Creating a Shade Equity Plan for Unincorporated East Coachella Valley

UP 217A-1 and 217b-1, UCLA Department of Urban Planning - Winter - Spring 2024

Objective

The objective of this course is to make recommendations for a comprehensive, equitable, and actionable shade plan for the Unincorporated Areas of Eastern Coachella Valley. This is not a traditional class with papers, exams, or traditional products.

Problem

Extreme heat is one of the greatest climate injustices facing communities around the world. Heat is the leading weather related cause of death by estimates most experts believe dramatically undercount actual morbidity. The impacts disproportionately impact low income and marginalized communities who are both more likely to be exposed to extremely hot conditions and lacking resources to cope. The physical environment can exacerbate the experience of heat in highly urbanized areas and rural communities, although research on the latter is lacking. Most recommendations about ways to cool local communities focus on highly urbanized areas, and ways to mitigate the Urban Heat Island (elevated temperatures in urban regions compared to undeveloped regions outside the city, primarily due to impervious surfaces like buildings, roads, and parking lots) that may not be appropriate for rural contexts. This focus is problematic because it directs attention to urban land surfaces and land use planning. In reality, heat affects almost every aspect of daily life and entails addressing policies and design across settings (e.g., housing, transportation, schools) where people live and work. Moreover, the focus on urban contexts limits the ability to address heat in some of the most vulnerable regions, inclusive of rural, peri-urban, and informal development where cooling infrastructure (e.g., air conditioning) may not be available. There is a need to understand how heat affects rural communities and identify solutions that are viable in those contexts.

Shade is the most effective way to cool people outdoors in arid environments. All else being equal, a person standing in the shade will feel 30-40C cooler than someone in the sun just a few feet away (as measured by mean radiant temperature, MRT, a composite indicator for human heat burden). Despite this fact, few communities are actively planning for shade and only a handful of Cities such

as Phoenix, Abu Dhabi, and Tel Aviv, have comprehensive shade plans. The result is that many communities function as “shade deserts'' - areas lacking the shade needed to protect and support human health during outdoor activities. As temperatures increase with climate change, more communities will need to adapt by actively planning shade infrastructure systems - a collection of strategically-placed environmental shade elements, both green (e.g., tree canopy) and engineered (e.g., buildings, walls, shade sails, awnings, photovoltaic canopies), as well as the associated land use policies that control production and delivery.

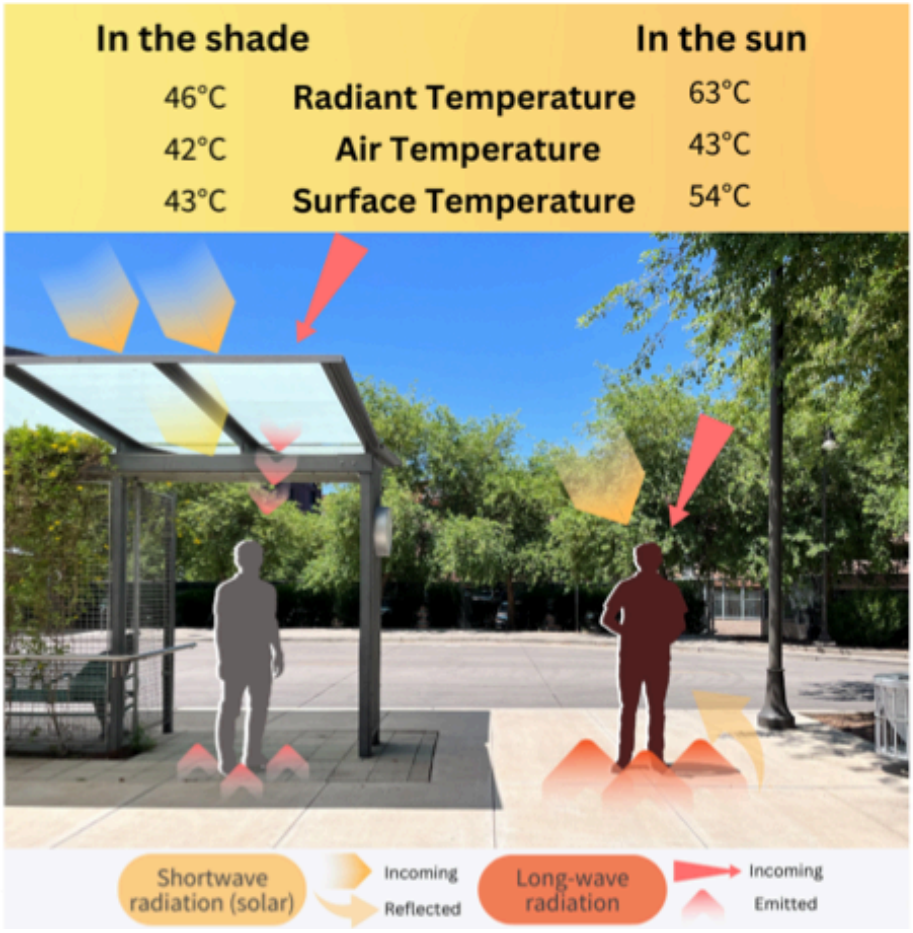


Figure 1: How shade changes air, surface, and radiant temperature (Credit: Jenni Vanos)

Rural communities will require special consideration because land development patterns and uses are fundamentally different than in urban centers. For instance, buildings are low rise and spread out and roads and lots may be unpaved. Therefore, there is a need to assess current infrastructure and engage communities to better understand where and what type of shade infrastructure is needed to support public health across different heat exposure settings like transportation, workplaces, schools, and residential communities.

Context

This proposed community collaborative focuses on developing a comprehensive plan for more and equitable shade infrastructure in the rural community of Oasis, California. This is also the goal of a

2023 California Adaptation Planning Grant awarded to KDI and UCLA from the Governor's Office of Planning and Research. Oasis is an unincorporated community in Riverside County on the Northwest side of the Salton Sea. The population (~4500) is predominantly (~98%) hispanic and employed in the agricultural sector. Many residents live in mobile homes. In 2019, arsenic levels 10x the legal limit were found in one mobile home community, and in 2022 the county allocated $15 million to the Oasis Housing Opportunity Program (OHOP) to relocate residents to a newly built mobile home community. The OLC emerged, in part due to this process, to advocate for social and environmental justice in Oasis.

In 2021-22, KDI, OLC, and UCLA engaged in a series of workshops on extreme heat and community-engaged data collection. UCLA monitored outdoor conditions and provided residents with indoor air temperature sensors, which the OLC distributed among residents in two mobile home communities. Results showed that indoor conditions were higher than the legal standards for tenantability in neighboring Palm Springs, and that homes without air conditioning operating were hotter than outdoor temperature. The community collaborated on developing a shade structure prototype for Sunline Transportation; only 2 of 10 bus stops currently have shelters. Like many rural communities, environmental conditions are not conducive to shade.

Figure 1: Ribbon cutting ceremony for shade structure prototype co-designed by KDI and OLC, Summer 2022.

Purpose

Over the course of Winter and Spring Quarters 2024, this community collaborative will develop recommendations for a comprehensive shade plan based on an assessment of current conditions and suitability of new shade infrastructure, community needs assessment, and a whole-of-government policy analysis of heat-exposure settings in collaboration with members of the community, the OLC, and KDI. We will review existing shade infrastructure plans and experts on the science and policy of shade and heat adaptation. The course will involve at least two and potentially more site visits and in person engagement opportunities, but most of the class will be conducted virtually. We will share our findings with relevant stakeholders including local state assembly members and Sunline Transportation.

Potential Research Questions

1. How can communities assess shade infrastructure in different settings where people might become heat exposed outdoors?
2. How should shade infrastructure be prioritized and delivered to address public health and equity concerns?
3. What existing policies need to change and what new policies need to be created to make the shade plan actionable?

Agricultural Worker Safety: Addressing Extreme Heat through Shade Strategies

Overview

Agricultural workers in the Eastern Coachella Valley (ECV) face significant challenges due to extreme heat exposure. These workers operate on large-scale, outdoor farms, cultivating crops such as dates, citrus fruits, and vegetables. Their tasks include planting, maintaining, and harvesting crops, which frequently involve manual labor under direct sunlight and high temperatures for extended periods, particularly during peak summer months. The combination of humidity and high temperatures exacerbate the effects of extreme heat, increasing the risk of heat-related illnesses, reducing productivity due to the need for more frequent breaks, and potentially leading to long-term health issues. Moreover, extreme heat can worsen existing medical conditions, further comprising the well-being of agricultural workers. While some temporary and permanent shade structures are currently in use, these measures are often insufficient to fully mitigate the effects of extreme heat.

For these reasons, we have selected three domains of interest we feel require further inquiry. The first is a review of heat-related policy, with a focus specifically on Occupational Safety and Health Administration (OSHA) regulations in various states in the US, and an examination of heat-related literature pertaining to agricultural workers. The second is an environmental assessment of current heat and shade conditions in agricultural lands in the ECV. Next, we explore elements of an effective shade infrastructure suitable for harvesting or fieldwork settings. Moreover, we hope to supplement our findings and hear directly from the residents through our survey questions regarding shade availability and effectiveness in the agricultural fields where they work. By addressing these areas and incorporating community input, we aim to contribute to the development of comprehensive and community-informed strategies that will enhance the safety, health, and productivity of agricultural workers in the face of extreme heat conditions.

Policy Review

There are 22 states that have their own Occupational Safety and Health Administration-approved State Plans, but only three have specific heat-specific regulations for outdoor workers (“State Plans,” n.d.). States without an OSHA-approved plan adhere to federal OSHA regulations. While federal heat-specific regulations are currently being developed and could take years to be enacted (Young, 2024), states adhering to federal regulations may choose to enact and enforce their own workplace safety standards. For instance, Colorado, which follows federal OSHA standards, mandates protections against heat-related illnesses for outdoor workers, including agricultural workers (Colorado Department of Labor and Employment 2022). Conversely, states like Florida and Texas, also operating under federal OSHA regulations, have passed bills to ban local municipalities from adopting ordinances that would go beyond state law, such as workplace heat-regulations (Florida Senate 2024; Texas Legislature 2023). Table 1 (below) details the heat-specific regulations regarding shade and rest breaks that California, Oregon, and Washington have enacted to protect their outdoor workers.

Table 1. OSHA State Plans with Heat-Specific Regulations

State	Temperature Trigger for Heat Procedures	Shade Requirements	Rest Breaks
California	80°F; High-heat procedures when the temperature equals or exceeds 95°F	(1) Shade shall be present when the temperature exceeds 80 degrees Fahrenheit. When the outdoor temperature in the work area exceeds 80 degrees Fahrenheit, the employer shall have and maintain one or more areas with shade at all times while employees are present that are either open to the air or provided with ventilation or cooling. The amount of shade present shall be at least enough to accommodate the number of employees on recovery or rest periods, so that they can sit in a normal posture fully in the shade without having to be in physical contact with each other. The shade shall be located as close as practicable to the areas where employees are working. Subject to the same specifications, the amount of shade present during meal periods shall be at least enough to accommodate the number of employees on the meal period who remain onsite. (2) Shade shall be available when the temperature does not exceed 80 degrees Fahrenheit. When the outdoor temperature in the work area does not exceed 80 degrees Fahrenheit employers shall either provide shade as per subsection (d)(1) or provide timely access to shade upon an employee's request. (3) Employees shall be allowed and encouraged to take a preventative cool-down rest in the shade when they feel the need to do so to protect themselves from overheating. Such access to shade shall be permitted at all times. An individual employee who takes a preventative cool-down rest (A) shall be monitored and asked if he or she is experiencing symptoms of heat illness; (B) shall be encouraged to remain in the shade; and (C) shall not be ordered back to work until any signs or symptoms of heat illness have abated, but in no event less than 5 minutes in addition to the time needed to access the shade. (4) If an employee exhibits signs or reports symptoms of heat illness while taking a preventative cool-down rest or during a preventative cool-down rest period, the employer shall provide appropriate first aid or emergency response according to subsection (f) of this section.	10 minutes every 2 hours (95°F+), near the employees' work area

			Employers are required to implement a heat illness prevention rest break schedule for outdoor workers exposed to a heat index of 90°F. May choose from three options: 1) Employer-designed schedule, 2) NIOSH schedule, or 3) Simplified schedule (rest breaks increasing with higher heat indices).
Oregon	80°F	(a) The shade area must either be open to the outside air (at least three open sides) or provide mechanical ventilation for cooling. (b) The amount of shade present must be at least enough to accommodate the number of employees on recovery or rest period, so that they can sit in a normal posture fully in the shade. Employees must remove any PPE that retains heat, such as chemical resistant suits, during recovery and rest periods. (c) The shade must be located as close as practical to the areas where employees are working. (d) Shade present during meal periods must be large enough to accommodate the number of employees on the meal period that remain onsite. (e) If trees or other vegetation are used to provide shade, such as in orchards or forests, the thickness and shape of the shaded area must provide sufficient shadow to protect employees.	
Washington	80°F (52°F for non-breathable clothing)	Provide and maintain one or more areas with shade at all times while employees are present that are either open to the air or provided with ventilation or cooling, and not adjoining a radiant heat source such as machinery or a concrete structure. The shade must be located as close as practicable to the areas where employees are working. (2) Ensure the amount of shade present is large enough to accommodate the number of employees on a meal or rest period, so they can sit in a normal posture fully in the shade. (3) In lieu of shade, employers may use other means to reduce body temperature if they can demonstrate such means are equally or more effective than shade. Some alternatives to shade may include the provision of misting stations, cooling vests, or air-conditioned areas.	10 minutes every 2 hours (90°F+), 15 minutes every hour (100°F+), near the employees' work area.

Literature Review

In a 50-state legal and regulatory framework mapping study, Rodman et al. (2016) analyzed agricultural exceptionalism in state-level wage and hour laws for agricultural workers, including minimum wage, overtime, rest periods, and meal periods. Agricultural exceptionalism refers to the historical exclusion of agricultural workers from standards that most other workers are afforded. They found that state-level exceptionalism is most far-reaching in minimum wage and overtime protections, with most states mirroring federal exceptions for agricultural. The study highlights the extent of agricultural exceptionalism and the difficulty in improving protections for agricultural workers, who hold far less political power than their employers.

The agricultural industry has one of the highest heat-related fatality rates, but researchers believe heat illnesses are likely underreported (Jackson and Rosenberg 2010). They outline specific recommendations, such as the provision of shade, and prevention strategies to be carried out by employers. However, another study forecasting future risk based on 2°C and 4°C global warming advises that bolder action is needed to protect agricultural workers (Tigchelaar et al. 2020). At the time of their study, they found that Riverside County experiences more than one month of unsafe working conditions on average, with neighboring Imperial County experiencing over three months. Further, multi-day heat events were found to occur once or twice a year, but were expected to increase to occurring five times as often. They conclude that mitigation efforts that rely on individual actions will be insufficient in the future, pointing to systemic change as the stronger approach to safeguarding the health and well-being of agricultural workers.

Through focus groups with farmworkers in California's Central Valley, Courville et al., (2016) reveal the structural factors that often shape the way agricultural workers view individual actions. They found that agricultural workers viewed rest breaks, with water and shade provisions, differently depending on their pay structure (Courville et al. 2016). Workers paid piece rate felt that requirements such as seeking shade were impositions, whereas hourly employees acted out of compliance. Researchers determined piece rate was the preferred structure, however neither structure is conducive to protecting agricultural workers.

In the Eastern Coachella Valley, two separate studies were conducted with employers and employees, concerning the topics of climate change and healthcare access. Employers cited heat as the most challenging hazard to adapt to, but they also felt that workers are responsible for ensuring they are taking the appropriate measures to protect themselves (Wadsworth et al. 2022). When researchers inquired about night crews, only one employer had attempted to harvest at night, stating artificial light made it difficult to discern if the fruit was ripe. In a qualitative study with agricultural workers from ECV, Cheney et al. (2022) reveal that taking individual actions to protect from heat-illness are not always easy or feasible. Referring to heat exhaustion, one participant shared, "You can deal with it because they're going to fire you or because you need to work" (8). Participants also shared that it was difficult to take individual actions due to their lack of training or health information. These two studies highlight the disconnect between employer responsibility and employee safety in the agricultural industry, echoing findings from Courville et al. (2016).

Beyond shade, researchers have studied alternative cooling measures, such as personal cooling gear (Chicas et al. 2012; McQuerry and Grzywacz 2023). Initial evidence from McQuerry et al. (2023) study, where agricultural workers were provided clothing with cooling technology, reveals that workers using the garments experienced better thermal comfort throughout their workday. Additionally, workers assigned to use cooling bandanas in a Florida study found them to be practical and comfortable (Chicas et al. 2021). Despite the success of the cooling bandanas, workers cited their cooling effect wouldn't last long due to the lack of shade and accessible water provided at their work site.

