them as worthy of safe, clean, and healthy spaces to learn (Kozol, 2005, 2012).

Beyond these negatives, however, another line of research has focused on the other side of the school facilities question—what happens when students have access to facilities that holistically support living and learning? In general, improved school facilities increase the property value of schools beyond what is invested (Filardo, 2016) and the property values of local homes (Filardo, 2006, 2021). Better school facilities boost enrollment and attendance, improve school accessibility for students with disabilities, enhance learning and academic performance, and rebuild community confidence in local schools (Baker & Bernstein, 2012; Crampton, 2009; Filardo, 2016). They can also play a positive role in sustaining student and neighborhood culture, fostering student joy and flourishing, and community mobilization and power (Syeed, 2022). Improved facilities attract investment, increase neighborhood social capital and cohesion, and provide jobs—closing the capital investment gap alone would produce nearly 950,000 jobs (Filardo, 2006, 2021; The Trust for Public Land, 2021c).

Scale

Lack of Data on Environmental Conditions of Schools

Schools represent the second largest sector of public infrastructure spending behind highways (Filardo, 2016). Despite this, there is little data available on the state of school facilities nationally. The most recent comprehensive federal assessment was undertaken by the Government Accountability Office (GAO) nearly 30 years ago. That report found that 60% of all schools had at least one major building system in disrepair and half of all schools had at least one problem with building environmental conditions. Addressing deferred maintenance would cost $113 billion (U.S. Government Accountability Office, 1995). This number does not include the construction of new schools, the modernization of existing schools, or upgrades that improve efficiency or resilience to climate-induced disasters. A more recent report estimated that 46% of schools have some form of environmental hazards (Eitland et al., 2017). Another GAO report (2020) found that more than 40% of districts need to replace their HVAC systems in at least half of their schools and 25% of districts need to replace lighting, roofing, and/or safety features in at least half of their schools. In total, the United States would need to spend an additional $85 billion per year to remedy existing problems, build necessary new schools, and make sure all schools are modern and technologically adequate (Filardo, 2021).

As of 2012, the last time the data was collected nationally, the average age of school buildings in the United States was 44 years (Alexander & Lewis, 2014). This means that the average school building was built in 1968—before the discovery of the health hazards associated with commonly used materials like lead and asbestos. As a result, in addition to building systems that fail due to age, many school buildings have widespread issues with these "legacy toxics." There are no national data sources on how many schools have lead paint or lead pipes. One study found that drinking water at 44% of schools across 12 states tested above the state's action limit for lead (Cradock et al., 2019). Another study found that drinking water in 1,300 California schools across 53% of reporting districts tested positive for lead (Colonnese, 2020). The last major study of asbestos in school buildings conducted by the federal government was in 1984 and found that 50% of districts had materials with asbestos in their schools (Greenblatt, 1984). In 2015, U.S. Senators Ed Markey (D-Mass.) and Barbara Boxer (D-Calif.) investigated asbestos in school buildings. In the 20 states that responded to their inquiry (not including California), 69.5% of districts had buildings with asbestos (Staff of Senator Ed Markey, 2015).

Nationally, schools spend $8 billion per year on energy. The EPA estimates that they could be reduced by as much as $2 billion if schools improved their energy efficiency.

School Facilities: More Than Just Classrooms

Discussions of school facilities traditionally included only the buildings themselves—not the grounds that surround them. There is a growing movement, however, that sees school grounds as a critical component of safe, climate-resilient, and sustainable communities. Partially as a cost-saving strategy, many urban schools have little green space because it is more cost-effective to maintain asphalt (Barboza, 2022). Even fewer (1% of all public schools) have green space that is available to the neighborhood community outside of school hours (The Trust for Public Land, 2021a). In LA Unified, for example, there are only 400 gardens, 150 edible teaching gardens, and 26 schoolyard habitats across more than 1,300 schools. The green space that does exist is often inequitably distributed and inaccessible to students or community members (The Trust for Public Land, 2021b).

Climate Change

Schools in low-income communities of color are often on the frontlines of climate change. The physical structures they inhabit play important roles in our ability to mitigate and adapt to the effects of a changing climate. One of the key strategies for mitigating climate change is reducing one's carbon footprint (i.e., the total amount of greenhouse gasses that are generated by an entity's actions). Many school buildings are old and energy-intensive because they are challenging to heat or cool, for example, giving them a disproportionately large carbon footprint (Filardo, 2021). Nationally, schools spend $8 billion per year on energy. The EPA estimates that they could be reduced by as much as $2 billion if schools improved their energy efficiency (U.S. Environmental Protection Agency, 2011).

Many schools are also located in places at risk for extreme weather events exacerbated by climate change. Across the country, nearly 6,500 schools are in counties that are in high-risk flooding areas (Stanley, 2022). In California, nearly 1 in 5 of the state's 10,000 schools are at moderate or high risk of flooding, the catastrophic consequences of which have been visible in the historic winter 2023 flooding (Peele et al., 2023). In recent years, there have been frequent school closures due to wildfires (Lambert, 2021), extreme heat (Tanenbaum, 2018), extreme cold (Wood & Richman, 2018), and floods (Cheves, 2022). Despite this, few school facilities are designed to withstand the increasing severity of these events, especially considering that schools are frequently used as shelters, command posts, and resource distribution sites during disasters (Filardo, 2021; The Trust for Public Land, 2021a, 2021b).

Racial Inequities of School Facilities

Problems with school facilities are not distributed evenly across the United States. Table 1 shows selected statistics from a GAO report (1996) on differences between schools in the United States. On every measure, schools with few non-white students or students with free/reduced-price lunch (a proxy for income) have better facility conditions than schools where the majority of students are non-white or on free/reduced-price lunch. The differences in schools with at least one inadequate building or building system are particularly striking: 25% of low poverty schools and 29% of predominantly Non-Latino/a White schools have at least one inadequate building, compared to 41% of high poverty and 42% of predominantly minority schools (U.S. GAO 1996). Other variables show similar patterns: 30% of predominantly minority schools have no unsatisfactory environmental conditions compared to 46% of predominantly Non-Latino/a White schools.

Table 1. Percent of schools with facilities problems by demographic characteristics.

	PERCENT OF SCHOOLS REPORTING				
Student body characteristics	**At least one inadequate building**	**At least one inadequate building system**	**No unsatisfactory environmental conditions**	**1–4 unsatisfactory environmental conditions**	**5+ unsatisfactory environmental conditions**
Free/reduced lunch					
Less than 20%	25.1	51.5	45.0	44.6	10.3
More than 70%	40.5	66.0	35.3	48.9	15.8
Non-White					
Less than 5.5%	28.7	54.1	45.9	41.9	12.2
More than 50.5%	42.0	69.9	30.0	53.2	16.9

Source: U.S. Government Accountability Office, 1996

These disparities persist today. A 2016 survey of California school facilities found that schools with lower quality facilities and a lack of green space have more students on free or reduced lunch and higher rates of suspension and expulsion (Eppley, 2017). These schools are also often in neighborhoods that lack access to parks, which are disproportionately inhabited by people of color, partially because of historic discriminatory real estate practices like redlining and racial covenants (Barboza, 2022; The Trust for Public Land, 2021a).

Inequities in School Facilities Finance

Inequities in school facilities are largely a product of inequitable school funding programs that systematically disadvantage predominantly non-White and low-income districts. School budgets are divided into two primary categories: operations, which includes instruction, personnel, and maintenance/operation of school facilities, and capital, which funds the construction of new schools and major renovations. School district operations budgets are typically composed of roughly 45% local funding, 45% state funding, and 10% federal funding (Filardo, 2016). Capital budgets, however, are primarily the responsibility of local districts, which contribute 77% of the funding on average, while the federal government contributes 1%. State contributions are highly variable—five states cover nearly all capital costs, 12 contribute nothing, and the rest fall somewhere in the middle for an average of 22% (Filardo, 2016, 2021). Additionally,