Although work-time shifting did not seem to be of interest for employers in the Wadsworth et al. study (2022), a study on shade and work-time shifting for agricultural workers in Italy demonstrated the success of adopting such strategies (Morabito et al., 2020). The researchers found that working in the shade reduced productivity loss by over 80%, and starting work shifts 1-2 hours earlier also resulted in a decrease. One key assumption Morabito et al. (2020) makes is that productivity loss occurs because agricultural workers are taking longer and more frequent breaks. This assumption does not align with previous findings for agricultural workers in the U.S., and more specifically in the ECV.

Previous research reveals the reason individual actions, such as seeking shade, will not be enough to protect agricultural workers from the heat in the future. More importantly, it reveals the reason agricultural workers might avoid taking individual action to protect themselves from the heat. Even so, as research on additional strategies and adaptation methods continues, shade remains an important provision to help agricultural workers stay safe and cool.

Environmental Assessment: Quantitative Findings

To better understand the needs of agricultural workers in the Eastern Coachella Valley, it is important to the assess the degree to which they are exposed to unsafe environmental conditions, and how this exposure compares with other groups in the region. This section, along with our qualitative analysis, serve as the basis for our recommendations to for improved shade structures for agricultural workers.

Results Summary

The quantitative analysis conducted on the Eastern Coachella Valley aimed to assess environmental conditions affecting agricultural workers, particularly focusing on shade cover and temperature exposure. The study revealed that farmland areas in the ECV have a higher shade cover (20.33%) compared to non-farmland areas (4.01%), primarily due to the presence of crops. However, the shade provided by buildings is minimal in both settings. The average temperatures in the ECV were significantly higher than the rest of Riverside County, with farmland and non-farmland areas experiencing nearly similar heat levels (approximately 91.43°F and 91.49°F, respectively). This

indicates a substantial exposure to heat for all residents, particularly those involved in agriculture. Additionally, the study found no significant correlation between shade cover and median household income, suggesting that income does not predict the availability of shade in the area. These findings underscore the need for targeted interventions to improve environmental conditions for the agricultural workforce in the ECV.

Data Sources

Sociodemographic Data

Census tract data containing demographic and socioeconomic attributes such as income, population, and race/ethnicity for the Eastern Coachella Valley region and Riverside County was obtained by The U.S. Census Bureau's American Community Survey as well as Riverside County Open Data. Relevant data was joined together into one attribute layer for further analysis.

Land Use Data

Data layers representing farmland and non-farmland areas in both the Eastern Coachella Valley and Riverside County were obtained from Riverside County Open Data.

Temperature Data

Heat data from the PRISM (Parameter-elevation Relationships on Independent Slopes Model) dataset was provided at the 800-meter resolution for the month of July. The temperature values represent the 30-year normal (1981-2010) for mean near-surface air temperature, typically measured at approximately 2 meters above the ground. This provides an estimate of the average air temperature conditions experienced by agricultural workers during the hottest month of the year.

Shade Data

Shade data for the Eastern Coachella Valley was obtained in the form of a raster dataset from the UCLA Luskin Center for Innovation (LCI). The shade data layer utilized was taken at 12:00 PM and encompasses the total measured shade.

Shade Cover Analysis

To compare the shade cover between farmland and non-farmland areas within the Eastern Coachella Valley, a raster dataset containing total shade data for the region at 12:00 PM was utilized. The shade raster was overlaid with spatial layers representing farmland and non-farmland areas in the Eastern Coachella Valley and the following steps were conducted:

1. Defining the farmland and non-farmland areas as separate zones within the Eastern Coachella Valley.

2. Clipping the total shade raster based on the farmland and non-farmland zones to create separate rasters for each land use type.
3. Generating unique values report for the farmland and non-farmland shade rasters to calculate the percentage of shade cover in each land use type.
4. This process was repeated with shade data containing only shade from buildings.

This process yielded the percentage of total shade cover for farmland areas and non-farmland areas within the Eastern Coachella Valley region.

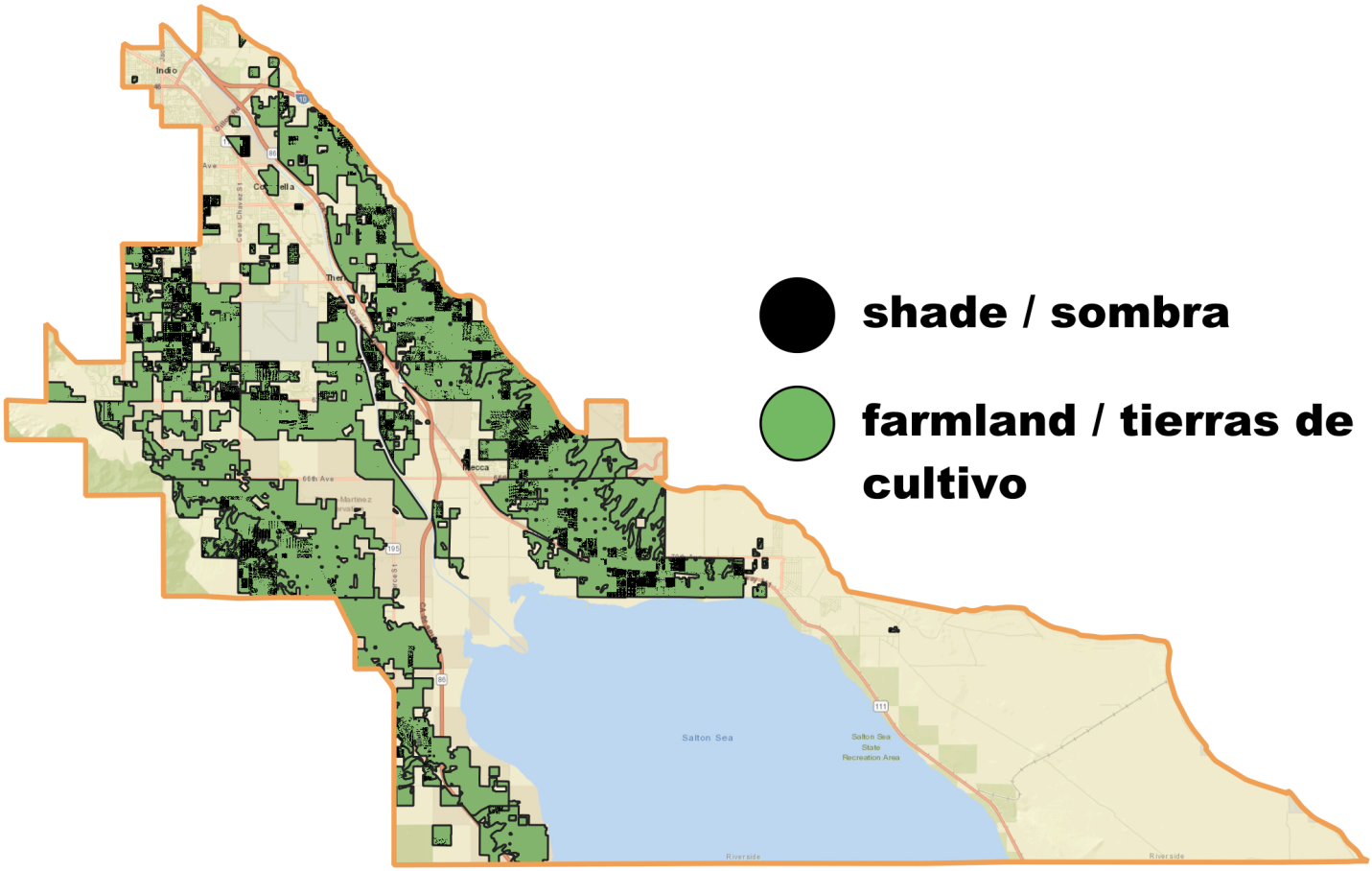
Shade Cover Analysis Findings

1. Farmland areas in the ECV had an average total shade cover of 20.33%, indicating that only about one-fifth of the farmland in the region is shaded.
2. Non-farmland areas in the ECV exhibited a significantly lower average total shade cover of 4.01%, suggesting that these areas have less extensive shade coverage compared to farmland.

The higher total shade cover in farmland areas (20.33%) compared to non-farmland areas (4.01%) in the ECV can likely be attributed to the presence of crops providing shade. This implies that in agricultural settings without shaded plants, there is very little shade available. The low total shade cover in non-farmland areas highlights the overall lack of shade in the ECV region.

When considering only the shade provided by buildings, the coverage was minimal in both farmland (0.00034%) and non-farmland (0.0023%) areas. These low values emphasize the scarcity of built shade structures in the ECV, particularly in agricultural settings.

The limited shade availability in the ECV, especially in farmland areas without shaded crops, may contribute to increased exposure to direct sunlight and heat for agricultural workers and residents. This lack of shade is particularly concerning given the high temperatures experienced in the region, which can have significant health and well-being implications for the population.



Temperature Analysis

To assign representative heat values to each plot of farmland and non-farmland, the "Zonal Statistics" tool in QGIS was employed. This tool calculated the average temperature value from the PRISM raster for each land parcel polygon in the farmland and non-farmland layers. The resulting average temperature values were then joined back to the respective land parcel layers based on a common identifier field.

This process allowed for the association of a representative mean heat value with each plot of farmland and non-farmland in the study area.

Temperature Analysis Findings

Farmland (County)	Other Land (County)	Farmland (ECV)	Other Land (ECV)
82.85° F	**79.96° F**	**91.43° F**	**91.49° F**

1. ECV farmland experienced an average temperature of 91.43°F, significantly higher than the average temperature of 82.85°F found in farmland across Riverside County.
2. Non-farmland areas in the ECV had an average temperature of 91.49°F, also notably higher than the 79.96°F average temperature in non-farmland areas countywide.

3. The minimal difference in average temperatures between farmland and non-farmland areas within the ECV (91.43°F vs. 91.49°F) suggests that the entire ECV region is exposed to high heat levels, regardless of land use.

These findings highlight the disproportionate exposure of the ECV region, including its agricultural workers, to extreme heat conditions compared to the rest of Riverside County. The results underscore the need for targeted interventions and recommendations to mitigate the impact of high temperatures on the health and well-being of ECV residents, particularly those engaged in agricultural labor.

Demographic Shade Access

Shade / Race Correlation

To explore the relationship between shade cover and race in the Eastern Coachella Valley, a spatial analysis was conducted using QGIS. The shade raster dataset was overlaid with the census tract layer containing racial demographic data. The "Zonal Statistics" tool was used to calculate the mean shade value for each census tract polygon, and the resulting values were joined back to the census tract layer.

Due to the fact that multiple races share the same mean shade value within each census tract, the data was summarized to compare the average mean shade cover for census tracts based on the dominant racial group (Hispanic or White) in each tract.

Shade / Race Correlation Findings

Most Prevalent Race	Average Shade Cover
Hispanic	13.21%
White	8.25%

These findings suggest that there is a disparity in shade cover based on the dominant racial composition of census tracts in the Eastern Coachella Valley. Areas with a higher proportion of White residents appear to have lower shade cover compared to areas with a higher proportion of Hispanic residents.

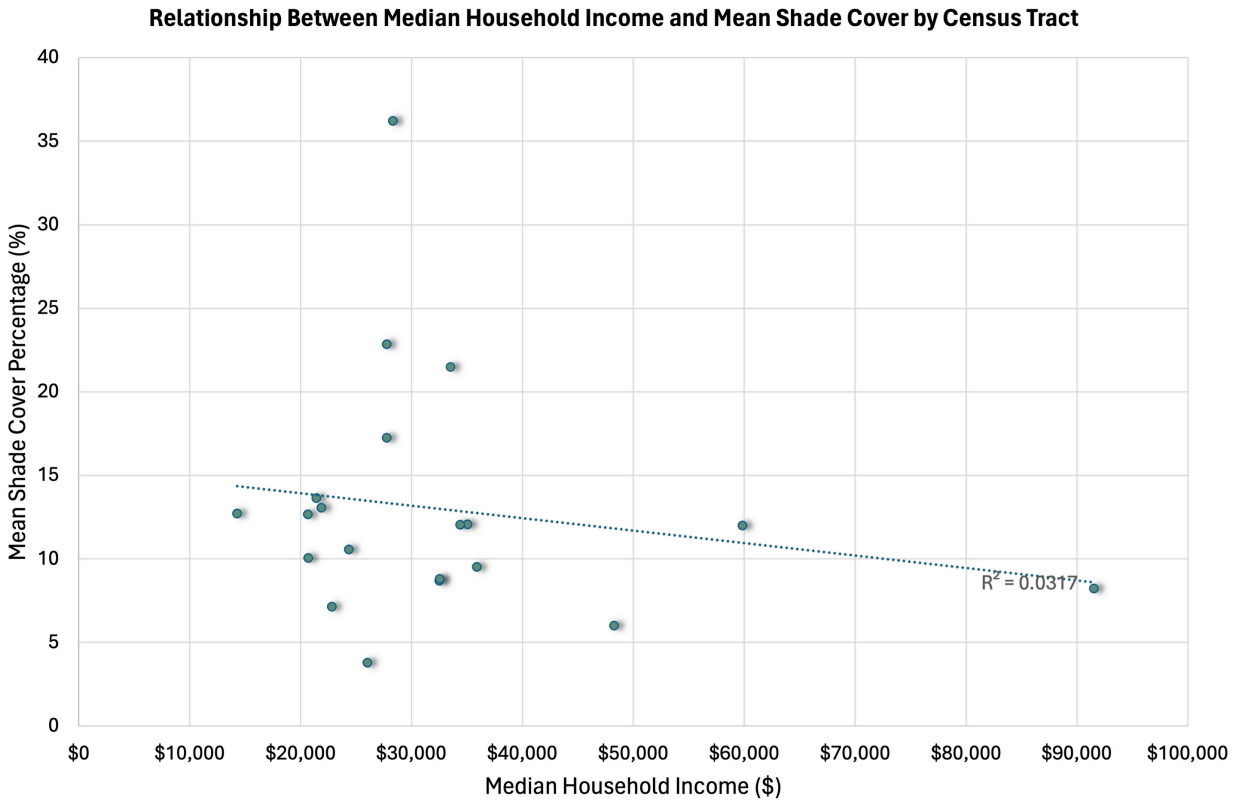
However, there is only a single census tract (Tract 456.17) that has more white residents than Hispanic residents. Therefore, no significant conclusion can be drawn from this data. Instead it is suggested that the entire Eastern Coachella Valley as whole is severely lacking in shade.

Shade / Income Correlation

To investigate the relationship between shade cover and income in the Eastern Coachella Valley, the shade raster dataset was overlaid with the census tract layer containing income data in QGIS. The "Zonal Statistics" tool was employed to calculate the mean shade value for each census tract polygon, and the resulting values were joined back to the census tract layer. The attribute table containing both income and mean shade values for each census tract was then exported to Excel for further analysis.

Shade / Income Correlation Findings

A simple linear regression was conducted to examine the relationship between Median Household Income and Mean Shade Cover Percentage.



The R-squared value was 0.01875574, indicating that only 1.88% of the variation in Mean Shade Cover Percentage could be explained by the variation in Median Household Income. The p-value for the Median Household Income coefficient was 0.57610937, which is greater than the significance level of 0.05, suggesting that there is no statistically significant linear relationship between the two variables.

Based on these findings, it appears that Median Household Income is not a strong predictor of Mean Shade Cover Percentage in the given dataset. The low R-squared value and the lack of statistical significance indicate that the linear regression model does not adequately capture the relationship between the variables.

Environmental Assessment Limitations

1. The shade cover analysis is based on a single raster dataset, which may not capture temporal variations in shade cover throughout the day or across different seasons. Additionally, the resolution of the shade data may not account for smaller-scale variations in shade cover.
2. The racial demographics analysis focused on comparing the dominant racial groups in each census tract rather than examining the shade cover for each individual race. This approach was necessary due to the shared mean shade values among multiple races within each tract but may not fully capture the nuances of racial disparities in shade cover.
3. The income and shade cover analysis revealed a weak and statistically insignificant correlation, suggesting that other factors not considered in this study may play a more significant role in determining shade cover distribution.
4. The temperature analysis relied on PRISM data, which provides a 30-year normal (1981-2010) for mean near-surface air temperature at an 800-meter resolution. While this data offers a useful estimate of average temperature conditions, it may not capture more recent temperature trends or finer-scale temperature variations that could impact agricultural workers' exposure to heat. Additionally, the temperature data represents air temperature at approximately 2 meters above the ground, which may not fully reflect the heat experienced by workers at ground level, especially in areas with limited shade cover.
5. The study did not consider other environmental factors that could contribute to heat exposure and worker discomfort, such as humidity, wind speed, and solar radiation. These variables, in combination with temperature and shade cover, may provide a more comprehensive understanding of the heat stress experienced by agricultural workers in the Eastern Coachella Valley.