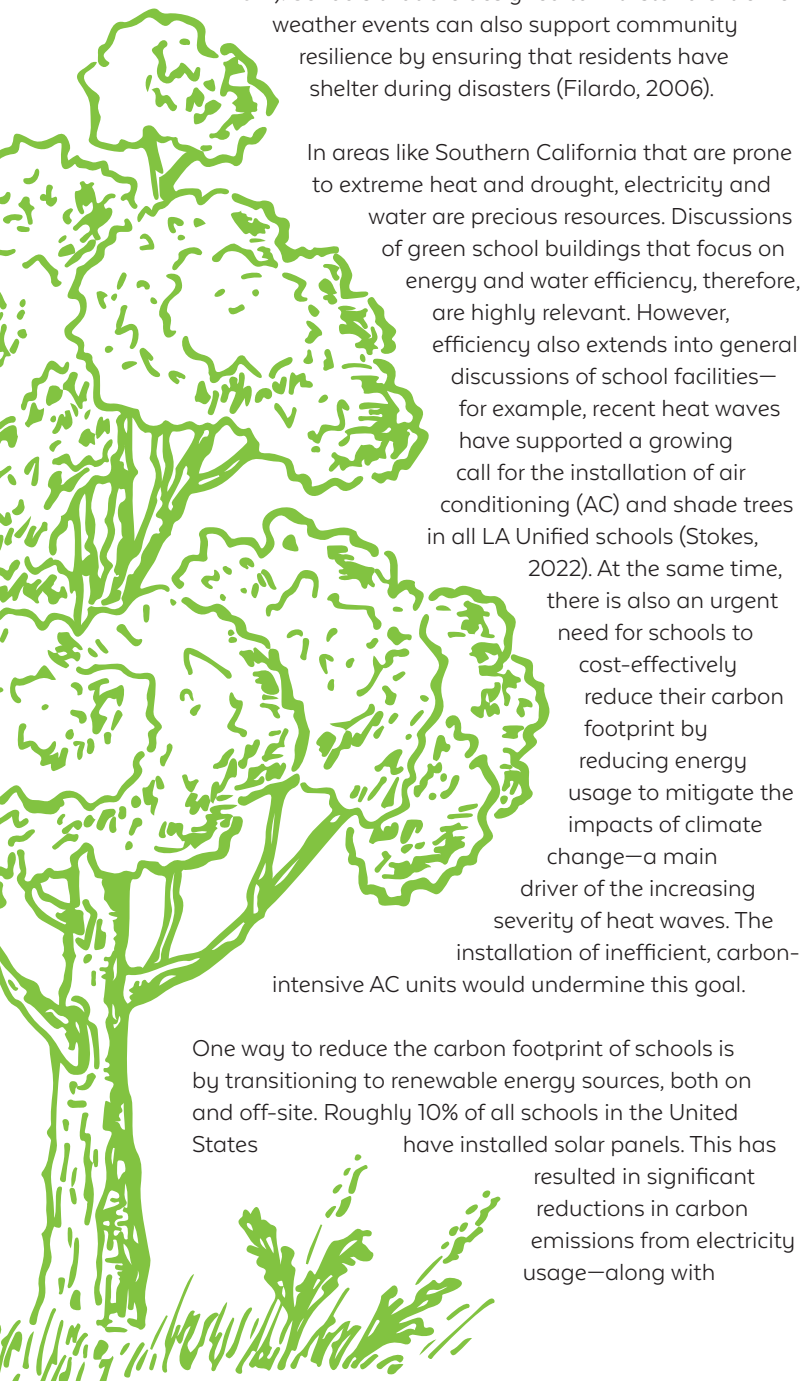
state contributions to capital funding have declined significantly nationwide since 2009 (Filardo, 2021). Funding for school facilities is, in many ways, more inequitable than general school instruction funding because it is seen as less important, particularly by the federal government.

In many states, contributions to capital construction projects are conditional on the ability of local districts to match funds (Vincent, 2014). In California, this resulted in the wealthiest districts receiving eight times as much state funding as the poorest districts ($5,361 compared to $661) (Fensterwald, 2019). Nationwide, high-income districts spend three times as much on capital projects as low-income districts (Filardo, 2016). What money low-income districts do spend is disproportionately used for emergency repairs and harm reduction rather than preventive action, resulting in massive quantities of deferred maintenance (Filardo, 2006, 2016). For example, as of September 2022, the cost of all deferred maintenance based on LA Unified's facilities condition assessment was estimated to be roughly $4.5 billion (LAUSD 2022). Race/ethnicity follows the same pattern—predominantly Non-Latino/a White districts spend significantly more on capital projects than districts with a majority of students of color. Finally, rural districts also have disproportionately poor school facilities because they face a trifecta of obstacles: low enrollment and therefore low funding, lots of space, and low organizational capacity (Filardo, 2021).

Making capital funding the responsibility of local districts means that the ability of districts to build new schools or make major renovations, including green spaces, to existing schools is directly tied to local wealth. Districts without a large tax base often cannot afford to replace or modernize schools without state and federal help until a catastrophic failure happens, creating a cycle of aging, disrepair, and crisis. Thus, as education and public policy scholar Mary Filardo notes, "increasing funding alone will not remedy the structural inequities and shortcomings of our nation's public education infrastructure" (Filardo, 2021, p.14). Truly solving the problem will require a complete overhaul of federal, state, and local education funding.

Green Schools

Green buildings are defined by the U.S. EPA (2011) as buildings that are energy and water efficient, designed to have minimal impact on the landscape, and built with sustainable materials that minimize consumption and waste. Prioritizing building and retrofitting schools to reflect these characteristics would help them play a leading role in the fight against global climate change and local pollution. For example, designing schools to be energy efficient would significantly reduce their fossil fuel consumption and reduce utility costs by as much as 25%, more than covering the cost of renovations (Filardo, 2021). Schools that are designed to withstand extreme weather events can also support community resilience by ensuring that residents have shelter during disasters (Filardo, 2006).



In areas like Southern California that are prone to extreme heat and drought, electricity and water are precious resources. Discussions of green school buildings that focus on energy and water efficiency, therefore, are highly relevant. However, efficiency also extends into general discussions of school facilities—for example, recent heat waves have supported a growing call for the installation of air conditioning (AC) and shade trees in all LA Unified schools (Stokes, 2022). At the same time, there is also an urgent need for schools to cost-effectively reduce their carbon footprint by reducing energy usage to mitigate the impacts of climate change—a main driver of the increasing severity of heat waves. The installation of inefficient, carbon-intensive AC units would undermine this goal.

One way to reduce the carbon footprint of schools is by transitioning to renewable energy sources, both on and off-site. Roughly 10% of all schools in the United States have installed solar panels. This has resulted in significant reductions in carbon emissions from electricity usage—along with millions of dollars in savings, which can be redirected to address other facilities problems or back into instruction (C. Buckley, 2022). However, there are two major obstacles to the installation of renewable energy sources on school campuses. First, they often have a relatively high up-front cost and second, they can introduce additional liability that school districts may be hesitant to take on. The first obstacle can be avoided in several ways. The U.S. EPA (2011) recommends reducing energy consumption first and using those savings to pay for renewable energy generation systems, or making agreements with third-party companies that pay for the installation and maintenance of renewable energy systems in exchange for locating them at a school (C. Buckley, 2022). It is less clear how to avoid the second obstacle, particularly when renewable energy sources are paid for and maintained by a third party on school land. Developing policies and legal agreements that protect schools and allow them to participate in these programs is an important area for future research and advocacy.

Table2. Financial Benefits of Green Schools

Area	Savings (per sqft.)
Energy	$9
Emissions	$1
Water and Wastewater	$1
Increased Earnings	$49
Asthma Reduction	$3
Cold and Flu Reduction	$5
Teacher Retention	$4
Employment Impact	$2
Total	$74
Cost of Greening	-$3
Net Financial Benefits	$71

Note: Reproduced from Kats (2006). Increased earnings refer to increased future earnings by graduates of green schools.

Reducing energy and water consumption and increasing efficiency are also important parts of developing green schools. This is particularly relevant when many building systems are near or beyond the end of their lifespan. Based on facilities data from September 2022, 40% of LA Unified schools have lighting systems beyond the end of their life. That number rises to 67% for plumbing, 80% for electrical, and 88% for HVAC (LAUSD 2022). Addressing the problems of even one system could result in major

reductions in energy consumption: Lighting alone can make up as much as 40% of a building's energy use, and heating and cooling systems can be 25% (U.S. Environmental Protection Agency, 2011). These reductions would also result in significant savings: Table 2 breaks down the cost savings of green schools. These include a net financial benefit of $71 per square foot. The specific techniques to reduce energy and water consumption and increase cost efficiencies are largely beyond the scope of this report, but they are described more in detail in this Environmental Protection Agency (EPA) report, *Energy Efficiency Programs in K-12 Schools: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs*, which also provides many other useful resources that support energy efficiency transitions.

Green Schoolyards

The definition of green buildings given at the beginning of this section lacks an emphasis on one of the key components of the current green schools discussion: green schoolyards (e.g. playgrounds, fields, turf, tree canopy). Perhaps the most talked about component of green schoolyards is the reduction of hardscape—asphalt, concrete, and other hard and impermeable surfaces. When the air temperature is 95°F, unshaded asphalt can reach up to 140°F, and rubber or artificial turf surfaces can go beyond 160°F—well above the temperatures necessary to cause burns (Aubrey, 2008; Knox, 2022; Munoz & Manthey, 2022). In addition to temperature concerns, there is growing evidence that artificial turf contains carcinogenic "forever" chemicals, including Per- and Polyfluorinated Substances (PFAS) (Persellin, 2019).

As a result, much of the work around green schoolyards focuses on replacing asphalt with green space or shading it with trees, either of which can reduce surface temperatures by more than 40°F and the temperature of the surrounding neighborhood by up to 6°F (Hertzberg & Montanez, 2022; Knox, 2022; A. Walker, 2022). This significantly reduces the urban heat island effect, which is created in part by large expanses of asphalt. However, green schoolyards are more than just about removing asphalt and planting trees. They reduce artificial turf and rubber play surfaces and introduce native plants, more permeable surfaces that support stormwater management, and provide outdoor learning spaces. These improvements offer a host of benefits, including increased flood resiliency, improved water quality, physical activity opportunities, better academic performance, and enhanced mental and physical health among students and teachers (Filardo, 2016; Hertzberg & Montanez, 2022; Noon, 2015; The Trust for Public Land, 2021b, 2021c, 2021d).