Shade Structure Design

The State of California Department of Industrial Relations, Division of Occupational Health and Safety (Cal/OSHA) defines shade as complete blockage of direct sunlight, which may be provided by any natural or artificial means that does not expose employees to unsafe or unhealthy conditions and that does not deter or discourage access or use. Shade is not adequate when it does not allow the body to cool (Cal/OSHA). Based on first-hand experience from community members of the Oasis Leadership Committee (OLC) and from agricultural workers we engaged with at our June 12th Community Meeting, combined with our environmental assessment, it is clear there that there is an intense need for adequate shade coverage within agricultural fields to protect outdoor workers, who are disproportionately exposed to extreme heat.

We propose the following shade structure design elements by incorporating the following sources:

1. **Cal/OSHA standards** on shade and other cooling measures
2. **Community stakeholders**' lived experience working in agriculture
3. **Environmental assessment** completed by our team
4. **Desktop research** on effective shade infrastructure

In summary, we recommend these design elements be incorporated to create an effective shade structure to shield workers from unsafe or unhealthy conditions:

1. **Material**:
    a. Durable and lightweight (e.g. aluminum frame)
    b. Blocks sunlight completely
    c. Allows for proper ventilation
    d. Reflective shade cover (e.g. white acrylic coating or aluminum coating)
    e. Non-reflective seating (e.g. wood)
2. **Adjustability and Portability**: Structures with wheeled base and lightweight structural material
3. **Size**: Wide overhang or extended eaves for maximal shade for every crew member, and seating land enough for all to sit comfortably and cool down
4. **Water Storage**: Equip each structure with insulated water cooler
5. **Signage**: Display signs languages spoken by the crew members with heat illness prevention information and emergency contact information and procedures
6. **Sanitation Facilities**: Prioritize nearby access to restrooms, handwashing stations, or portable toilets and provide shade over them

Background from the Agricultural Worker Community

This section compiles context information we gathered on experiences working in the agricultural field as a heat exposure setting. This is based on conversations with OLC members we met with regularly over the course of two quarters and with community members who attended our Community Meeting which took place on June 12, 2024.

Heat Exposure on Agricultural Workers

On a typical work day in the fields during peak heat periods, humidity has a great impact on workers' overall work experience and ability to complete the necessary tasks for the day. Working during peak hours is tiring, increasing the need for water and rest breaks. Though staying hydrated is crucial to combat heat-related illnesses, portable toilets can get unbearably hot inside, which discourages workers from drinking enough water.

In communication with the foreman, it is not uncommon for crews to collectively halt work for the rest of the day when the heat and/or humidity becomes unbearable. However, workers will not receive compensation for the remaining hours of the work day that are missed, which incentivizes them to endure unsafe working conditions.

Current Shade Structures

According to OLC members, shade structures used in agricultural settings are similar throughout the ECV. Some common examples of shade structure in the ECV and throughout California are presented in the following section (Table X). In one instance, a community member shared there is a shade structure on either side of the field where they work, and both are equipped with water. They find this to be an effective placement strategy.

There are also design inadequacies with the current shade that is being provided. Chief among them is that the canopy material, such as shade cloth meant for produce, leads to workers feeling hotter sitting underneath it than being unshaded, so they seek other sources for relief such as a tree. However, trees are not a readily available type of shade and it is not feasible to increase tree canopy in a heat exposure setting like agricultural fields. This is because workers are moving throughout the day, and farming crops are the priority land use.

Community Input for Shade Structure Improvement

Overall, the OLC members advocate for greater investment in shade infrastructures for farm workers. There simply is not enough shade and not enough shade structures. More specifically, they would like more mobile shade structures. Workers are moving throughout the day, farming equipment may need to drive through the field, and the ability to move the structures to inactive areas would minimize wear and tear. Shade structures over sanitation facilities are also necessary to encourage workers to stay hydrated. On a systematic level, there is also a need for land owners to prioritize greater shade distribution to protect agricultural workers. Currently, contractors are hired to manage farms take on the responsibility of keeping workers safe, but the owners of the land—who have the ultimate say on whether to expand to shade on their property—must join the conversation.

Standard Shade Structures

The following images are examples of shade structures used by agricultural employees in the ECV and throughout California. They are generally portable, provide seating, and feature a reflective canopy material.

Table 2. Standard Shade Structures

	Shade Structure	Location
1.		Eastern Coachella Valley, Riverside County, CA (Photo taken by OLC member, 2024)
2.		Vineyard in Northern CA (Saint Helena Agricultural Services)
3.		Agricultural field in Heber, Imperial Valley, CA (Farm Show Magazine, 2007)
4.		Muranaka Farms in Moorpark, CA (Photo by Morgolis for LAist, 2021)

		
5.		Melon orchard at Del Bosque Farms in Firebaugh, San Joaquin Valley, CA (Photo by Joe Proudman for UC Davis, 2017)
6.		Farmworkers in an unknown location in CA (Photo by California Farm Bureau Federation for Capital Press, 2022)

Shade Structure Design Elements

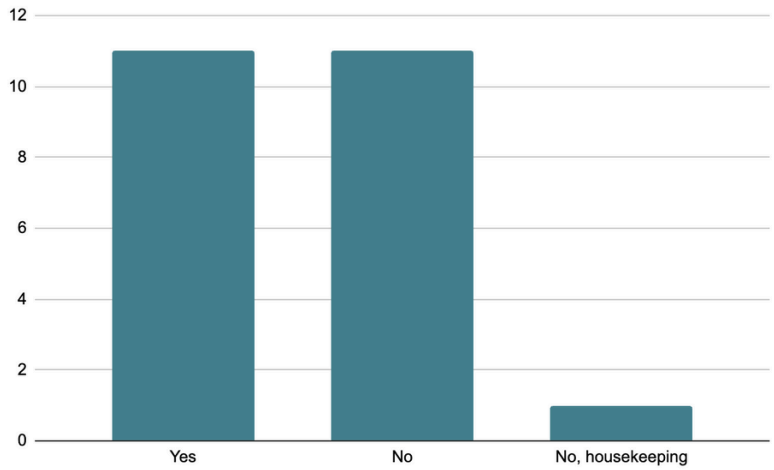
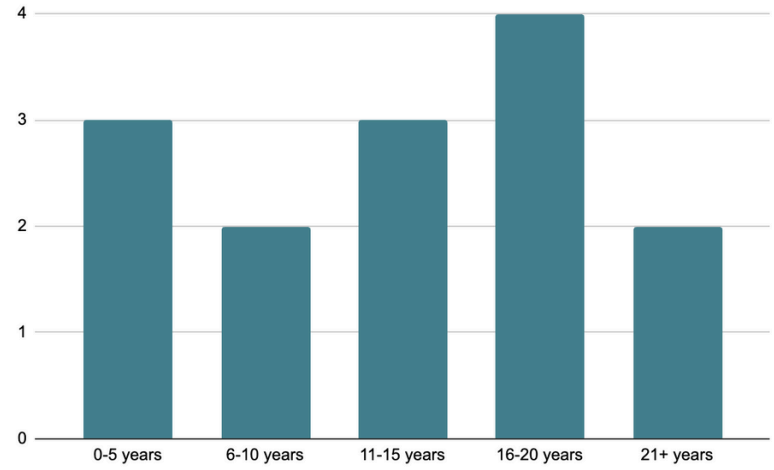
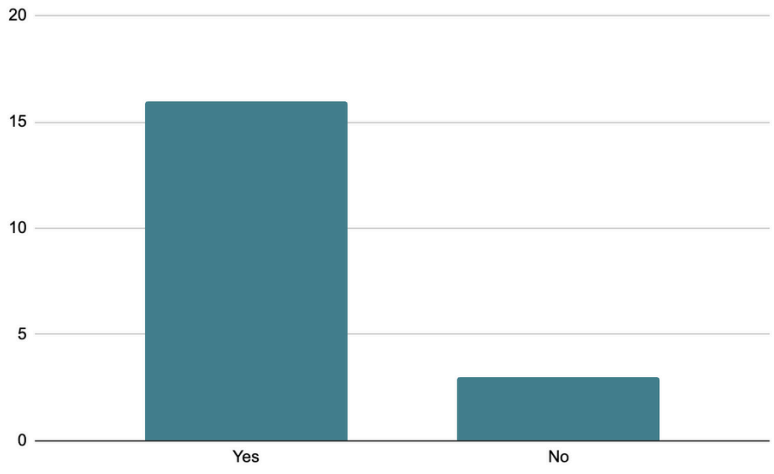
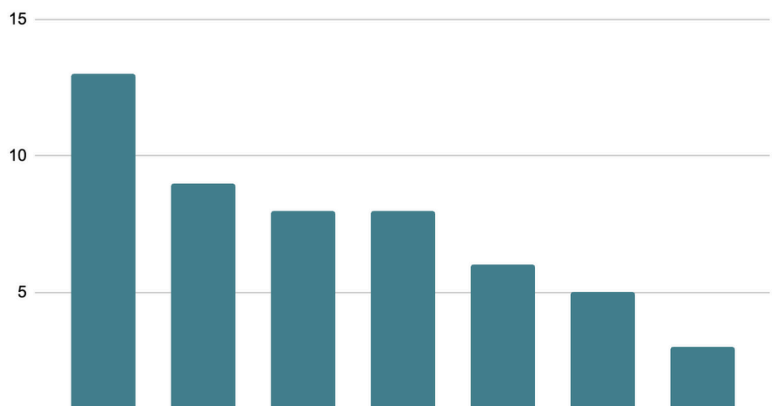
When designing shade structures for an agricultural heat exposure setting, there are several additional elements to consider in addition to providing just shade. We propose the following shade structure design elements based on Cal/OSHA standards, community member feedback, our environmental assessment, and desktop research on constructing effective shade structures. These design elements provide direct relief from the sun, and also aim to meet the specific needs of those working outside in agricultural fields.

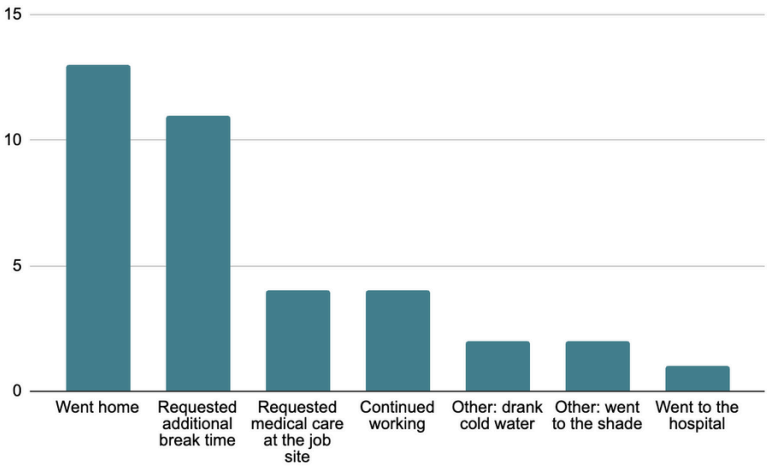
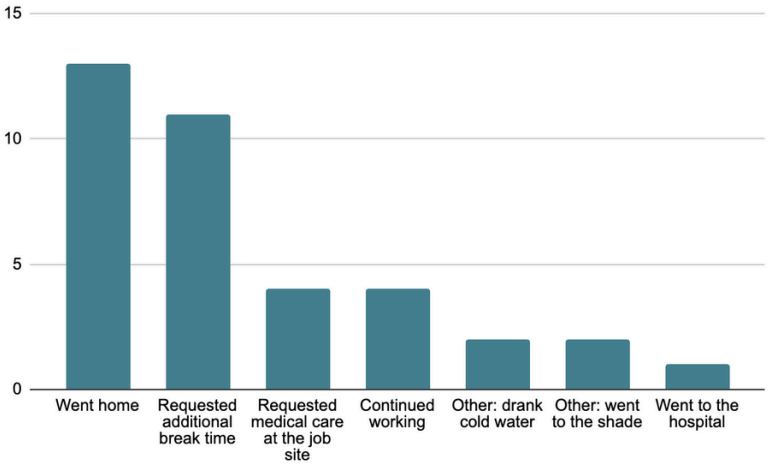
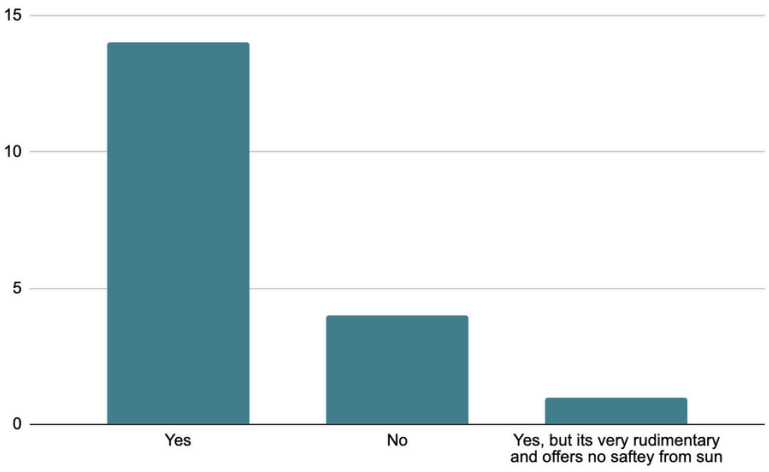
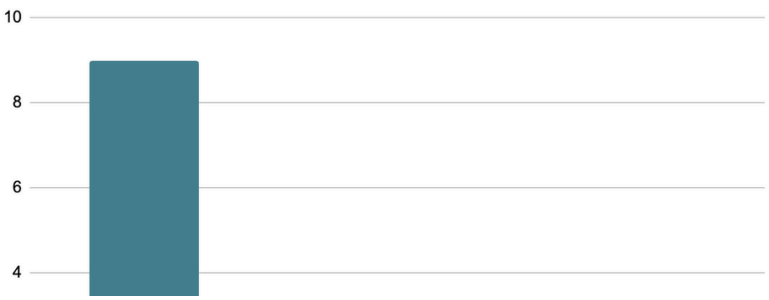
Table 3. Shade Structure Design Elements

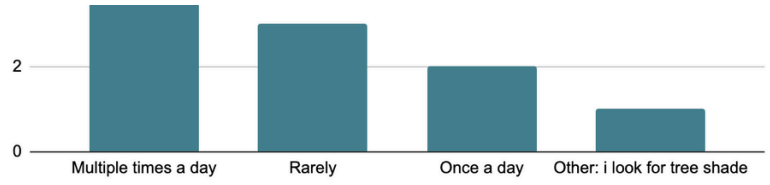
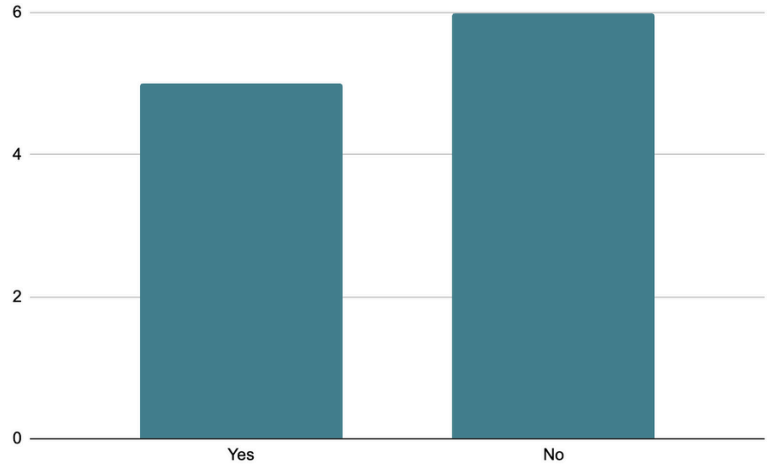
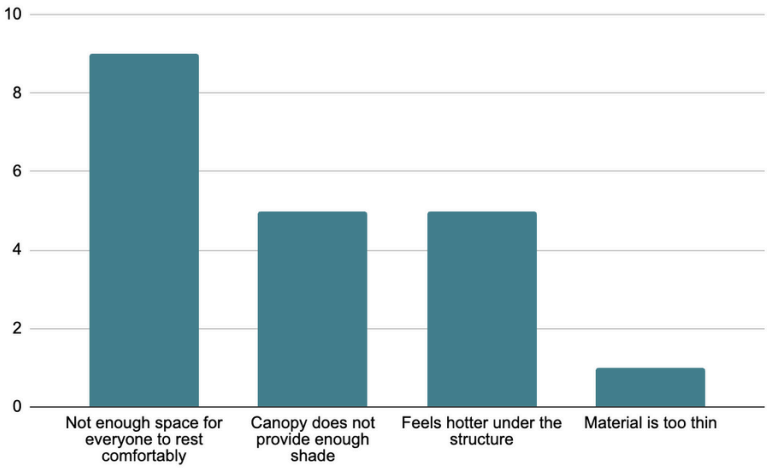
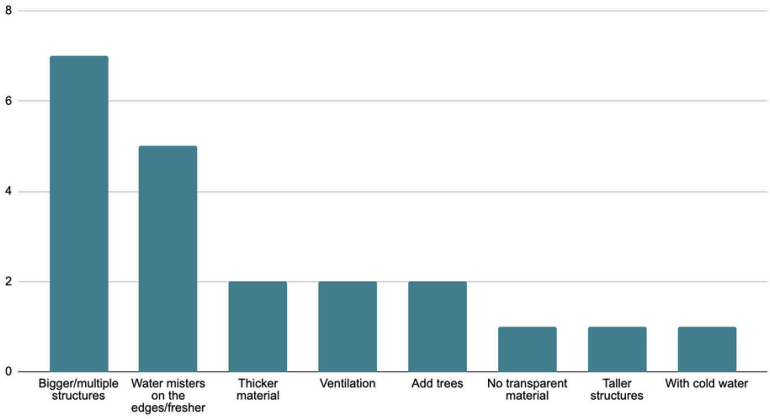
Shade Structure Element		Description
1.	Material	The major aspects to consider when deciding on the materials that make up a shade structure is constructing one that is durable, lightweight, blocks direct sunlight completely, and allows for proper air flow to prevent the structure from trapping hot air. In hot climates like the ECV, it is best to opt for heat-reflective shade materials that minimize the body's heat absorption gain (Enviroclass, 2024). Some examples include materials with white acrylic coatings and aluminum coatings (De Masi et al. 2018). Additionally, an aluminum frame is a weather-resistant, lightweight, and reflective material that is suitable for this purpose. However, aluminum can get exceptionally hot when it is exposed to the sun, so it is recommended to choose a material like wood for surfaces such as the seats and table, where it will come into human contact throughout breaks. Other considerations include choosing a materials that are easy to cleans and repair.
2.	Adjustability and Portability	Portable structures with a wheeled base and sturdy but light construction material allow workers to move shade as close to work areas as possible, and adjustable canopies allow users to respond to the angle of the sun throughout the day . Both aspects also support the ease of operation and maintenance in a dynamic setting where heavy farming equipment may be present.
3.	Size	The canopy should be sized to ensure the provision of adequate shade for all crew members. We recommend an overhang or extended eaves for increased shade area. Similarly, there should be enough seating such that individuals are able to assume comfortable body postures—without having to be in direct contact with one another. This allows workers to properly cool down and recover from the heat.
4.	Water Storage	Individuals are encouraged to drink sufficient amounts of water when it is hot. Shade structures should be equipped with insulated water coolers or dispensers to provide easy access to cool drinking water.
5.	Signage	Displaying signs—in English, Spanish, and other relevant languages—with heat illness prevention information, emergency contact information and procedures, and proper use of the shade structure can reinforce safety practices.

6.	Complementary Considerations	The following are additional considerations beyond shade to take into account to when designing shade structures: • Sanitation facilities: Nearby access to restrooms, handwashing stations, or portable toilets reduces the risk of heat risk due to dehydration (El Khayat et al. 2022). Hot portable toilets are also a serious health concern, therefore sanitation facilities should be shaded • Hooks or racks: To hang personal protective equipment (PPE) or clothing • Electrical outlets: Electrical outlets (solar-powered options) allows for the use of fans, misters, or other cooling devices within the shade structure
7.	Additional Cooling Mechanisms	Alternative cooling measures include, but are not limited to, cooling employees by providing: • An air-conditioned environment • Misting machines • Cooling vests (e.g., commercially available ice vests) • Water-cooled garments (e.g., hoods, vests and "long johns"). • Battery operated, portable cooling devices or equipment • Air cooled garments (e.g., suits or hoods)

Community Survey Questions and Results

1	Are you an outdoor fieldworker?	
2	How long have you worked as an outdoor field worker?	
2	Have you ever felt sick at work because you were too hot?	
3	If you said YES to Question 1, circle the top three symptoms you have experienced most often at work because you felt sick from being too hot.	

		
4	If you said YES to Question 1, which of the following did you do when you felt sick from being too hot? Circle the top three you have done the most often.	
5	Do you feel pressure to work even when you are feeling sick because it is too hot?	
6	Does your employer provide a shade structure? If NO, skip to question 10.	
7	If you answered YES to Question 5, when it is too hot outside, how often do	

	you use the shade structure?	
8	Do you like the shade structure that is provided? If YES, skip to question 9.	
9	If you said NO to Question 7, why don't you like the current shade structure?	
10	Could you describe what improvements would make the shade structure better?	

Shade Structure Design Limitations

There are three major limitations we faced while developing our recommendations of shade structure design elements.

1. Lack of input from management-level agricultural employees. Our subgroup had initially planned to interview farm supervisors to get their perspective on providing adequate shade for workers and the barriers they may face when attempting to implement more shade. However, it was a challenge to identify an individual who would be willing to speak to us.
2. Missing input from a wider group of community members working in the agricultural fields. Though we did not get the opportunity to analyze the survey we distributed to assess shade-related needs, we were still able to gather meaningful insight members of the Oasis Leadership Committee and those we spoke with at our Community Meeting. In the future, the survey results will provide a deeper understanding of agricultural workers' lived experience working in extreme heat conditions and a broader assessment of shade infrastructure needs in the Eastern Coachella Valley.
    a. Upon completion of the Agriculture survey analysis, our design recommendations appear to still be relevant to what farmworkers have provided feedback on. We compiled a set of 11 questions designed to get direct feedback on farmworkers' experience with heat in the workplace as well as their critiques on currently utilized shade structures and their ability to effectively ward off heat effects.
3. Unable to incorporate shade structure preferences based on feedback of existing standard shade structures used throughout California. During our Community Meeting, we led an interactive activity displaying four shade structures with varying design elements used throughout agricultural fields in the state. We asked members to rank them from the shade structure they prefer the most to least and numbered stickers beneath the image. We have not analyzed the data, but it is clear that the ideal shade structure is one that is not enclosed, induces ample air flow, and has the widest shade coverage.

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Schools and Parks: Addressing Extreme Heat through Shade Strategies

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OLC Members: Gloria Yolanda Rodríguez, Rosalba Olivarez de la Cruz, Juan Olivares Padilla

Abstract

Our group focused on two settings where heat affects children – schools and parks. Heat impacts the health of children, interferes with learning and cognitive performance, and decreases the usability of important community spaces. Shade can mitigate some of these impacts by cooling outdoor spaces, making them safer to use and more available for use. This section of the report 1) describes how heat impact children in schools, 2) calculates how much more use outdoor facilities could get with adequate shade, 3) presents where community members recommend adding shade at parks and schools, 4) recommends potential shade trees for use in the Eastern Coachella Valley, and 5) describes some of players who might be adding shade to schools and parks.

Heat and Childhood

We focus on three impacts of heat: health, learning, and community. Heat clearly impacts the physical health of children and those who care for them. In our community survey, 100% of online responses had a child who had become sick at school due to the heat. Heat impacts children more severely than healthy adults for three reasons: children inhabit smaller bodies that heat up faster, engage in physical play, and have less capacity to both perceive, communicate, and address their physiological needs. Supervising children playing outside also exposes adults to extreme heat, both

school employees for whom heat may be an occupational risk, as well as parents and guardians who wait to pick up children after school and supervise them playing at the park. Outdoor recreation facilitates the physical, mental, emotional, and social growth of children; heat's suppression of outdoor play also impacts the healthy development of children.

A growing body of literature demonstrates heat's negative effect on children's cognition and learning. Heat also decreases long-term learning for students in school, an effect more acute in lower-income school districts such as Coachella Valley Unified School District. Heat decreases performance on high-stakes exams, unfairly closing doors for students who would perform better in a cooler environment. Heat also decreased cognitive performance subsequent to exposure, suggesting that overheating on the playground can impact learning even in air conditioned classrooms. Heat also decreases worker productivity across sectors, impacting both local income and therefore resources for schooling as well as the cognitive performance of adults essential for effective schools. Heat decreases student attendance and increases school disciplinary issues, increases violence and workplace injuries, and impacts students outside of school when they study and sleep. Climate change will not only increase heat exposure in the Eastern Coachella Valley, but will also increase other threats to schooling.

Extreme heat also impacts the larger community that develops around children at schools and parks. Students form significant friendships through extracurricular activities and adults also often bond through their participation and supervision of these activities. When, as a survey participant wrote, "the heat prevents my child from participating in outdoor activities", not only does the child lose important developmental opportunities, but the community loses time together. Two critical informal times for community-formation associated with children is when parents and guardians wait at school drop-off and pick-up and also when they supervise children playing at the park; when it is too hot for either kids to play or adults to step out of the car, the community loses too. Shade then not only may keep kids healthier and learning more, but may also strengthen the community as a whole.

How Shade Helps

Shade lowers the impact of hot weather on the body, making outdoor activities safer and outdoor play spaces usable for more hours and days over the year. Even casual experience in the outdoors tells us that "heat exposure" consists of more than air temperature; other key factors are humidity, wind, and radiative heating from hot surfaces, including direct sunlight. To quantify the potential impact of shade, we need a metric that combines all these factors into a single quantity. In the United States, the standard metric for this purpose for both schools and workplaces is the "Wet Bulb Globe Temperature" (WBGT) and can either be measured directly by a specialized multi-part sensor or calculated from a collection of other measurements. Unlike the "heat index" commonly reported

by the National Weather Service, WBGT includes the effect of direct sunlight and other radiant heating, which are essential when evaluating the relevance of shade. The National Institute of Occupational Safety and Health (NIOSH) adopted WBGT as its heat exposure metric in 1972 and the American Council of Governmental Industrial Hygienists articulated heat exposure threshold limit values for heat exposure using WBGT in 1974, making WBGT the standard metric for occupational heat exposure in the United States. WBGT is also recognized as the heat exposure metric by the International Organization for Standardization (ISO), leading NIOSH to declare WBGT to be the heat exposure "index most frequently used and recommended for use throughout the world." While much recent shade research has used air temperature, surface temperature, and mean radiant temperature (MRT), "translating" shade effects into WBGT puts numbers on a scale with statutory authority. Therefore, while this report focuses on the benefit of shade in the Eastern Coachella Valley, the methods could be generalized to augment shade research everywhere.

The next few subsections (Data, Methods, and Results) estimate WBGT for a representative point in Oasis for every hour of 2022 with and without shade to determine how many more hours an outdoor space would be usable if shade were present. The general reader uninterested in the calculation methods is encouraged to jump to "Discussion" where the results of the calculation underscores the power of shade to increase the usability of outdoors spaces such as play yards and playgrounds.

Data

For hourly air temperature, dew point temperature, and both longwave and shortwave radiant fluxes, we used the ERA5-Land hourly reanalysis dataset (Munoz-Sabater, 2021), produced by the European Center for Midrange Weather Forecasting (ECMWF). ERA5-Land provides hourly estimates of many surface weather values (e.g. temperature, precipitation) by stitching together short-term weather projections from ECMWF based on observations from weather stations and satellites. For daily maximum mean radiant temperature (MRT), we used the ERA5-Heat daily dataset (Di Napoli, 2021), also from ECMWF. To understand the effect of shade and calibrate the proceeding reanalysis datasets to a representative site, we used heat exposure modeling of an Oasis mobile home park by UCLA's Morgan Rogers, specifically modeled air temperature and MRT with and without shade for 8am, 10am, 12pm, 2pm, and 4pm on August 1st, 2022, henceforth referred to as the "Rogers dataset."

Methods

Until recently, explicit calculation of WBGT required iterative calculations in C++ (Liljegren, 2008), a process simplified with a Python adaptation by Kong and Huber (2022). WBGT calculations were further streamlined by the thermofeel Python package (Brimicombe, 2023), which calculates WBGT given air temperature, dew point temperature, wind speed, and mean radiant temperature. This report uses the thermofeel Python script downloaded from GitHub and "translated" into R by ChatGPT (OpenAI, 2024).

Hourly dew point temperature and wind speed data for Oasis were collected directly from ERA5-Land using Earth Engine (Gorelick, 2017). Hourly air temperature was also collected from ERA5-Land but was adjusted from the overall 9km ERA5-Land grid cell value to a location specific value through a linear model of ERA5-Land air temperature and Rogers air temperature on August 1st, 2022. Air temperature was fit separately for shade and no-shade Rogers models, providing separate hourly air temperature estimates with and without shade. In contrast, dew point temperature and wind speed were assumed to be shade independent, likely a reasonable approximation for small shade structures e.g. over a playground.

ERA5-Heat provides daily maximum MRT which was modeled against daily maximum air temperature, surface downward solar radiation, and surface downward thermal radiation from ERA5-Land to enable prediction of MRT for all hours from the hourly ERA5-Land dataset. This method could be improved by instead downloading the hourly MRT directly from ECMWF (only daily maxima are currently available through Earth Engine). As with air temperature, these hourly MRT values were then locally-calibrated based on the relationship between reanalysis MRT and Rogers MRT on August 1st, 2022, for both shade and no-shade scenarios.

From these inputs, WBGT was determined hourly with and without shade and the total hours lost to extreme heat determined for each scenario for a set of thresholds taken from the Kansas State High School Activities Association, as published by the National Weather Service. The highest of these standards, 89.8°F, is also the cutoff recommended by Grundstein et al. (2015) for any outdoor athletic activity in the Eastern Coachella Valley, with lower thresholds corresponding to WBGT values for which activities should be interrupted with increasing breaks.

Results

The following table presents results of hours lost for shade and no-shade scenarios for 2022 under a range of WBGT thresholds. Shade decreased the time facilities were unusable by 12 -40%, depending on the WBGT usability threshold. Notably, the change in hours a facility would be usable remained relatively constant independent of threshold selection.

Threshold	Hours lost (no shade)	Hours lost (shade)	Difference	Percent
80	2337	2052	285	12
84.7	1538	1250	288	19
87.8	1020	728	292	29
89.8	687	412	275	40

Discussion

Shade clearly increases the usability of outdoor spaces in Oasis. That the difference in usable hours is roughly the same for different thresholds suggests the benefit of increased shade is

relatively insensitive to the particular WBGT standard. Indeed, not only does this enable approximation of the impact regardless of potentially conflicting standards in Oasis, but also suggests the benefits of shade would be relatively equally distributed across the population, regardless of individual's personal thermal thresholds.

The impact of shade, approximately 280 additional hours of use, are substantial, equivalent to more than a month of 8-hour days, which could increase the usability of a facility by 5-10% over the year. Assuming outdoor facilities are constructed when benefits exceed costs and that most of their benefits come from their use, it makes economic sense to allocate at least 5-10% of facility construction budgets to shade installation. If projects more than break even when comparing benefits and costs, net utility justifies even greater allocations for shade.

Community Recommendations

At a community meeting on June 12th, 2024, community members placed stickers on aerial images of Oasis Elementary School and Oasis del Desierto Park to share their ideas and recommendations

for where both shade trees and shade structures should be installed. Please find our summary findings in the shared course drive.