Green schoolyards are a particularly pressing environmental justice issue in Los Angeles' low-income neighborhoods and communities of color, which disproportionately lack green amenities (Barboza, 2022). With more than 6,400 acres of property, LA Unified is the single largest landowner in the Los Angeles area (The Trust for Public Land, 2021b). However, because of long-standing cost-saving measures (resulting from state and federal under-funding), many of LA Unified's schools have little to no access to green space. Twenty percent of schools have no trees on their grounds (Walker, 2022), according to the district's Greening Index. The Greening Index is a measure of a school's outdoor environmental amenities and community needs (discussed in detail in the next section). A school's green index score is based on the percentage of green space on their campus and the Los Angeles County Parks Needs Assessment, which considers population density and how close a community is to a public park (LAUSD Sustainability Initiatives Unit, n.d.-a).

The average percentage of LA Unified school grounds covered by green space for the 671 schools included in the Greening Index is 17.44%—a number that includes artificial turf and does not necessarily guarantee that students actually have access to the green space during school hours (The Trust for Public Land, 2021b). In response to calls to expand access to green space on school grounds, LA Unified created the "Greening Index," which is evaluated in the next section.

LA Unified Greening Index

Top 100 Ranked Campuses Geographically

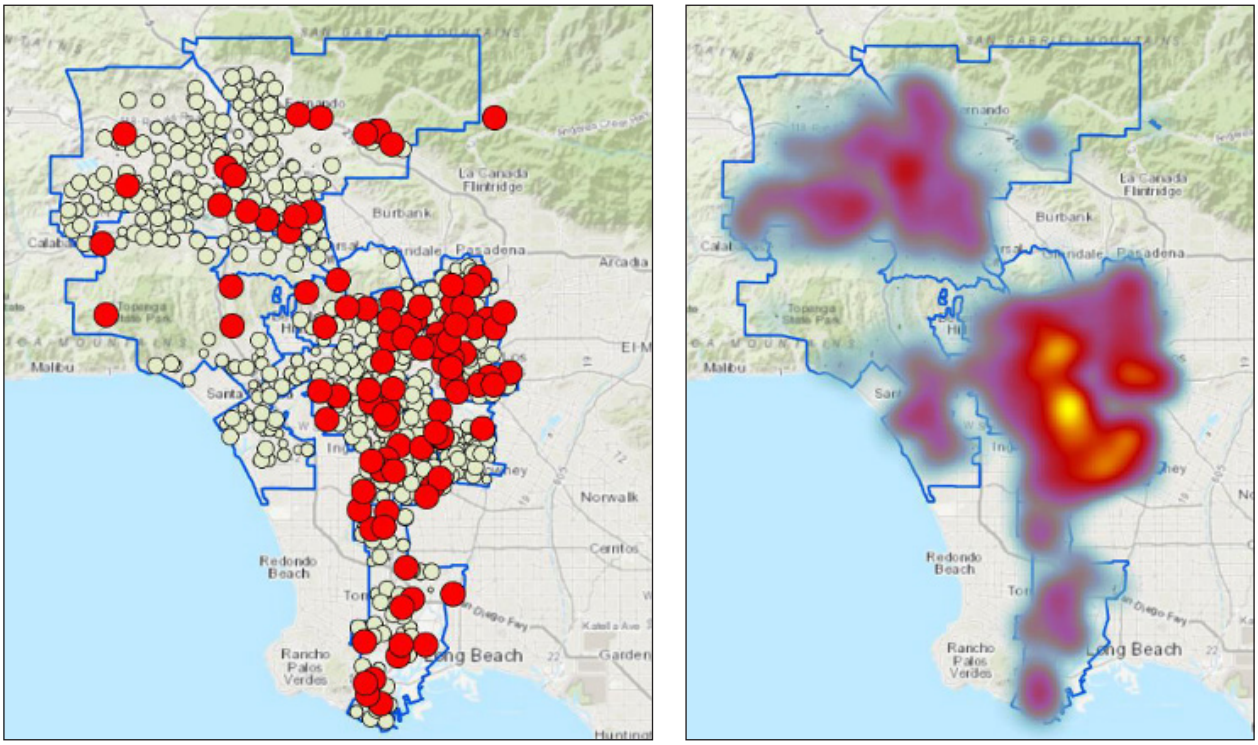
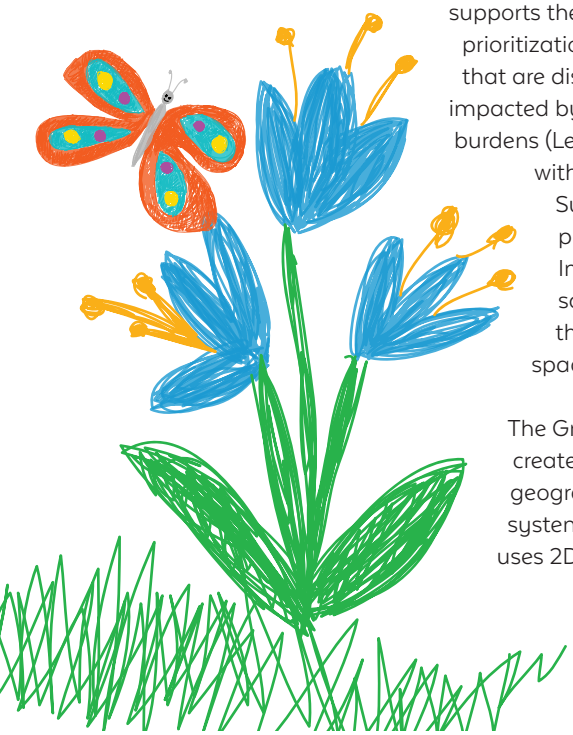


Figure 2: Left: Top 100 schools in need of greening (marked in red) according to LA Unified's Greening Index. Right: Heat map of areas with schools that are most in need of greening (yellow is the highest need). Source

Renowned environmental justice scholar and practitioner Charles Lee identifies mapping as critical to advancing environmental justice because it supports the identification and prioritization of communities that are disproportionately impacted by environmental burdens (Lee, 2021). In keeping with this, the LA Unified Sustainability Initiative published a "Greening Index" that ranks 671 schools according to their need for green space on school grounds.



The Greening Index was created using ArcGIS, a geographic information system software that uses 2D and 3D maps to spatially display environmental patterns. The Greening Index rankings are determined by combining data from the LA County Park Needs Assessment and the LA Unified Facilities Condition Assessment (LAUSD Sustainability Initiatives Unit, n.d.a). The LA County Park Needs Assessment divided the county into 188 study areas and calculated how urgently parks were needed in each area according to the number, condition, and accessibility of existing parks and population density. This metric makes up 40% of the Greening Index. The LA Unified Facilities Condition Assessment calculated the square footage of green space and hardscape on the grounds of each school. The percentage of school grounds made up of green space makes up 60% of the Greening Index. Figure 2 shows the locations of 100 schools identified by the index as the highest priority for school greening (left) and the areas with the highest concentrations of schools that the Greening Index indicates should be prioritized for greening (right). These schools are spread throughout the district, but are most concentrated in central LA.

Figure 3. Satellite imagery of Mayberry Street Elementary School's grounds. Source: Google Maps.

Limitations of the LA Unified Greening Index

While the LA Unified Greening Index is an important step to assess environmental justice in schools, it has several limitations. First, the full data used to calculate scores are not available to the public (via open-sourced platform) and were not included in documents received through public records requests. Second, it is unclear when the data that the index is based on was collected. Some education advocates believe that some of the data could be 10 years or older. This is supported by the fact that the last Facilities Condition Assessment began in 2012 (Hovatter, 2015). Third, the reliance on park space outside of school grounds may be useful for considering whether green spaces on school campuses should be open to the public. However, it is less helpful for understanding the experiences of children within particular schools.

The LA County Park Needs Assessment study areas are large and are not based on particular school district areas. Therefore, while it does provide insight into which schools are near public parks, the assessment may not show smaller urban heat island effects on school campuses.

More importantly, it fails to analyze how green spaces may alleviate the effects of the high temperatures created by hardscape while students are outside during the school day. For example, 98% of Mayberry Street Elementary's grounds (in the Echo Park neighborhood and pictured in Figure 3) are hardscape, but it is ranked 312th of 671 schools because it is located in an area that is moderately close to existing parks. These nearby parks do not change the fact that Mayberry students spend recess on sweltering asphalt instead of shaded grass fields and other green spaces. Finally, LA Unified's methodology notes that it includes artificial turf in its definition of green space. As previously noted, such surfaces can be hotter than asphalt reaching above 160°F and leak carcinogenic compounds, like PFAS.

Mayberry Street Elementary, like many of the schools in LA Unified with little to no green space, has a student body that is more than 95% Latino/a. Figures 4–6 demonstrate similar patterns of racialized access to green space and exposure to extreme temperatures.