Shade Tree Recommendations

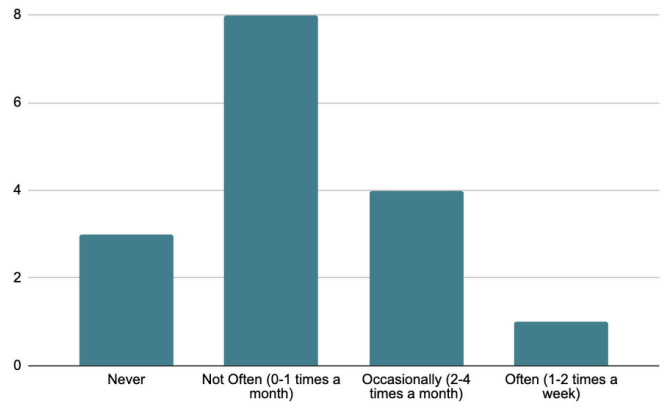
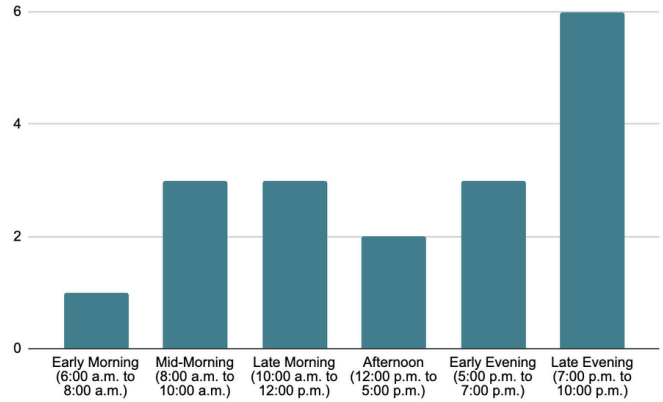
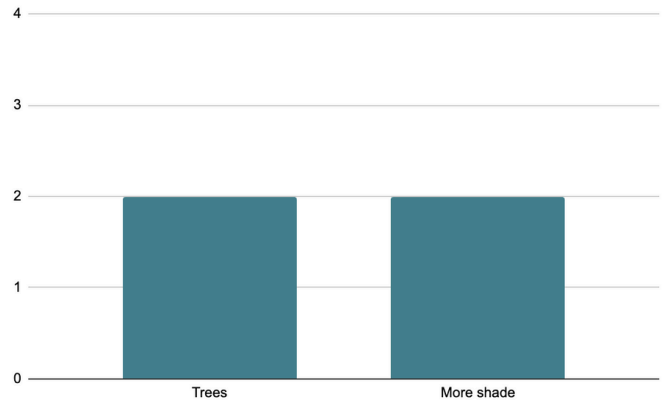
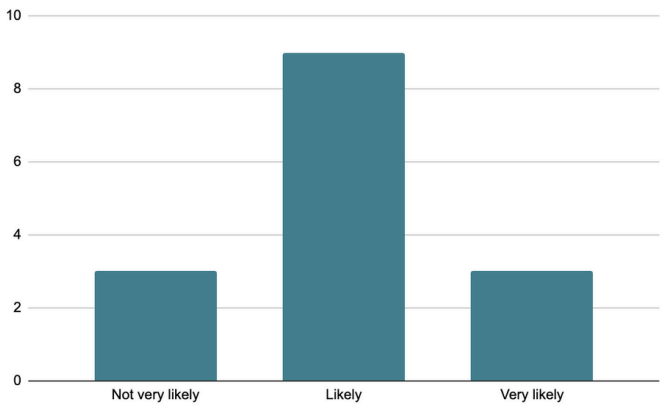
Members from the Oasis Leadership Council strongly recommended use of trees for shade whenever practical. The United States Department of Agriculture (USDA) reports between 0–14% tree canopy coverage in the ECV, mostly from date palms, and high-use public spaces have much lower canopy coverage, suggesting an urgent need for additional trees. In response to these stated interests and documented need, we cataloged tree species best adapted for the Eastern Coachella Valley. Our recommendations were presented to the community as a “plant palette”, a graphical guide to recommended trees for the ECV. A diversified and heat-tolerant tree canopy in the ECV is a resilience strategy for extreme heat, bringing additional co-benefits of thermal comfort, enhanced

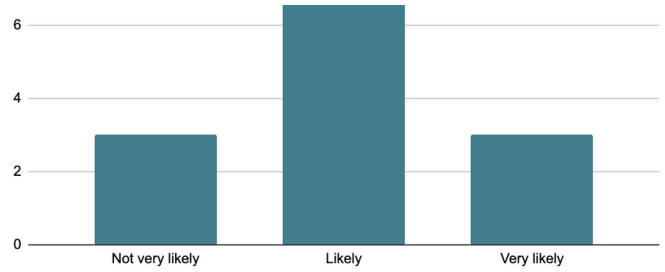
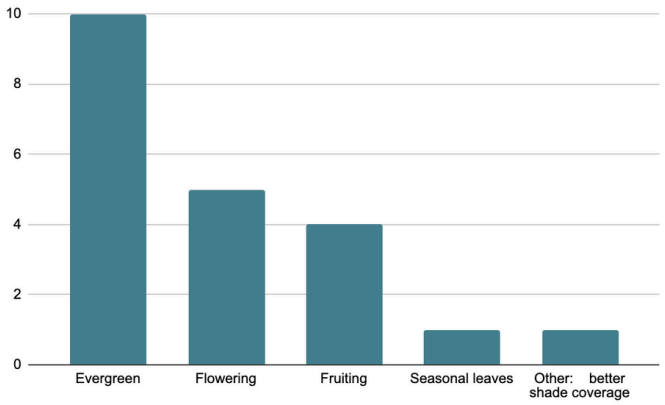
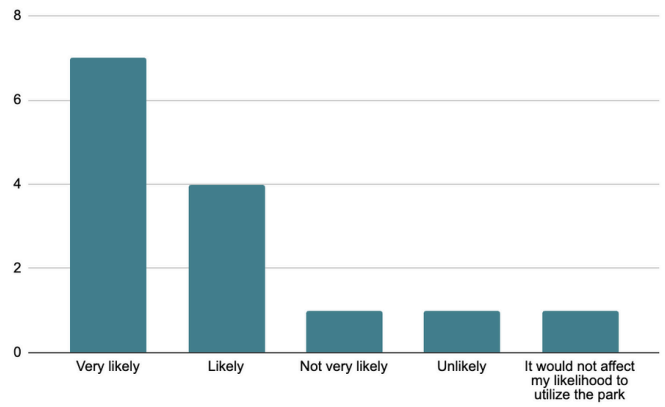
quality of life, and community beautification. Please see the guide itself (English , Spanish) for this component of our report.

Survey results and Questions

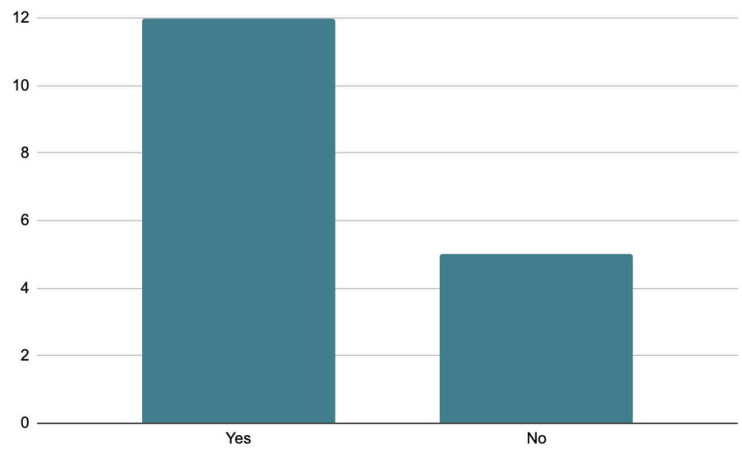
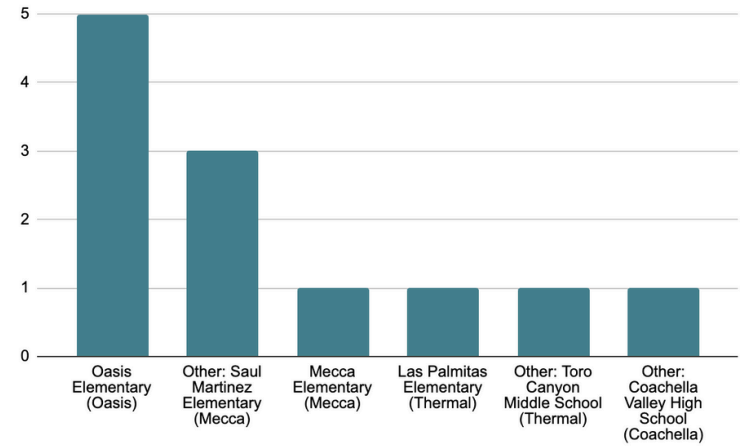
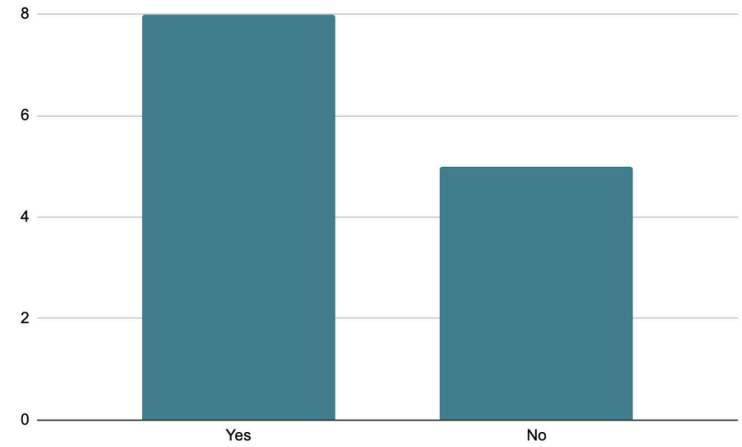
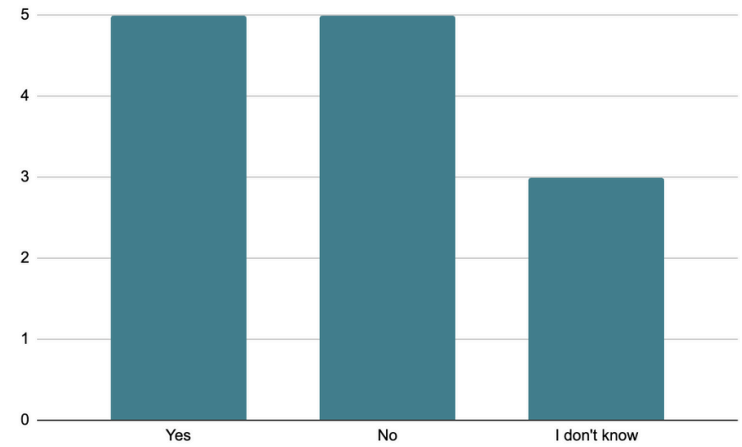
We also distributed two survey question sets to the community of Eastern Coachella valley in order to gather information on residents' experience with heat in shade and parks/schools.

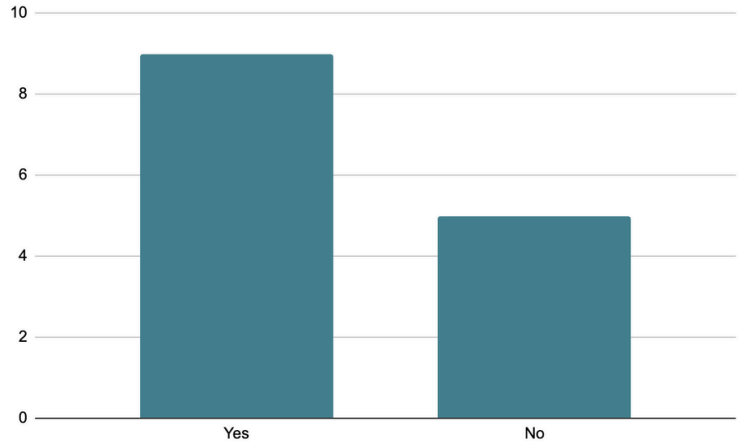
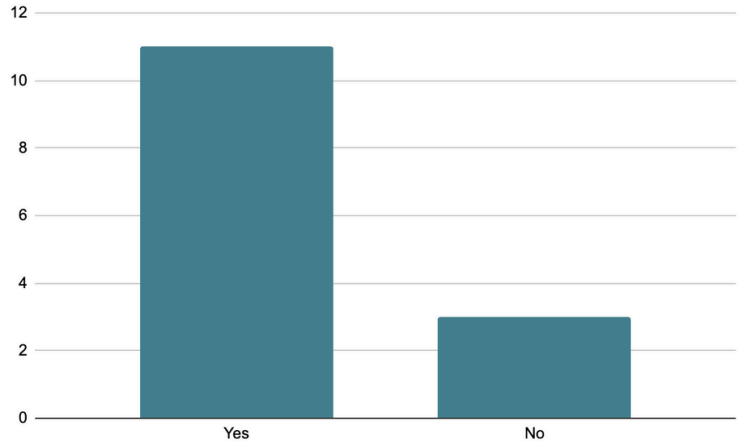
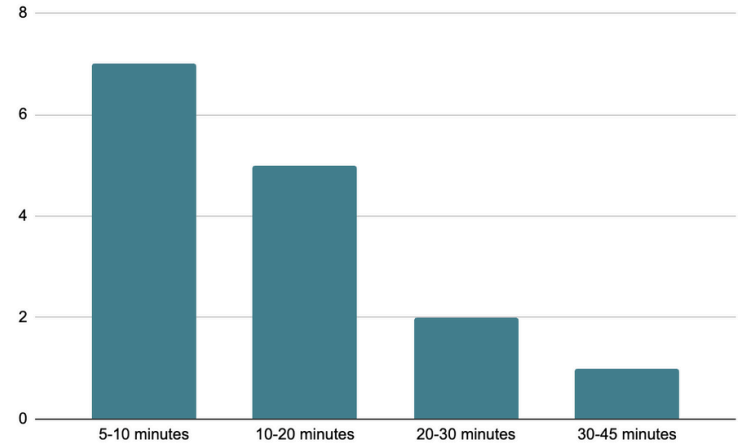
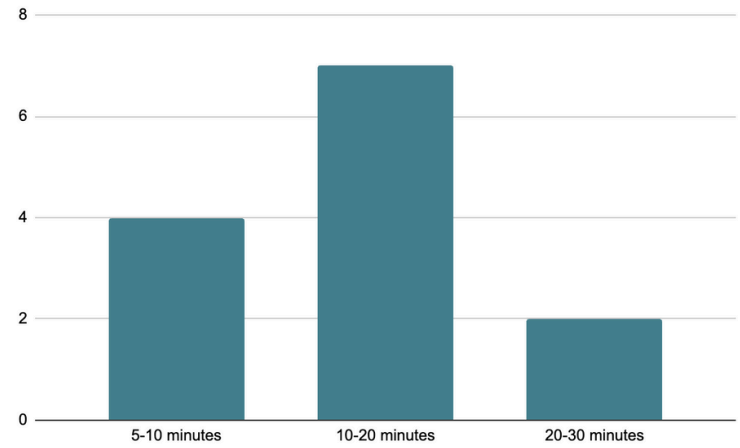
Parks

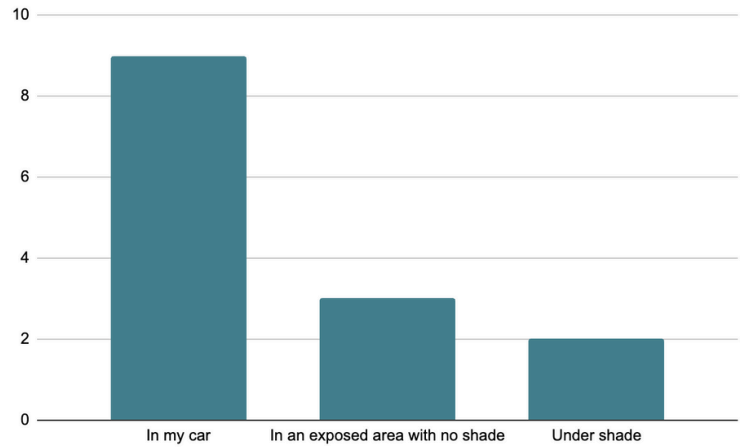
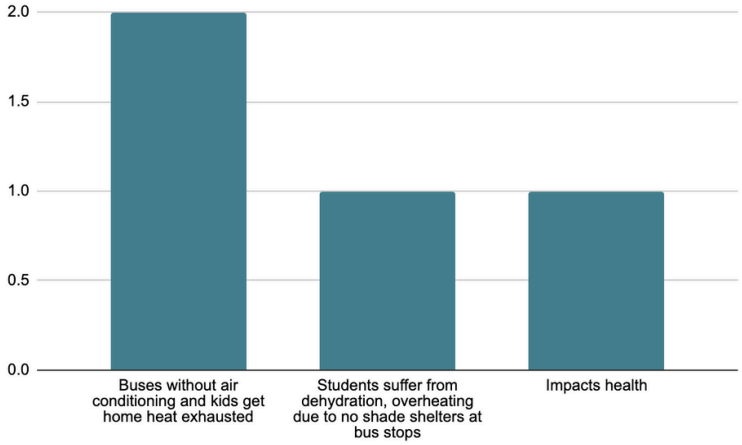
1	How often do you go to the Oasis Del Desierto Park?	
2	Based on how often you visit the Oasis Del Desierto Park, what times of the day are you discouraged or less likely to go to the park due to heat?	
3	Briefly describe what shade interventions would encourage you to use the Oasis Del Desierto Park more often during hot weather	
4	What cooling interventions would encourage you to use the Oasis Del Desierto Park more during hot weather? (Check all that apply)	
		

5	If the park was to offer more shade from trees, would you be more likely to utilize the Oasis Del Desierto Park?	
6	What tree characteristics are most important to you?	
7	If the park was to offer shade structures, would you be more likely to utilize the Oasis Del Desierto Park?	