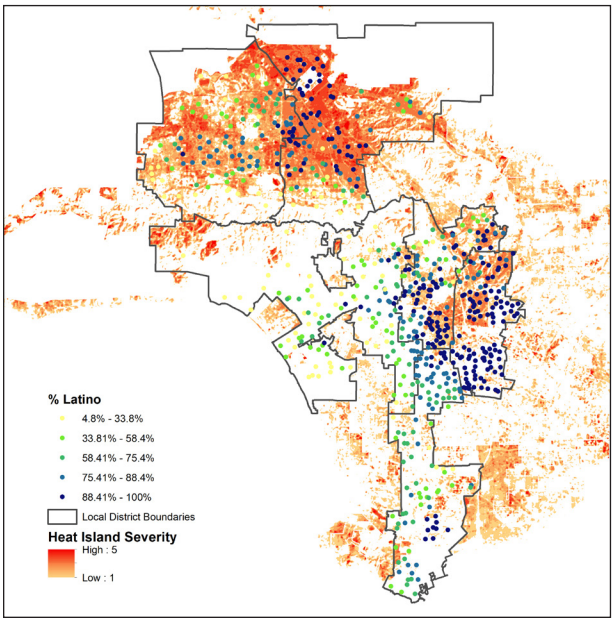


Figure 4. Latino/a student population and green space on school grounds. Figure created by Margaret Tebbe. Data source: LA Unified.

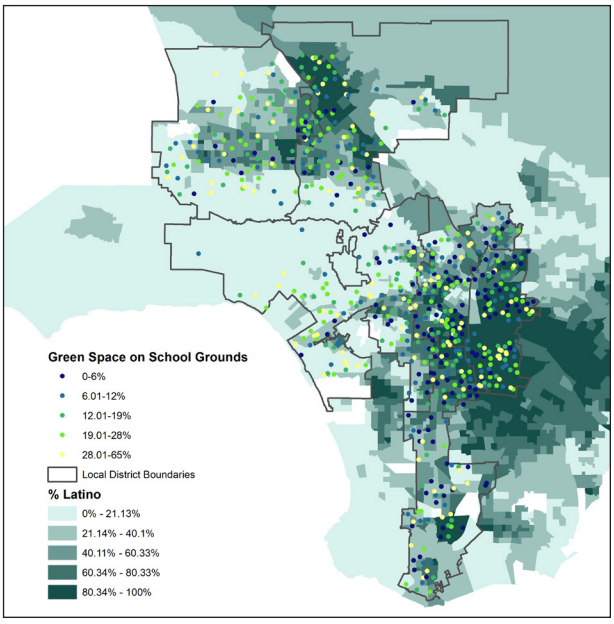


Figure 5. Latino/a student population and heat islands. Figure created by Margaret Tebbe. Data sources: LA Unified, Trust for Public Land.

Figure 4 overlays each school's percentage of green space on the percentage of the student body that is Latino/a. Of the 106 schools with less than 5% green space on their campus, 38% (41) are more than 90% Latino/a and 86% (91) are more than 50% Latino/a. Of the 230 schools with less than 10% green space, 37% (86) are more than 90% Latino/a and 86% (197) are more than 50% Latino/a.

Figure 5 overlays the percentage of each school's student body that is Latino/a on urban heat islands. As previously noted, urban heat islands are defined by the Trust for Public Land as areas that have temperatures above average for their city. In the Los Angeles area, heat islands correlate fairly closely with the Latino/a population. LA Unified's largest and most severe heat island is the eastern San Fernando Valley (e.g. neighborhoods of Sun Valley, Pacoima, Sylmar, North Hollywood), with schools that are almost entirely Latino/a. East and Northeast LA, such as Boyle Heights and the San Fernando Valley, are also major heat islands populated almost entirely by Latino/as.

Figure 6 overlays tree canopy coverage and the percentage of each school's student body that is Latino/a. For example, the western San Fernando Valley (e.g. Woodland Hills, Chatsworth, Encino) has fewer Latino/as and more tree canopy than the eastern portion (e.g. Pacomia and Sun Valley), and Latino/a students surrounding downtown Los Angeles have the least tree canopy. Taken together, Figures 4–6 demonstrate that heat islands, scarcity of tree canopy, and lack of green spaces at schools are major issues

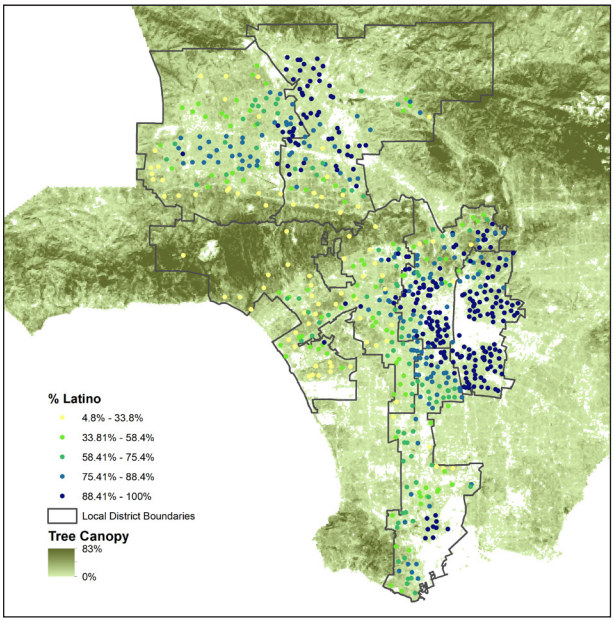


Figure 6. Latino/a student population and tree canopy. Figure created by Margaret Tebbe. Data sources: LA Unified, U.S. Forest Service.

for LA's Latino/a communities. Greening efforts should, therefore, also ensure a focus on equity for schools and neighborhoods whose infrastructure has been historically underdeveloped, making them less prepared to adapt to and mitigate climate change.

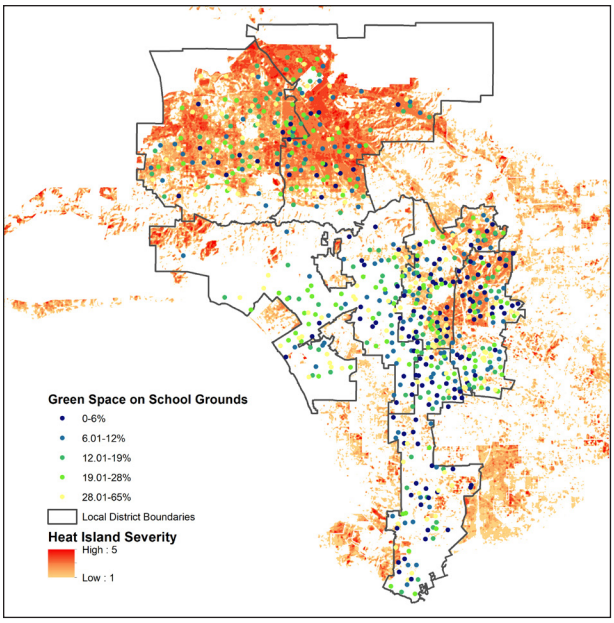


Figure 7. Heat islands and green space on school grounds. Figure created by Margaret Tebbe. Data sources: LA Unified, Trust for Public Land.

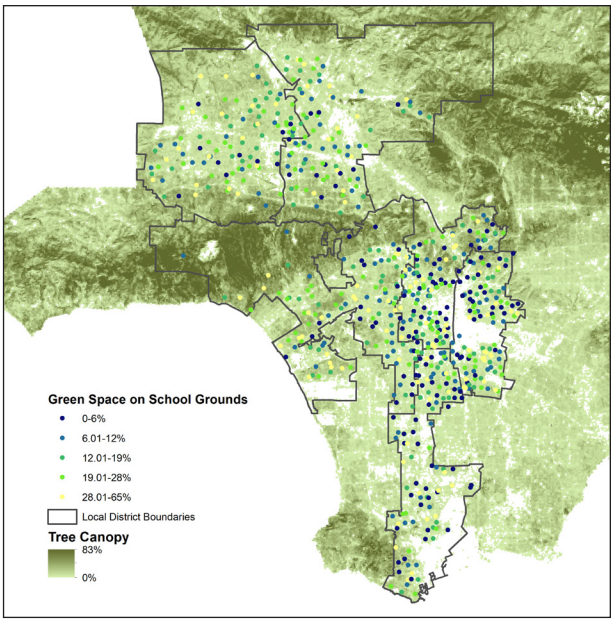


Figure 8. Tree canopy and green space on school grounds. Figure created by Margaret Tebbe. Data sources: LA Unified, U.S. Forest Service.

Figures 7 and 8 show the relationships between green space on school grounds, heat islands, and tree canopy coverage. Schools with little green space have large expanses of hardscape (concrete, asphalt, etc.) that contribute to the urban heat island effect, raising temperatures not just at the school but in surrounding spaces as well. Schools that lack green space and are located in heat islands will be disproportionately impacted by extreme heat and should be prioritized in greening efforts. Figure 7 shows across LA-area heat islands, there are a significant number of schools with grounds that have less than 10% of green spaces.

Figure 8 shows that many schools with little green space are located in regions of the city with low tree canopy. In particular, the area surrounding downtown Los Angeles and the corridor that follows the 110 freeway to the port cities have high numbers of schools with low tree canopy. Tree canopy provides several benefits, including reductions of 20–45 degrees Fahrenheit in shaded areas compared to non-shaded areas (U.S. EPA, 2022). Increasing the number of trees in an area is also a critical strategy for reducing the urban heat island effect and cooling children's play spaces and other school facilities.

Figures 9 through 11 show the relationship between LA Unified's Greening Index and heat islands, tree canopy, and Latino/a student population. As noted above in the discussion of Figure 7, schools with very little green space located in heat islands should be prioritized. Figure 9 shows that LA Unified's Greening Index does not do this, particularly in the San Fernando Valley and areas immediately north of downtown LA. Instead, it focuses on schools in South and East LA that have little green space but are not located in heat islands.

Figure 10 shows that LA Unified's Greening Index generally succeeds at prioritizing schools that have little green space and are located in areas with low tree cover. However, it does deprioritize some schools with low surrounding tree canopy in Gardena, Torrance, and the San Fernando Valley.

Given that the environmental hazards and benefits that produce extreme heat are unevenly distributed across racial lines in Los Angeles, as is evidenced by Figures 4–6, it is important for the Greening Index to prioritize racial equity. Figure 11 shows that LA Unified's index succeeds in doing this in the major Latino/a centers of South and East LA, but deprioritized Latino/a schools in the Northern East San Fernando Valley and near the harbor cities.

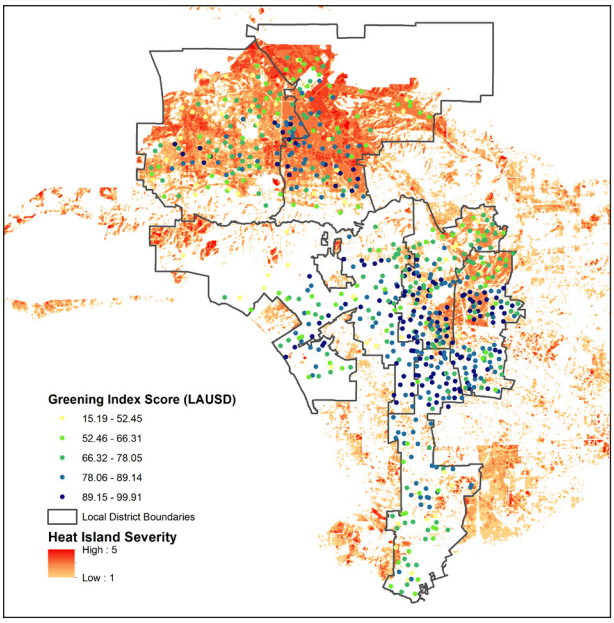


Figure 9. LA Unified's Greening Index and heat islands. Figure created by Margaret Tebbe. Data sources: LA Unified, Trust for Public Land.

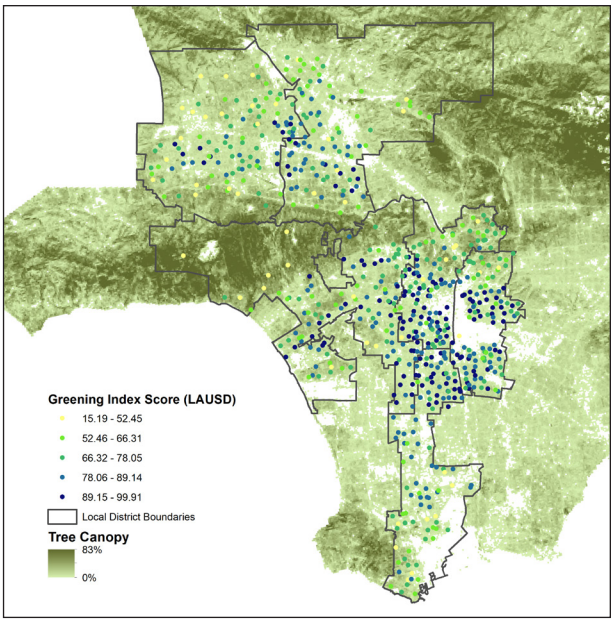


Figure 10. LA Unified's Greening Index and tree canopy. Figure created by Margaret Tebbe. Data sources: LA Unified, U.S. Forest Service.

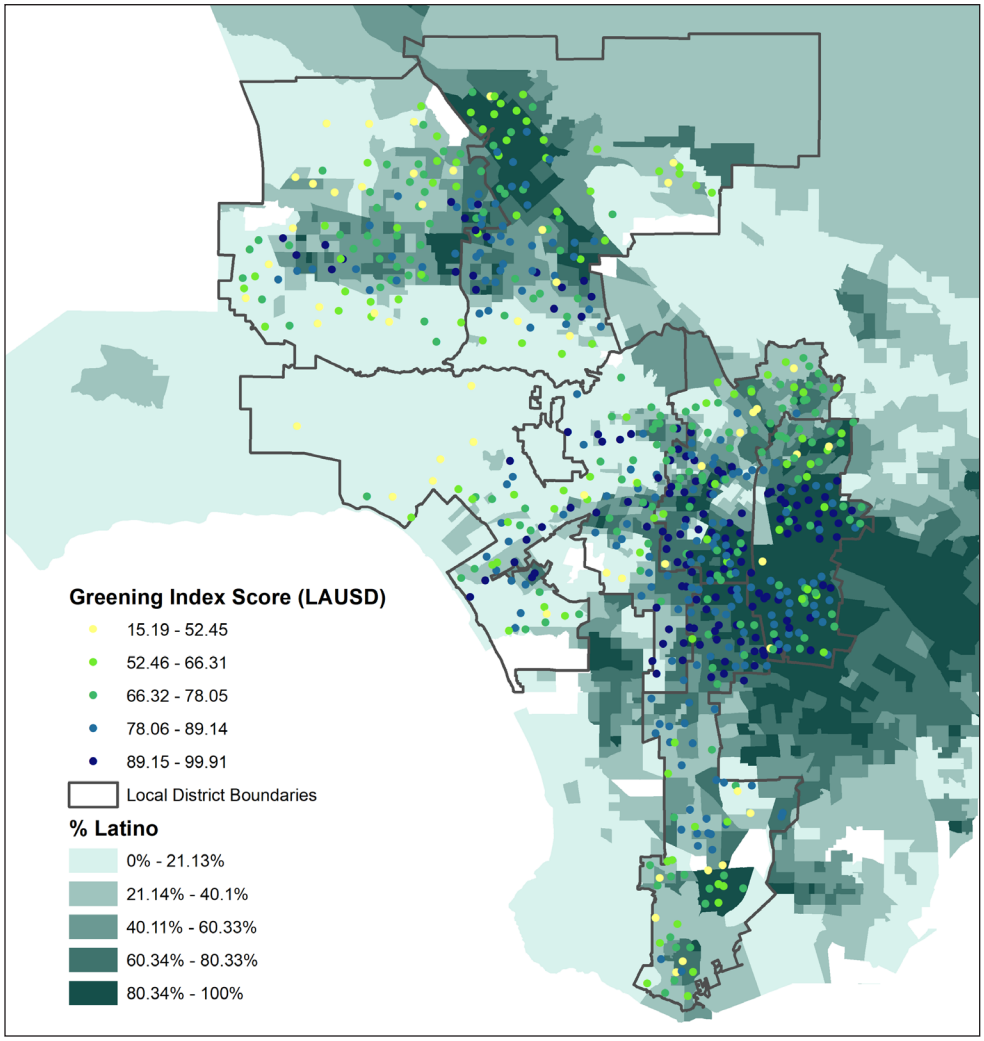


Figure 11. LA Unified's Greening Index and Latino/a student body populations. Figure created by Margaret Tebbe. Data source: LA Unified.

Building an Alternative Greening Index

Schools that are located in heat islands that have low tree canopy or have little green space on campus are likely to experience the most severe effects of extreme heat. As demonstrated above, the LA Unified Greening Index does not adequately prioritize these schools. Instead, it generally targets schools that lack access to nearby neighborhood parks. As a result, we developed an alternative greening index that focuses on three variables that shape temperatures on school campuses--heat islands, tree canopy, and green space--while also attending to racial disparities in exposure to extreme heat.

The data used to develop the alternative greening index comes from the Trust for Public Land (urban heat islands), the U.S. Forest Service (tree canopy), and LA Unified (percent green space at each school).

Each school was assigned a value for each of these three variables on a scale of 0 to 100, with 0 being the worst (severe heat island, no tree canopy, or no green space) and 100 being the best. We then created an alternative greening index, weighting each of the three scores as follows:

We flipped the values so the highest scores were the schools most in need of greening, matching LA Unified's index. Finally, we compared the alternative index to heat islands, tree canopy, and the concentration of Latino/a students.

Like LA Unified's Greening Index, this index does not include race or other demographic characteristics in its calculations. Overall, the index is fairly similar to LA Unified's in terms of prioritizing Latino/a populations. The differences are primarily in which areas are emphasized: LA Unified prioritizes areas like Huntington Park in South LA, which is not a heat island but does lack park access, while our index (shown in Figure 13) prioritizes areas like the east San Fernando Valley that may have more tree canopy but are severe heat islands. To explore the alternative greening index further, visit the online interactive map here.

In summary, it is almost impossible for a single index, especially one that is not open-source or verified by local community groups, to quantify which schools are most in need of school greening in a way that reflects the complex environmental inequities present in LA Unified schools. Factors taken into account by the index should be carefully chosen with parent and community leaders to reflect the goals of school greening, whether that is beautification, extreme heat mitigation, or expansion of safe recreational space. The heat wave that impacted the Los Angeles area in early September 2022 demonstrated that extreme heat mitigation is a high priority for many Los Angeles parents. Therefore, school Greening Indexes must include factors to indicate which schools are most vulnerable to extreme heat.