Schools

1	Do you have a child(s)/student(s) who attends or attended a school in the Coachella Valley Unified School District?	
2	Which school(s) does/has your student(s)/child(s) attend(ed)?	
3	Has your child(s)/student(s) ever missed school due to heat?	
4	Has your child(s)/student(s) had trouble learning in school due to heat?	

5	Has your child(s)/student(s) ever gotten physically sick (heat exhaustion, prolonged heat illness, fainting, dehydration) due to heat while at school?	
6	Have outdoor activities (e.g recess, extracurricular activities, etc.) at school been canceled due to heat?	
7	How long do parents wait outdoors for their student(s) to get released after school?	
8	How long do students wait outdoors to get picked up by a parent, a guardian, or the bus after school?	

9	Where do you wait/supervise for your child(s)/student(s) during dismissal/drop off when it's hot?	
10	Please briefly share how heat personally impacts your and your child's/ student's school experience	

Who Can Make Shade Happen

How to Read the Power Map

The checkerboard jurisdiction that characterizes land use designations in the Eastern Coachella Valley lays out a unique pathway towards implementing shade solutions in community parks and public schools. In identifying power dynamics to approve shade infrastructure projects, we classified four power types: (1) high-approval decision making, (2) land management, (3) advocacy, and (4) funding. Moreover, three scales of power were developed to further subcategorize entities who may hold the four power types. Varying from *most distanced* to *greatest proximity* in key decision making to implement shade needs, the scales of power consist of:

- **Scale 3** - executive power
  - (e.g. absolute authority to fund and or approve a project)
- **Scale 2** - project adjacency

    - (e.g. includes paid staff in government or CBO positions directed by leadership to push a project forward through administrative or non-executive tasks)
- **Scale 1** - advocacy efforts led by mission-driven, grassroots, community-based organizations and external jurisdictional partners
    - (e.g. Native tribal organizations, churches, nonprofits organizations, leadership councils)

To visualize the established and potential influence amongst various entities involved in the approval process of shade infrastructure in schools and parks, two versions of the same power map were developed. Digital versions of the power maps can be viewed here. The power maps are to be analyzed in conjunction with this database, which records contextualized information on a nearly exhaustive list of entities involved in the process to tangibly meet community shade needs in the rural and unincorporated areas of Riverside County. The database includes information regarding memberships and partnerships, the roles of local leaders, the geographic jurisdictions of elected officials, the designated scales of power and power type, hyperlinks to organizational websites, contact information, and team-drafted notes.

Summarizing the Power Map

The Desert Recreation District (DRD) and the Coachella Valley Unified School District (CVUSD) are the main decision makers and funders for shade infrastructure installation in parks and schools, respectively. They are county-wide governing bodies designated with land use supervision of public facilities on agricultural land. Specifically, the DRD is a special district with discretionary power by the State of California to manage, maintain, and deliver programs and park services for over 278,000 residents. As the largest recreation district in California, DRD also has the ability to acquire and develop park land to meet community needs at the discretion of its five-member Board of Directors. Moreover, its funding arm is the Desert Recreation District Foundation. As for executive decisions on tree canopy and structural shade installation in public schools, the CVUSD Board of Education takes responsibility. The Board of Education is made up of seven Trustees and three Student Trustees to represent constituent school interests in the four Trustee Districts. Both the DRD and CVUSD hold the four essential power types to approve, manage, fund, and advocate for projects situated on their respective campuses and boundaries. Both also scored a 3 in executive power.

While executive power to gain approval for projects is important, the funding arm leveraged through elected representatives and other external funding stakeholders is essential to consider. For instance, Supervisor Manuel Perez is delegated to the following three power types: funder, decision maker, and advocate. He formerly sat on the Coachella Valley USD Board of Trustees where he led the passage of a $250 million bond to renovate schools. His reputation and experience in school infrastructure policy makes him an ideal candidate for targeted local advocacy campaigns. As part of the Riverside County Board of Supervisors, by default, he oversees the Board of RivCoParks and sits on the Coachella Valley Mountains Conservancy, a regional nature conservancy organization that funded the development of the Oasis Del Desierto Park.

Lastly, the grassroots advocacy efforts of local constituents is arguably the most crucial element to the success in the approval and implementation of neighborhood shade solutions. Locals who resiliently work, play, and live in the extreme heat of the Eastern Coachella Valley are testaments to their collective pride in making the valley their home and to their commitment to placemaking shade improvements for future generations. Dedicated members of the Oasis Leadership Committee (OLC) include agricultural farmworkers, residents of mobile homes, youth, students, flora enthusiasts, and public transportation riders who are the force bridging the gap in local environmental inequities as a result of municipal neglect. Although community groups received a 1 in scale of power, this denotes their influence through grassroots organizing and collective unity to hold elected representatives accountable in driving their political will to meet life-saving shade demands.

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Transportation: Addressing Extreme Heat through Shade Strategies

Think about the last time that you felt hot outside, such as walking home from school, waiting for your bus, or playing at the park. How often do you seek shade at these times? Do you prefer to cool down under natural sources of shade, like trees, or constructed sources, like under a canopy? Consider how hot you feel in the sun versus in the shade. Shade is an important factor for how your body responds to heat, especially in light of increasingly extreme hot weather conditions.

From 2013 to 2023, heat emerged as a significant cause of death in the surrounding area of Coachella Valley. 143 deaths were attributed to heat-related causes, according to data from the Riverside County Sheriff's Office. This trend underscores the severity of heat-related risks in the region. Elevated temperatures pose various health risks, including an increase in heart attacks, cardiovascular deaths, and respiratory illnesses.

Transit riders are one group that faces significant risk of excess heat exposure, including while at stops, transferring between buses, and walking to and from their destinations.

Vulnerable, transit-dependent groups such as children and adults are particularly susceptible to respiratory issues exacerbated by high exposure to ground-level ozone, leading to conditions like asthma, bronchitis, and even premature death. Furthermore, a heat index of 90 degrees Fahrenheit heightens the likelihood of heat-related illness, such as heat cramps and heat exhaustion.

Despite the severe and sometimes fatal consequences of excess heat exposure, shade, one of the most significant methods of cooling, is limited at many stops in the Coachella Valley. 39% of bus stops in unincorporated Riverside County and 64% of stops across SunLine's service area. However, **only 20% of bus stops in Oasis have a shelter, one of the lowest rates across Sunline's system.**

The objective of this knowledge sharing is to provide community members and stakeholders with a tool for understanding the existing conditions and governance structures tied to the ECV's transit infrastructure - SunLine Transit Agency. Ultimately, the goal is to provide recommendations from the community based on what they see as priority considerations linked to the relationship between shade and transit. These recommendations will ultimately characterize next steps within the broader pursuit of a comprehensive shade equity plan. These recommendations will be derived from a thorough needs assessment. This project aims to ensure that our recommendations are borne of knowledge and research shared with and developed alongside community members.

Environmental and Infrastructural Challenges

The escalating temperatures also pose ecological and infrastructural challenges. The widespread use of air conditioning contributes to the urban heat island effect, exacerbating nighttime temperatures and escalating the demand for cooling systems, which further amplifies energy consumption and greenhouse gas emissions already associated with transportation. This phenomenon, coupled with the lack of supportive infrastructure and high temperatures

discouraging transit use, presents significant challenges for transit-dependent communities,

exacerbating environmental and health disparities.

Trees can provide a significant source of shade, but shade can also be constructed. Buildings and other structures can assist with cooling, even indirectly, particularly in areas where trees may fall short. Natural sources of shade require significant water and can be severely damaged by weather events, such as the dust storms and heavy rains sometimes experienced in the East Coachella Valley.

The materials utilized to construct shade structures present another challenge. Certain metal materials can heat up and make the area underneath it hotter in comparison to being exposed to direct sunlight. Materials like plastic, fabric, or brick interact with heat differently and impact the

effectiveness of cooling. Additionally, weather conditions in the Coachella Valley imply a greater need for sturdier structures that can withstand dust storms, heavy rain, and other circumstances. Similarly, as a low density region primarily dedicated to agriculture, distances to and from different destinations can be further apart and difficult to walk to, making planning for shade more difficult.

Existing Regulatory Landscape

Existing regulations significantly impact and limit options for shade at transit stops. For instance, Sunline Transit, the main transit agency servicing the East Coachella Valley, defines its own Stop Amenities Standard, Stop Spacing Standard, and Service Frequency Standards that determine bus stop conditions, which present challenges for shade implementation.

For instance, many areas of the Coachella Valley may not have built sidewalks, which are a prerequisite for the implementation of stop amenities including a bench or trash receptacles. In order for a stop to qualify for a shelter, a stop must have at least 10 average daily boardings; although it is possible that some stops within the unincorporated ECV may meet this requirement, a lack of a sidewalk may hinder implementation, such as by stops adjacent to mobile home parks with limited infrastructure. Similarly, Sunline Transit's service quality standards negatively affect riders in cases where bus service is unreliable, creating prolonged heat exposure as riders wait for a late bus service. Longer distances between stops also reduces accessibility and has the potential to increase heat risks. In addition to the restrictions presented by Sunline Transit, the ECV also faces jurisdictional challenges in implementing new infrastructure, as the right-of-way might be governed by several jurisdictions, such as tribal governments or private property owners.

The table below indicates how bus stops located in Oasis compare to other areas in the Valley in terms of shelter access and boardings. While Sunline's standard indicates that a stop with 10+ boardings are eligible for a shelter, some eligible stops have not yet had a shade structure installed, while others that have fewer than 10 average daily riders have a shade installation.

Bus Stop by City/District (FY 23-24).

City/District	Total stops	Total shelters	Stops with 10+ boardings	Stops with shelters and 10+ boardings
Thermal	8	2	1	1
Oasis	10	2	1	1
Mecca	20	9	3	3
Coachella	34	21	9	7
Indio	87	39	33	25
Unincorporated Riverside County	70	27	13	11
La Quinta	52	34	19	14

City	Most Frequented Stop	Avg Riders/Day
Coachella	5th/Vine	286
Mecca	66th/Mecca Family HC	83
Indio	Hwy 11/ Golf Center	80
Cathedral city	B St/ Buddy Rogers	369
Palm Desert	Town Center / Han East Drive	216
Desert Hot Springs	West/ Pierson	152
Palm Springs	Palm Canyon/ Stevens	141
	Indian Canyon/ Ramon	137
	Palm Canyon/Baristo	76

Source: APC Data March 1, 2022–February 28, 2023

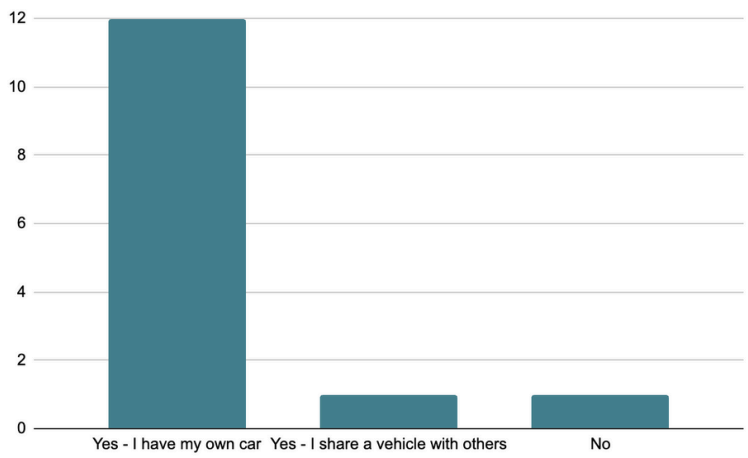
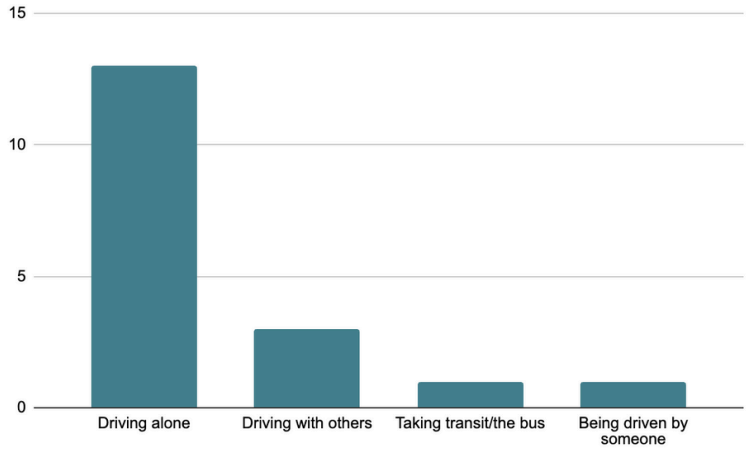
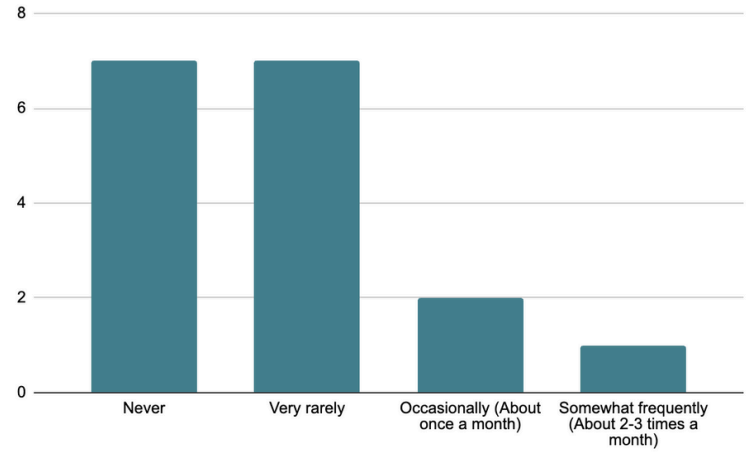
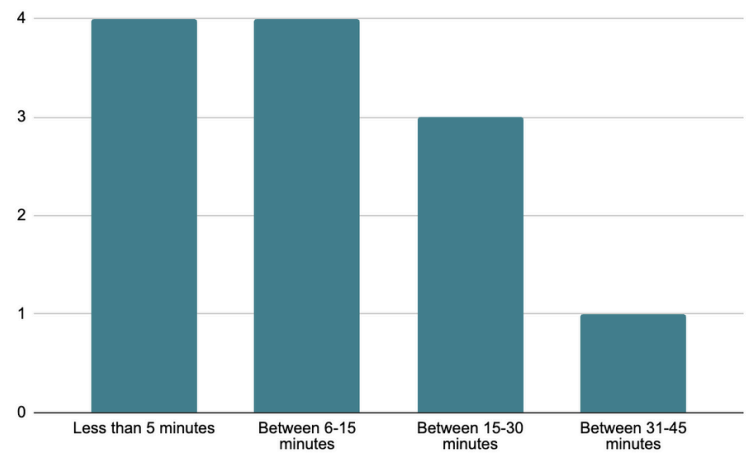
Expanding shade strategies on transit throughout the region