*Greening Index = (% Green Space * 50%) + (% Tree Canopy * 40%) + (Heat Island * 10%)*

Results of Alternative Greening Index

Figure 12 maps our alternative greening index based on tree canopy, heat islands, and existing green space on school grounds. This map shows that this index heavily, but not exclusively, prioritizes schools located in heat islands. The highest priority schools under this alternative index are located in the northeastern San Fernando Valley, Downtown LA, and Northeast LA, with some schools throughout South LA, the harbor cities, and the western San Fernando Valley.

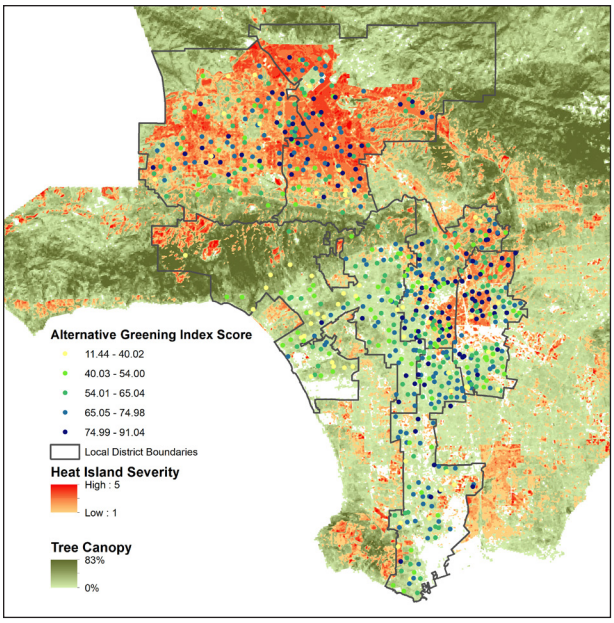


Figure 12. Alternative Greening Index, tree canopy, and heat islands. Figure created by Margaret Tebbe. Data sources: LA Unified, Trust for Public Land, U.S. Forest Service.

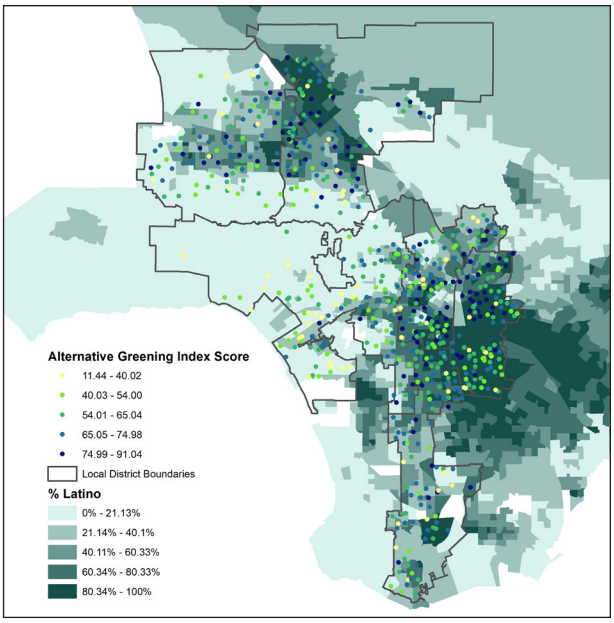


Figure 13. Alternative Greening Index and Latino/a student populations. Figure created by Margaret Tebbe. Data sources: LA Unified, Trust for Public Land, U.S. Forest Service.

Recommendations

Creating sustainable school buildings and playgrounds that adapt to our changing climate is imperative. However, schools continue to be constructed and maintained toward the status quo—concrete playgrounds and climate-inefficient buildings. In this context, our report is inspired by painter Vincent van Gogh's quote, "Normality is a paved road: It's comfortable to walk but no flowers grow." There are often few opportunities to enable asphalt-paved school grounds to flourish sustainably and protect students from the changing environment.

We provided an alternative greening index and a critical synthesis of research on facilities and green schools through the case study of the Los Angeles Unified School District. LA Unified is the second largest school district in the country, serving nearly 600,000 students, nearly 75% of whom are Latino/a. In particular, our report explored how Latino/a students are disproportionately exposed to climate change impacts and environmental injustices in their schools. The following policy recommendations provide opportunities to move away from the normality of concrete/asphalt paved schoolyards and unsustainable classrooms and towards more equitable and climate-resilient environments.

1. Green Schoolyards

In 2022, LA Unified assigned $58 million for green schoolyards and the state of California allocated $150 million in funding, unfortunately the $150 million in funding was vetoed by Governor Newsom and never made its way to schools (Arizon, 2022; Stone, 2022). Additionally, Board Member Kelly Gonez introduced a resolution that directs the Superintendent to develop a plan that sets a minimum threshold of 30% green space for playgrounds by 2035, prioritizing schools with the most asphalt for immediate action. The resolution was passed unanimously. The following recommendations represent considerations that local communities should take as they plan and finance their green schoolyards strategy.

a. Prioritize removal of asphalt, concrete, and artificial turf/synthetic playfields.

Artificial turf may contain harmful chemicals like PFAS that may leak into water supplies and is not recyclable. Even in drought-prone regions like Southern California, artificial turf is not recommended (Santa Clara Valley Water District, 2014). Community groups and education leaders should advocate for the removal of artificial turf

along with asphalt in school greening projects. Alternative permeable surfaces include wood chips and grass-gravel mixes (Urban Green-Blue Grids for Resilient Cities, n.d.).

b. Plan and advocate for green schoolyards that incorporate green stormwater infrastructure that collects runoff from other sites.

Stormwater capture is one of the most important functions of green schoolyards. The inclusion of permeable surfaces in schoolyards reduces the likelihood of sewage overflows into water sources, improves the quality of stormwater re-entering water sources, enhances native habitats, provides groundwater recharge, and cools the school and surrounding areas (The Trust for Public Land, 2021b). This is particularly true when schoolyards are planned to capture stormwater produced off-site, not just water from the school site itself (Bloome & Lipkis, 2015). The local environmental nonprofit TreePeople is currently conducting a pilot study that will focus on greening, water capture, and climate resilience for 10 LA Unified schools. They are entering the design process for each of the 10 schools and plan to collect feedback from school communities in the 2023–24 school year. These types of programs should be expanded throughout the district to support this work and incorporate the findings into future plans for school greening projects.

LA Unified should continue to work closely with the Los Angeles Department of Water and Power and the Metropolitan Water District of Southern California to identify priority campuses to develop green schoolyards that incorporate sustainable stormwater infrastructure that collects runoff from schools and surrounding sites. These projects could be partially funded from the 2018 Los Angeles County voter-approved Measure W, a special parcel tax funding the Safe, Clean Water Program (SCWP).

c. Develop plans for the long-term maintenance and management of green schools.

Green schoolyards, like all school facilities, are not one-time investments. They require long-term funding and support for maintenance (watering trees and other plants, etc.). This long-term support is one reason why it has been LA Unified policy to lay down asphalt in outdoor spaces instead of grass or other green surfaces. When developing plans for green schoolyards, LA Unified should take into account the need to plan for long-term maintenance of these spaces. TreePeople's standards can serve as a benchmark for the duration of these plans. They require plans for at least three years of maintenance and aim to plan for at least five.

d. Explore the possibility of joint-use agreements with local and regional governments, businesses, and community-based organizations.

A popular way to reduce the costs associated with implementing green schoolyards is the negotiation of joint-use agreements between school districts and local government organizations —typically parks and recreation departments. These agreements divide the cost of creating a new park on school grounds between multiple organizations, making it more affordable for all organizations involved and ensuring that the parks are accessible to the entire community after school hours, rather than being locked away. Although joint-use agreements tend to be made between school districts and other government organizations, it is also possible for them to be made between districts and community-based organizations. However, these agreements and the designs that result from them must meaningfully consider the desires and concerns of community members, who may fear that making school grounds public could invite activities that would make them unsafe.

e. Continue developing a more sophisticated Greening Index that is community-based and open source.

Arsenio Mataka has identified six key characteristics of successful environmental justice mapping tools (Lee, 2021):

1. Science-based
2. Informed by community experience
3. Endorsed and utilized by government
4. Available statewide to everybody
5. Made with thorough public participation
6. Validated by third parties

This report presents one alternative method of creating a greening index. However, it is only a starting point. Greater engagement of key stakeholders is critical. LA Unified staff and administration, parents, and community leaders should continue to work with geographic information systems specialists to develop this Greening Index so that it ranks the schools most in need of greening according to priorities articulated by students and other community experts during participatory mapping processes. The index should also consider equity, making sure that groups that have historically faced environmental racism and other forms of discrimination are prioritized. Once created, the index, along with its component data and layers, should be made available for everyone to view, download, validate, and reuse, in keeping with open-source data practices. The alternative greening index developed for this report is available online here.

2. Green School Buildings

Although most of the green schools conversation in California is currently focused on schoolyards, there are still many toxic, dilapidated, and inefficient buildings in the LA Unified school district. Environmental injustice cannot be eliminated in schools unless both the inside and outside of buildings are safe and efficient. There is less precedent for collaboration between school districts and outside organizations on renovations of school buildings/classrooms than for schoolyards, so this list of recommendations focuses on actions that community groups should advocate for LA Unified to take.

a. Make information about facilities condition assessments easily accessible to the public.

LA Unified school facilities condition assessment reports should be made publicly available and include more key data. Access was requested via the Public Records Act for the development of this report and Facilities Condition Index (FCI) scores, including repair and replacement costs, for all schools were given. Some of this information is publicly available, but not easily accessible online. No context (e.g., date collected, methodology, specific problems with school facilities) is provided.

The lack of data is an obstacle to organizing and advocacy around school facilities. Without specific facilities information, it is difficult to understand the scope of the facilities issues facing LA Unified, much less the challenges facing a particular school. LA Unified should make full school facilities condition reports available to the public, along with materials that contextualize the data and explain technical terms to the general public. Other large school districts that have conducted major facilities assessments include the School District of Philadelphia, which could be used as a model for how this information should be provided to the public.

b. Conduct a new facilities condition assessment focused on sustainability and climate resiliency.

Traditional facilities condition assessments focus on whether existing school building systems are in disrepair or beyond the end of their service life and what it would cost to replace them with a similar system. However, the growing threat of climate change demands that schools transition to more resource-efficient and sustainable systems and adapt to withstand increasingly frequent extreme weather events. A new facilities condition assessment should be developed that goes beyond service life to understand the current capacity of various building systems, particularly in a rapidly changing climate. This allows for analysis of what needs to be done to ensure that buildings are operating efficiently: For example, right-sizing HVAC systems can reduce energy consumption by up to 50% (U.S. Environmental Protection Agency, 2011). Similarly, assessments should also consider what types of climate-change-related disasters are likely to occur around a school in the next few decades and what should be done to prepare schools not only to withstand them but also to potentially serve as a place of refuge or supply distribution. For example, schools in Los Angeles should be built to withstand increasingly severe heat and flooding in between periods of drought (Zhong, 2022).

c. Install renewable energy sources on school sites and explore options for purchasing energy solely from renewable sources.

To mitigate the effects of climate change, schools should move toward carbon neutrality as soon as possible. LA Unified has already set the ambitious goal of transitioning to 100% renewable energy sources for electricity by 2030 and for all other energy uses by 2040 (Los Angeles Unified School District Board of Education, 2019). As part of this effort, LA Unified has installed solar panels at 64 sites and a ground source heat pump that regulates building temperature at one site (LAUSD Sustainability Initiatives Unit, n.d.-b, n.d.-a). This is a meaningful start, but there are more than 1,000 schools in LA Unified that could also host renewable energy sources. Installations at more schools could be paid for by savings from ongoing retro-commissioning processes and energy reduction efforts or by partnerships with third-party companies. Schools located near environmental hazards and pollution sources should be provided priority installation of such renewal energy sources.

d. Use community-engaged research methods to ground-truth existing facilities condition assessments.

Official facilities data generally does not always reflect the realities experienced by people on the ground. Many of the metrics used in facilities condition assessments and other evaluations are highly technical for students, parents, or community members to conduct their own full assessments. But they can ground-truth (validate) key data points in the district's facilities conditions assessments. Community science technology to test for legacy toxins like lead and asbestos and conditions of extreme heat are relatively inexpensive (UCI Public Health, 2022) and are becoming more accessible. Community members can use these technologies, along with photographs, surveys, and interview accounts of their experiences, to verify or dispute official accounts of school facilities.

3. Eco-Sustainability Office

The newly established Eco-Sustainability Office has been developed to oversee greening and climate resilient projects in LAUSD schools. This office should ensure that climate resilient projects are being prioritized for all schools through an equitable lens. This is critical to developing an effective strategy for addressing climate change—siloing of efforts is a real and present threat. Moreover, a parent and community taskforce should be established to advise the district on equitable greening school projects.

4. Community Engagement

Achieving safe, equitable, resilient, and green school facilities will be impossible without support from parents and other community members.

a. Train parents and community members to understand challenges and opportunities with school facilities, greening projects, facilities planning processes, and decision-making processes.

Although some specific facilities issues have received significant attention (e.g., asphalt during heat waves and ventilation during the height of COVID-19), most school stakeholders know relatively little about the importance and impacts of school facilities. For example, some community members may oppose removing asphalt from schoolyards and replacing it with grass because grass is more expensive, and they feel the money would be better spent directly on educational instruction. It will be important to spend time informing community members about both the negative impacts of poor school facilities and the potential benefits of fixing these problems, focusing especially on academic and public health benefits. These educational outreach efforts are necessary because school facilities funding often comes from bond measures that require 55% of the vote to pass. Parents and other community members need to understand how decisions about school facilities are made and where there are opportunities for them to make their voices heard.

b. Establish meaningful and equitable participatory design processes that include parents, students, and other community members.

LA Unified should develop meaningful participatory design processes for school facilities that engage parents, students, and other community members. Truly engaging these stakeholders means treating them as having a voice equal to that of technical experts like architects and engineers. In addition, participatory opportunities for stakeholders should include a broad variety of backgrounds to engage in the process.

Designing these participatory design processes should be guided by the Four Pillars of Procedural Justice (The Justice Collaboratory, n.d.):

- Participants are treated with respect and dignity.
- All participants are given space to use their voices and tell their story.
- Decision-makers demonstrate trustworthy motives.
- Decisions are transparent and unbiased.

Offering parents, children, and other stakeholders the chance to participate in decision-making processes at their school is important for more than just eliminating environmental hazards in schools and making them greener and more resilient. Achieving procedural justice offers the chance to build the community's trust in the school system and create a sense of collective ownership of the school. For children specifically, it is a rare opportunity to self-determine what their surroundings look like and a learning opportunity that helps prepare them for potentially entering green careers in the future (The Trust for Public Land, 2021c, 2021d).

5. Funding

Few of the recommendations discussed above are possible without funding. The following recommendations focus on methods to secure funding for school facilities and green school projects.

a. Prioritize achieving equity and alleviating disproportionate burdens when allocating funds.

Inadequate school facilities are not equally distributed across all populations—schools that serve non-White students (particularly Black, Latino/a, and Indigenous students) and/or low-income students are significantly more likely to have problems with school facilities (Eppley, 2017). Outside of schools, neighborhoods that are predominantly non-White and/or low-income are also less likely to have parks and more likely to be at risk for climate-related disasters (Bullard, 2011; The Trust for Public Land, 2021b). This means that an equitable funding process would prioritize renovation and greening projects for schools that face the heaviest environmental burdens.

Moreover, part of making school facilities funding equitable is eliminating requirements for matching funds. For example, many school bond measures passed at the state level either require districts to demonstrate that they can match the state's contribution or prioritize districts that can match. This disadvantages districts like LA Unified that primarily serve low-income populations

and therefore have less revenue. LA Unified and education leaders should advocate for the removal of matching requirements from state funding for school facilities.

b. Make funding allocation decisions participatory and transparent.

Funding allocation is part and parcel of facilities planning and design processes, and the lack of opportunity for meaningful participation and transparency of the broader planning process extends to funding. LA Unified should create a funding allocation process that is based on a clear and equitable set of criteria that is developed in cooperation with community members.

Conclusion

Climate change and the current physical condition of school buildings and school grounds in low-income communities of color have exacerbated environmental injustice and created a new front for a broader injustice occurring in Los Angeles and across the country. Many school buildings are inefficient, in disrepair, and located on toxic sites or in the path of climate-related disasters. These schools disproportionately serve students of color, especially Latino/a youth, and low-income students. Poor school infrastructure and public disinvestments can impact students' sense of self-worth when they perceive the government's failure as a reflection of their worthiness of safe, clean, and healthy spaces to learn. All students deserve not simply adequate learning environments but those that also allow them to thrive. It is therefore critical to direct resources and attention toward rebuilding schools that keep children safe and support global efforts to reduce pollution and adapt to the effects of climate change.

This report reviewed existing research on the state of school facilities across the United States and on the characteristics, benefits, and costs of green schools. It also brought together unique data on heat islands, tree canopy, and green space at schools to create a new Greening Index. This new Greening Index addresses some of the concerns about LA Unified's existing index brought up by Latino/a parents during the recent heatwave. Namely, that the index did not reflect childrens' experiences with extreme heat at schools. However, the new index itself could be strengthened with greater community input and open-source data, so it too should be used with care. The reality is that there are many schools in LA Unified that are desperately in need of green space—but it is a first step toward thinking about more equitable methods to prioritize schools. In sum, at the core of all the recommendations in this report is the goal of authentically engaging communities and making schools in LA Unified safe, greener, and climate-resilient in order to ensure the well-being and academic success of all students.