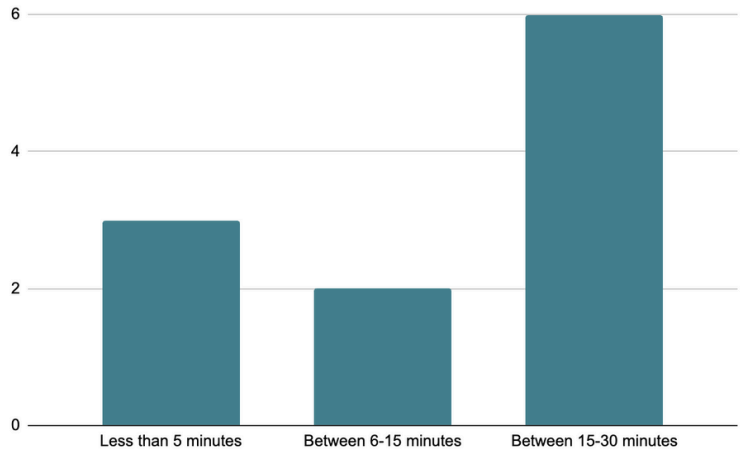
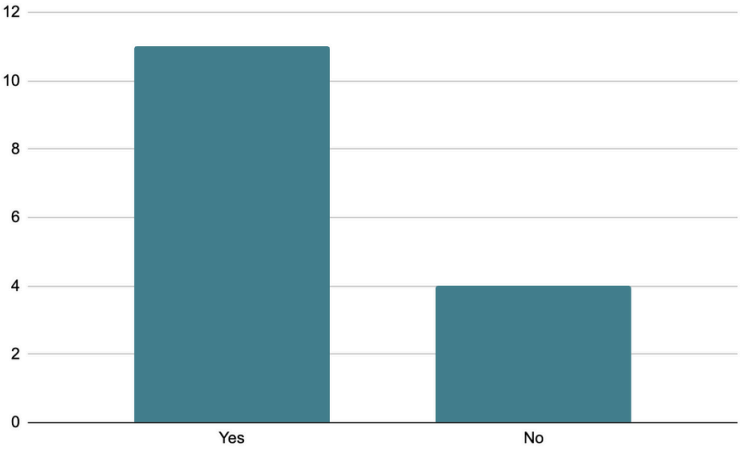
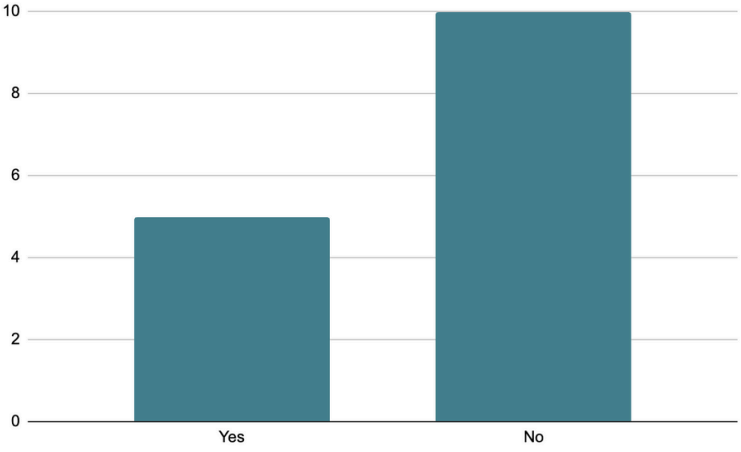
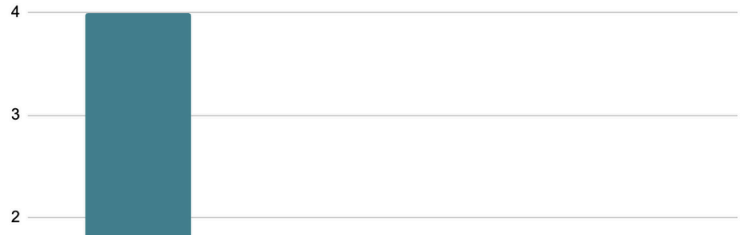
SunLine not only serves the Coachella Valley with transit options but also facilitates connections with neighboring transit agencies. Through interagency agreements with Riverside Transit Agency, Omnitrans, Metrolink, and California State University, SunLine operates the 10 Commuter Link service, linking Indio/Palm Desert to the CSUSB campus and the SBTC/Metrolink Station, with a stop in Beaumont. Additionally, SunLine collaborates with the Morongo Basin Transit Authority, hosting Routes 12 and 15 at its downtown Palm Springs stops. This partnership enables commuters to access destinations such as Yucca Valley, Landers, Joshua Tree, and Twentynine Palms.

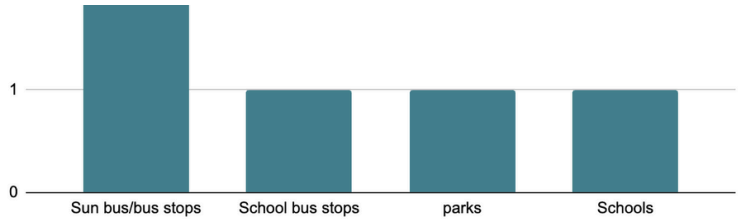
Considering the larger transit network (and its lack of shelters and boardings reported throughout), we believe that cross-agency coordination would best address the need for thermal protection and comfort on transit throughout the region. Collaboration between the region's transit authorities provides not only the opportunity to standardize models, ensuring consistent coverage for riders throughout the network, but also maximizes resources to achieve the best results. This extends our scope to address the broader landscape of mobility justice in the region, recognizing that progressing our shade equity goals solely in our focus areas (Thermal, Oasis, and Mecca) would limit mobility for riders outside of our focus area and leave gaps in the larger connected network where the lack of shade remains a deterrent for riders.

Community survey

Through the help of the OLC, we were able to distribute survey questions regarding transportation and its heat effects to members of the Eastern Coachella Valley. Below are the results for each question.

1	Do you have access to a personal car/vehicle?	
2	In a typical week, how do you travel [Select all that apply]?	
3	How often do you ride transit?	
4	How long do you typically spend waiting at a stop for the bus?	

5	How much time do you typically spend walking to or from the bus stop?	
6	How does heat impact how you travel (including walking, biking, bus)?	No Responses
7	Are you able to change your travel plans when it's too hot?	
8	Have you ever changed travel plans because it was too hot? For example, missing school, work, or an activity. If yes, please explain:	
		

9	Where do you want to see more shade along your route? (e.g., specific bus stops)	

Potential Solutions and Approaches for Policy Makers

- Encourage research into cost-effective, desert shade structure designs that consider the unique needs of the Coachella Valley
- Pursue funding from programs, such as the California Strategic Growth Council's Community Assistance for Climate Equity
- Incorporate landscaping into shade design to serve as a cooling agent; examples include cool pavements (in addition to removing concrete paving where possible), cool roofs, and green roofs
- Expanding on the artificial shade structures that have been explored in Oasis; examples include **solar canopy** which improves perceived thermal support, provides electricity and requires no water.
- Implement hydration stations and cooling machines near transit stops; previous community feedback indicates an interest in amenities such as water sprinklers at stops

Conclusion

Considering the varying challenges associated with implementing shade at transit stops, community members can advocate for shade at the local level by:

- Attending and engaging in ongoing community meetings/events organized by the Oasis Leadership Council and KDI in regards to the East Coachella Valley Shade Equity Master Plan
- Contacting and engaging in public comment at Sunline Transit Board Meetings
- Directing correspondence or feedback to individual Sunline Board members/representatives
- Using Sunline's customer service feedback form (http://customerservice.sunline.org/)
- Attending and engaging in ongoing community meetings/events organized by the Oasis Leadership Council and KDI in regards to the East Coachella Valley Shade Equity Master Plan
- Utilized tactical urbanist strategies, such as small potted trees, along areas where implementing a structure is difficult, such as at a stop without a sidewalk

Mobile Homes: Addressing Extreme Heat through Shade Strategies

Statement of Purpose:

In the Eastern Coachella Valley, the unincorporated community of Oasis's housing stock predominantly comprises mobile homes, where residents rent the land or "space". A "mobile home," as defined within a specific legal context, refers to a structure built before June 15, 1976, that is movable in one or more parts, is at least eight feet wide or forty feet long when being transported, or, when placed on-site, occupies 320 or more square feet. When properly connected to utilities, it must also have a permanent chassis and be designed as a single-family dwelling, with or without a foundation. This definition also encompasses any structure that meets these requirements and complies with state standards for mobile homes at construction (Cal. Health & Saf. Code § 18008). California's Department of Housing and Community Development (HCD) oversees the titling and registration of mobile homes and parks (HCD).

There are over 100 mobile home parks in the Eastern Coachella Valley, and the majority are considered Polanco Parks. A "Polanco Park" is a smaller mobile home neighborhood encompassing no more than 12 mobile homes on agriculturally zoned land. Much of the existing housing stock is considered "affordable", however, it is aged, and dilapidated. Of the many mobile home parks in the Eastern Coachella Valley, many of the substandard mobile home parks are located within tribal jurisdiction in the Torres Martines reservation. Per the zoning code, Polanco Parks located within Riverside County's jurisdiction must be up to code per the rules and regulations set forth by Riverside County and the California Department of Housing and Community Development (HCD). Riverside County rules and regulations on mobile homes do not apply to home parks within tribal boundaries.

Due to the significant amount of aging mobile home units in Oasis, there is an overwhelming need for updates to be implemented for the health and safety of residents, specifically in relation to heat. For community residents to feel "cool at home," there will need to be an enormous investment in affordable housing and water infrastructure. Some examples of housing investments include an improved mobile home replacement program, funding the ECV Waster Master Supply Plan to invest in water and wastewater infrastructure, and investments in affordable apartment units. To "cool residents in their homes" there needs to be quality housing and infrastructure put into place that is resilient to the impacts of climate change, such as extreme heat, mudslides, flooding, sandstorms, and rainstorms. Beyond the development of mobile home parks, other types of housing developments will also require this infrastructure, specifically connection to water and sewer lines.

Without the proper infrastructure being constructed and laid out in the community, new developments such as apartments, homes, and mobile parks, will be difficult to build. Therefore, a significant investment in water and sewer infrastructure may result in more housing opportunities.

New housing development in the region should require heat-resilient infrastructure to be incorporated and it must be reflected in Riverside County's building code. When possible new developments should consider:

- Awnings
- Canopies
- Carports
- Screened porches
- Pergolas
- Umbrellas

Land Acknowledgments and Disclosures:

Eastern Coachella Valley Bureaucratic Status and Jurisdictional Disclosure:

The majority of the Eastern Coachella Valley region is unincorporated. This means that zoning and land use regulations fall under Riverside County Jurisdiction. Within the jurisdiction, the board of supervisors is made up of five separate boundaries. As of 2021, the Eastern Coachella Valley region falls under District 4, the largest of them all, and is led by supervisor Victor Manuel Perez. Separating jurisdictions and the valley's unincorporated status could lead to issues in effective planning and project completion.

Likewise, due to jurisdictional issues, homes located on tribal land are beyond the scope of this plan and under the purview of the tribal government and the Bureau of Indian Affairs. Mobile home units are under the purview of HCD and the responsibility of the owner of the unit for its upkeep, maintenance, and up-to-date paperwork. Polanco Parks, larger mobile home parks, and new housing developments must follow the building codes set forth by Riverside County. There is an opportunity to incorporate heat-resilient infrastructure into the building code and set an example for the region that considers extreme heat, shade, and cooling. We plan to learn more about site-specific locations for possible heat interventions, emergency response programs, and heat policy.

Indigenous Land Acknowledgment:

It is important to note that the city of Thermal sits upon the Torres Martinez Desert Cahuilla Indians' land. The chairperson of this region is Thomas Tortes, who runs the Pacific region for the Bureau of Indian Affairs. In 2021, the response to BIA's actions at the Oasis Mobile Home Park was called into question. Issues addressed were the possibility that the park was operating without a proper lease for at least 15 years, subjecting residents to unsafe living conditions.

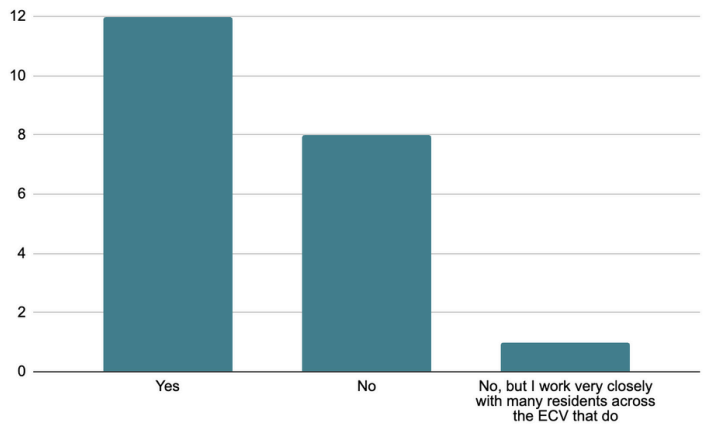
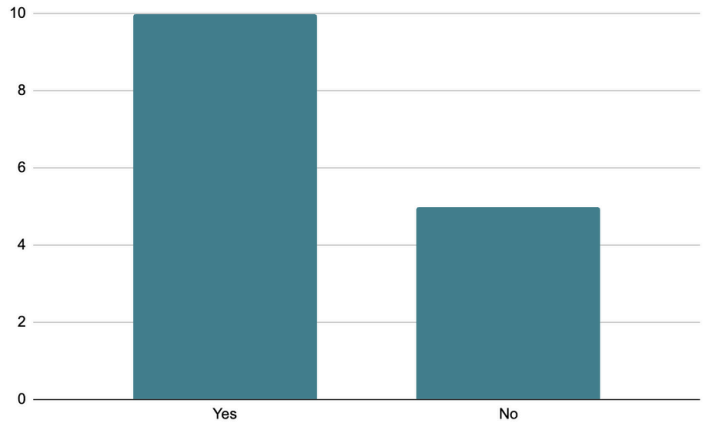
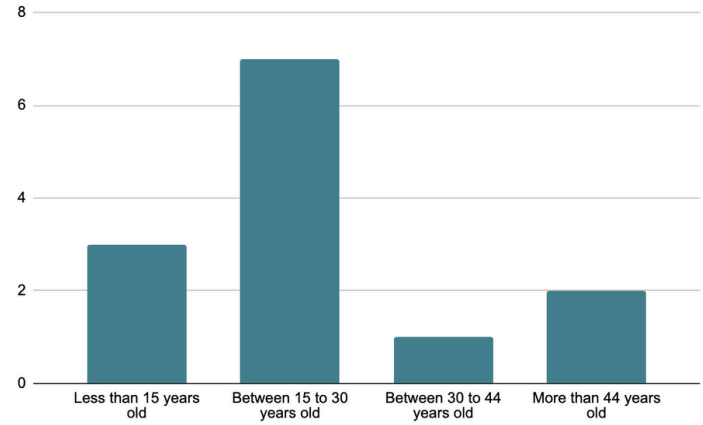
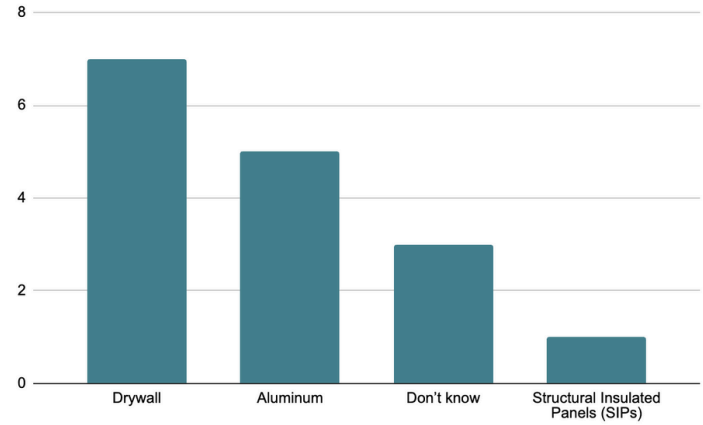
This issue highlights the complexities surrounding jurisdiction, sovereignty, and regulatory control. The local tribal government has its internal building codes for mobile homes. In the next stage of the work, there is an opportunity to connect with the Torres Martinez Tribal Government to understand better building regulations under their jurisdiction. This could also prove to be multi-beneficial, improving the habitability of homes while providing a framework for permitting future heat and shade structures.