Appendix

Existing Programs, Organizations, and Legislature

Legislation & Budget Items

AB 2566 (2022): This state bill allocates $50 million for school greening projects focused on urban forestry, administered by the California Department of Forestry and Fire Protection (CAL FIRE). The state bill was vetoed by Governor Newsom on September 25, 2022. Any future attempts to pass legislation with similar goals and budgetary language as AB 2566 is supported by Alliance for a Better Community. Despite the state bill being vetoed by the Governor, the LA Unified 2023-2024 budget has increased the funding to $150 million for the creation and upgrades of greening projects on campuses, with much of the funding already being allocated to LA Unified partners for green projects on campuses (Gonez, 2022)"

California Natural Resources Agency Urban Greening Grant Program: This program was created by a combination of AB 32 (2006), SB 859 (2016), and SB 170 (2021). The Urban Greening Program received a one-time appropriation of $50 million to allocate to projects that improved park access for a disadvantaged community, were proposed by a disadvantaged community, developed relationships between government agencies and local organizations, and utilized existing public resources (like schools). The Los Angeles Neighborhood Land Trust successfully used this funding to support the greening of Esperanza Elementary School.

LA Unified Budget (2022–23): The LA Unified School Board approved a budget that includes $58 million for outdoor education and schoolyard greening.

Measure A (2016–): This county measure approved a parcel tax generating approximately $94 million each year for parks, playgrounds, recreation centers, natural areas, and open spaces. This replaced expiring measures from 1992 and 1996 (Ballotpedia, 2016). Green schoolyards qualify for this funding.

Measure W (2018–): This county measure approved a parcel tax generating approximately $300 million each year for protecting water quality and marine life, capturing stormwater, and increasing drinking water supply. This established the Safe, Clean Water program, which directs money primarily to infrastructure projects (96% of $1 billion spent thus far) but also to technical resources (2.5%) and scientific studies (1.5%) (Safe, Clean Water Program, 2022). One study funded by this program is currently being conducted by TreePeople (in cooperation with LA Unified) and explores what it would look like to combine greening schoolyards with capturing off-site stormwater (TreePeople, 2020).

Measure RR (2020–2055): This LA Unified bond measure approved a tax generating approximately $330 million each year to purchase and install technology supporting safe and modern learning and address facilities hazards and inequities (Ballotpedia, 2020). Green schoolyards and school facilities fall under this measure because they are inequitably distributed throughout the district.

Proposition 39 (2012–2017): This statewide ballot initiative approved $1.7 billion for energy efficiency upgrades to school buildings. Acceptable uses of the funding included HVAC repairs, new boilers and furnaces, new lighting systems, installation of energy-efficient technology (e.g. windows and thermostats), and installation of clean energy generators (California Energy Commission, 2022). LA Unified received funding for 58 projects.

Proposition 68 (2018–): This statewide ballot initiative approved $4.1 billion for "state and local parks, environmental protection and restoration projects, water infrastructure projects, and flood protection projects" (Ballotpedia, 2018). Greening schoolyards and improving school infrastructure contributes to many of these goals—for example, replacing asphalt with permeable surfaces increases flood resiliency. This legislation has funded the State Parks Development Fund, among other programs.

Programs & Organizations

Angelenos for Green Schools: This organization is an LA Unified parent and stakeholder advocacy organization focused on green schoolyards. They were started in August 2022 as a result of record-breaking heat waves as students returned to school for the 2022–23 school year (Reyes-Velarde, 2022; Tat, 2022; Walker, 2022).

California Schoolyard Forest System: This program was launched on August 30, 2022, by Green Schoolyards of America (a national advocacy organization), Ten Strands (a California environmental education organization), CAL FIRE, and the California Department of Education. This program aims to plant enough trees to cover 30%

of outdoor space at all California PreK–12 schools (Ten Strands, 2022). The program has secured at least $50 million to support this goal, which is enough to cover 100 campuses.

LA Unified Programs: Most of LA Unified's green infrastructure projects are housed under the Sustainability Initiatives Unit (SIU) in the Facilities Services Division, which was created after the passage of the Green LA Unified resolution in 2007. The SIU focuses primarily on reducing water and energy consumption (LAUSD Sustainability Initiatives Unit, n.d.-c). Other programs related to green infrastructure are highlighted by the School Greening Task Force, which was created in 2019 and is a collaboration between LA Unified, United Teachers of Los Angeles, and various cities and nonprofits (Green Space Task Force, 2020).

- **Collaborative for High Performance Schools (CHPS) and Leadership in Energy and Environmental Design (LEED) schools:** This program has directed that new modernization projects and the construction of new schools follow green building criteria set by the Collaborative for High Performance Schools organization. LA Unified has also set pilot programs to begin constructing seven new schools and modernization projects that meet LEED criteria (LAUSD Sustainability Initiatives Unit, n.d.-d).
- **Community School Parks Initiative:** This program has opened four schoolyards for community use and aims to expand to 30 schools in the next few years. However, it does not address green space deficiencies, as the schoolyards may be covered entirely in hardscape (The Trust for Public Land, 2021b).
- **Nature Explore Outdoor Classrooms:** This program has supported 40 projects creating outdoor learning spaces for preschool students, with $10–15 million remaining for other projects (Green Space Task Force, 2020).
- **Paving Repair and Sustainability Projects:** This project contributes to LA Unified's goal of all new projects having at least 30% of their surface area covered by green space or other sustainable features (Green Space Task Force, 2020).
- **Solar Energy Initiative:** This program has installed solar panels on 59 schools and five administrative buildings.
- **Sustainable Environment Enhancement Developments for Schools (SEEDS):** This program funds school-initiated greening projects of up to $100,000 each. Roughly $7 million had been spent as of 2020, and $500,000 remained available (Green Space Task Force, 2020).

Los Angeles Living Schoolyards Coalition: This is a coalition of several local and national nonprofits (listed and described below) focused on transforming LA Unified's schoolyards from hardscapes into green spaces.

- **Amigos de Los Rios:** This organization's goal is to create an "emerald necklace" of parks and green spaces along rivers throughout LA County. They operate primarily in the San Gabriel Valley and have created green schoolyards at several schools, including Bassett High School.
- **Angelenos for Green Schools (see above)**
- **Cal Poly Pomona**
- **Council for Watershed Health:** This organization supports research, education, and planning for sustainability in LA's three watersheds: the Santa Monica Bay, Los Angeles River, and San Gabriel River.
- **From Soil 2 Soul**
- **Heal the Bay:** This organization focuses on protecting Santa Monica Bay by opposing oil drilling and single-use plastic bags, cleaning beaches and neighborhoods, and maintaining data sources about water quality.
- **Hunger Action Los Angeles:** This organization works against hunger by educating the public and officials and advocating for beneficial policies and programs.
- **Kounkuey Design Initiative:** This organization is a community development and design nonprofit that works to develop "Productive Public Spaces" in Southern California and Kenya.
- **Latino Outdoors:** This organization supports programming aimed at getting Latino/a communities outside and into nature across the country. These programs include actual outings, storytelling, and leadership development.
- **Los Angeles Beautification Team:** This organization focuses on improving the quality of life in Los Angeles by "planting trees, designing and implementing resource conservation projects, and improving school campuses, neighborhoods, and business districts." LABT has supported 140 public schools in the last 20 years, including green schoolyards at Eagle Rock and Victory Boulevard Elementary Schools.
- **Los Angeles Neighborhood Land Trust:** This organization helps develop parks in areas that lack green space across Los Angeles. They have helped create 29 parks in the last 20 years, including a green schoolyard at Esperanza Elementary School.
- **Los Angeles Sanitation & Environment**
- **The Los Angeles Trust for Children's Health:** This organization addresses educational inequality by focusing on student health.
- **Los Angeles Waterkeeper:** This organization supports the health of LA's local waterways and drinking water.
- **Natural Resources Defense Council:** This organization is a major national environmental advocacy group.

- The Nature Conservancy: This organization is a major international environmental advocacy group.
- The Niles Foundation: This organization supports access to land, food, clean energy, and green spaces in Los Angeles. They have partnered with schools to produce, harvest, and compost fresh food.
- North East Trees: This organization supports urban greening by planting trees, planning parks, and planning watershed improvements. They have partnered with Buchanan Street Elementary to redesign and green the campus.
- Occidental College
- **TreePeople (see below)**
- **Trust for Public Land (see below)**
- Venice Community Housing
- Wildwoods: This organization provides outdoor and nature education programming for K–12 students.
- Women Organizing Resources Knowledge & Services

Question Fake Grass: This organization was formed to oppose the use of artificial turf in the Los Gatos Union School District because of concerns that it is hotter than asphalt, contains chemicals (like PFAS) that cause cancer and other adverse health effects, and contributes to the fossil fuel industry. They are actively campaigning against the use of artificial turf in LA Unified's school greening initiative.

Reclaim Our Schools LA: This is a coalition of diverse LA Unified stakeholders focused on transforming education in LA. One of their seven demands that came out of the 2019 UTLA strike is focused on climate justice and mitigation in and around LA Unified school buildings—for example, electrifying school buses and greening schoolyards.

The Trust for Public Land: This is a national organization focused on increasing park access across the United States. One of their primary tactics for doing so is creating green schoolyards. They have created more than 300 community schoolyards and plan to build 28 in LA Unified by 2028.

TreePeople: This is an environmental organization located in Southern California that supports access to nature and green space through schoolyard greening, reforesting, and education. They have partnered with Pacoima Middle School to establish a school greening pilot program and are conducting a pilot study on living schoolyards funded by the Safe, Clean Water Program.

Other national & international organizations:

- Children and Nature Network
- Green Schools National Network
- Green Infrastructure Leadership Exchange
- **SUGi**
- Tiny Forests

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