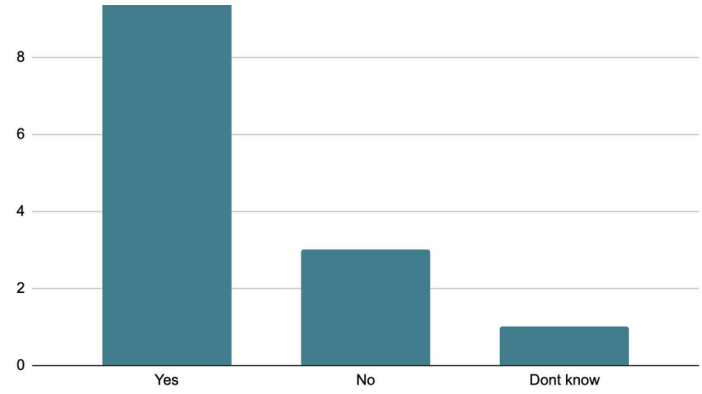
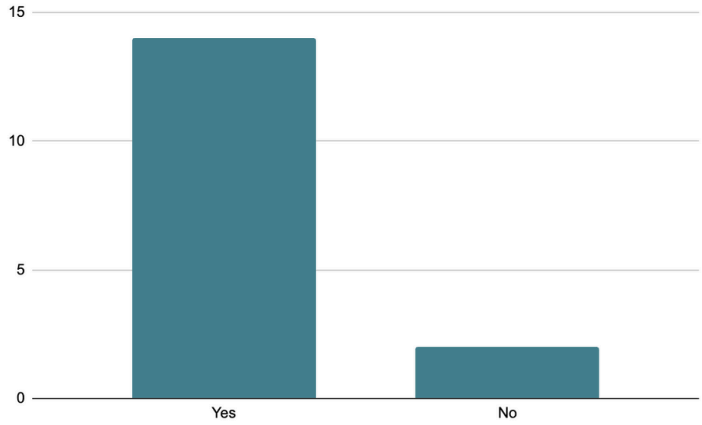
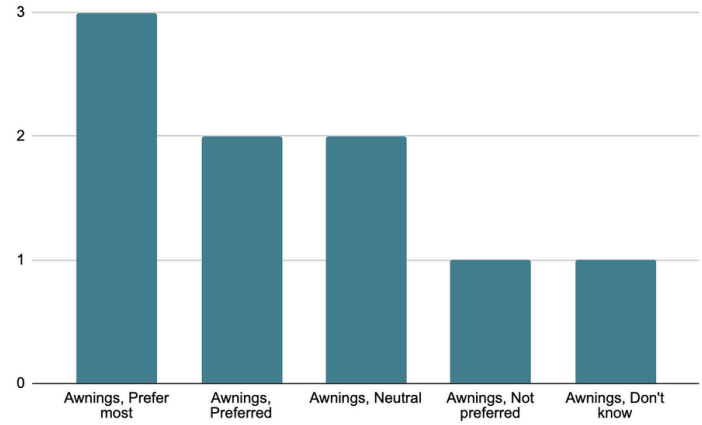
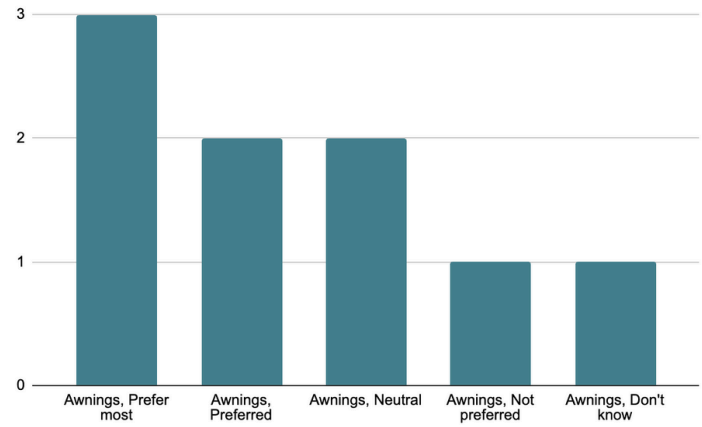
Research Findings:

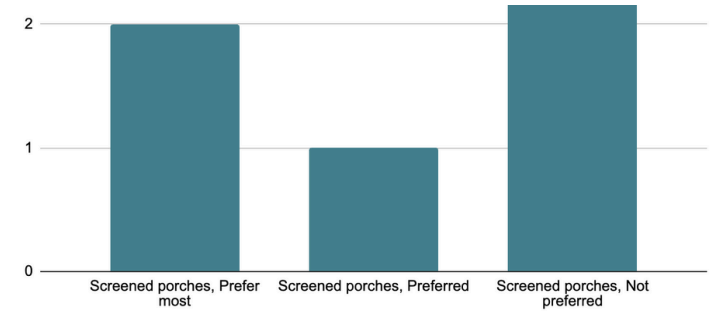
Various key points stand out throughout our work with the OLC and interviews with community members. Of these points is the issues of ownership models, zoning, landlord strictness, ability to meet requirements, lack of affordable housing, and accessible shade regulation. (EXPAND UPON EACH)

- Different ownership models of housing units, land type (tribal/county/fee/federal), and permit status of mobile home parks and units make it difficult to add various types of shade structures.
  - Landlord strict rules about shade structures + regulation navigation
  - Financial constraints
  - Historical Negative Legacy
    - 5 requirements:
      - Fire suppression
      - Sewer system
      - Water well -> Environmental health and safety tests
      - Electrical system
      - Gravel
    - Those in permitted parks have a better chance of getting shade structures permitted. Older parks can’t get shade structures permitted because park as a whole is not permitted
    - Tribal checkerboard pattern and jurisdictional issues
- The county is looking for apartments to and other affordable housing options (overall**)
  - Make sure incentives are in place for affordable housing such as inclusionary housing
- Older infrastructure still in use, informal connections to utilities and water, and inability to use air-conditioning to cool home down
- Mobile homes are the primary affordable housing type (Polanco parks)
  - Need for various affordable housing types and types more resilient to weather/heat
- Provide options for both (existing parks) and apartment/affordable complexes
- Recommending heat-resilient infrastructure for new development
- We found that asking residents these specific share questions would give us a better idea of what exists or what is needed:
  - Awnings
  - Canopies
  - Carports
  - Screened porches
  - Pergolas
  - Umbrellas
- Shade over mobile homes or adjacent to mobile homes

- OLC members distributed this survey for Eastern Coachella Valley residents to give input on their experiences with shade and mobile homes.

1	Do you live in a mobile home? If you answered ‘no’ to this question, please skip to the next section]?	
2	Is your mobile home located on land that is family-owned, either your own family or a family living in the mobile home park?	
3	How old is your mobile home?	
4	What material is your home primarily made of? Circle all that apply.	
		

5	Does your mobile home have adequate insulation to keep your home cool during extreme heat?	
6	Have your utility bills increased in the last 3 years?	
7	Regardless if you have it in your home or not and assuming the structure is made of a suitable material, please rate your preference level for the respective shade structures and shade types. Check (x) each box that applies.	
		
		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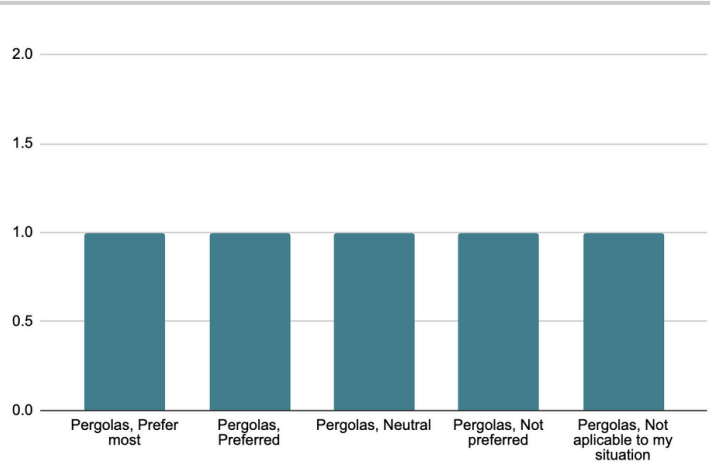
Screened porches, Prefer most
Screened porches, Preferred
Screened porches, Not preferred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1.5
1.0
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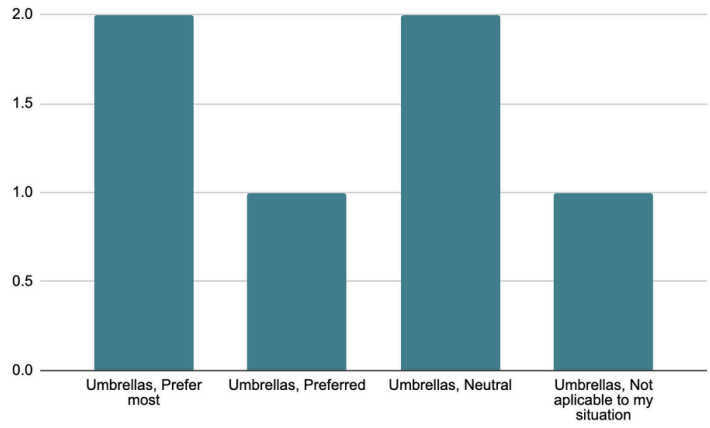
0.0
Pergolas, Prefer most
Pergolas, Preferred
Pergolas, Neutral
Pergolas, Not preferred
Pergolas, Not aplicable to my situation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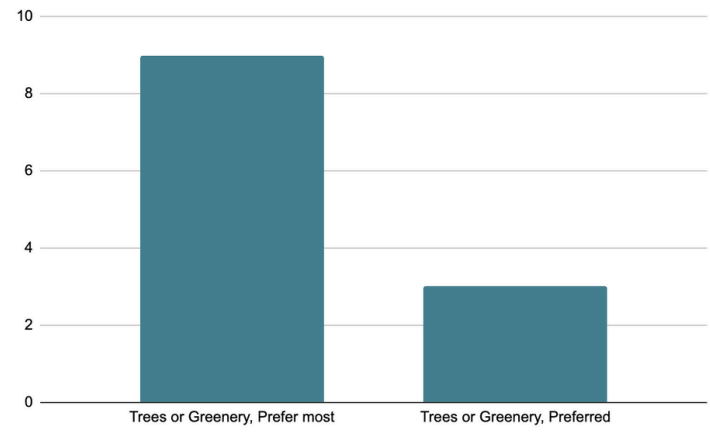
Umbrellas, Prefer most
Umbrellas, Preferred
Umbrellas, Neutral
Umbrellas, Not aplicable to my situation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8
6
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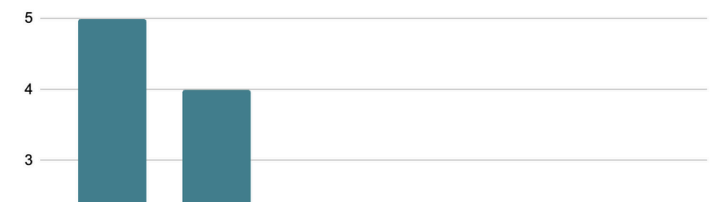
Trees or Greenery, Prefer most
Trees or Greenery, Preferred


5
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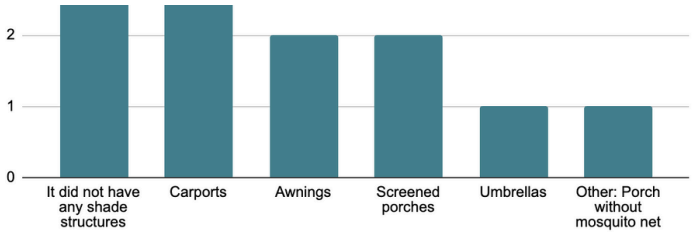
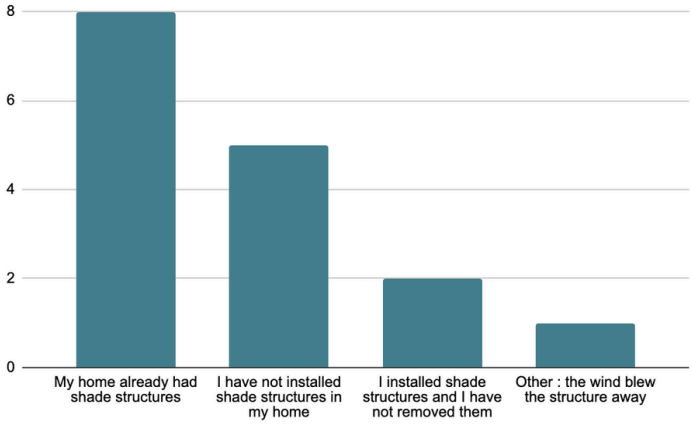
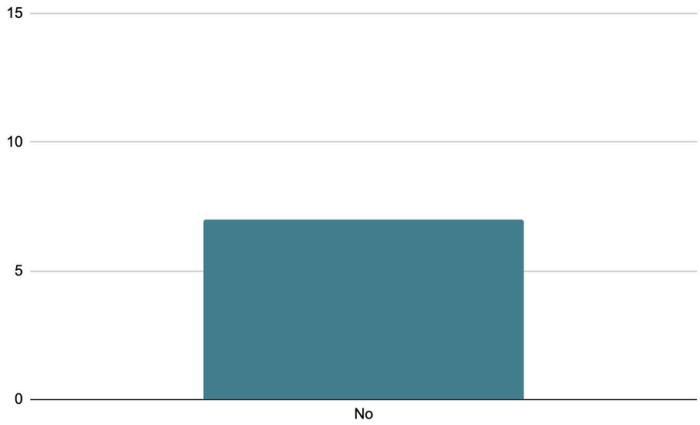
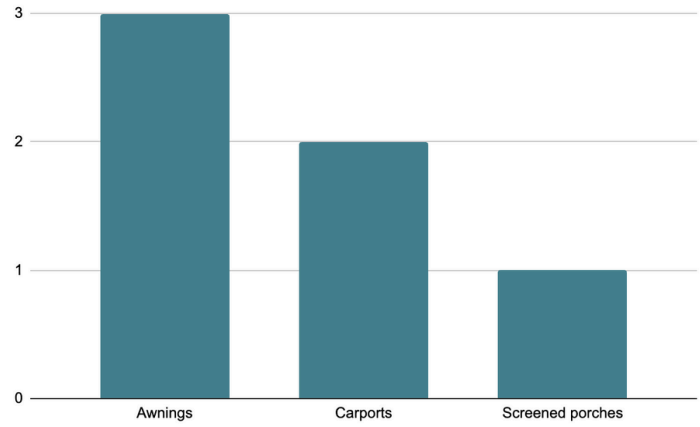
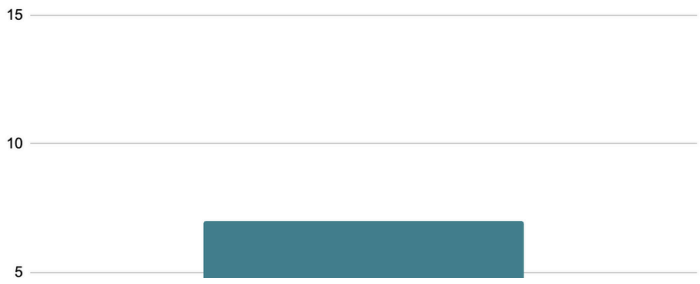
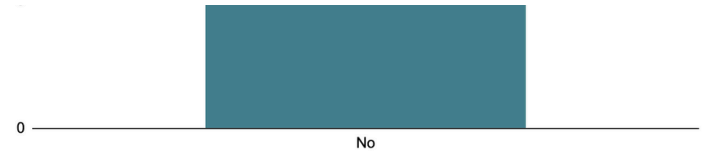
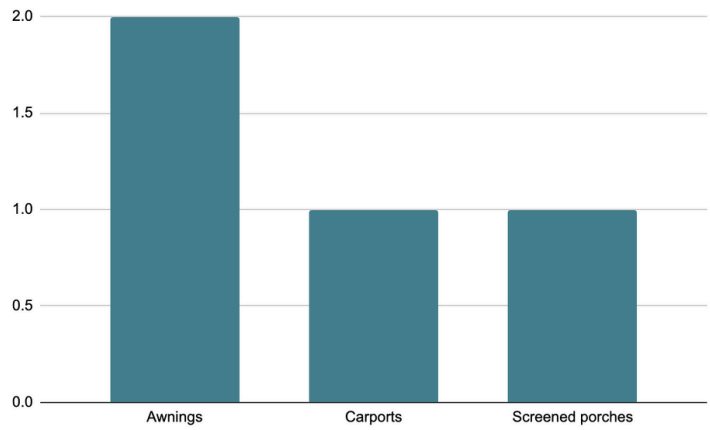
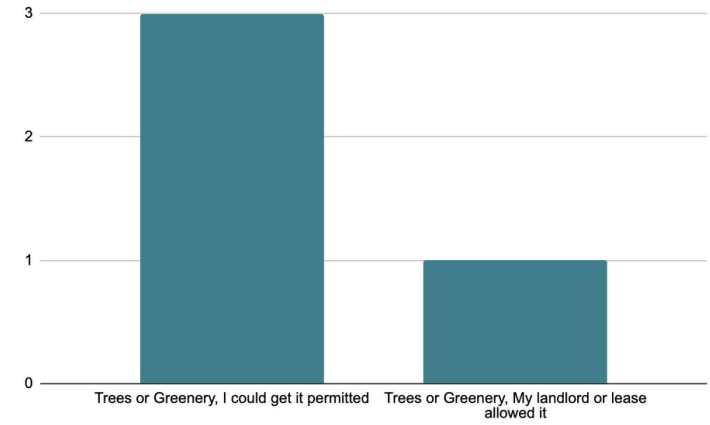
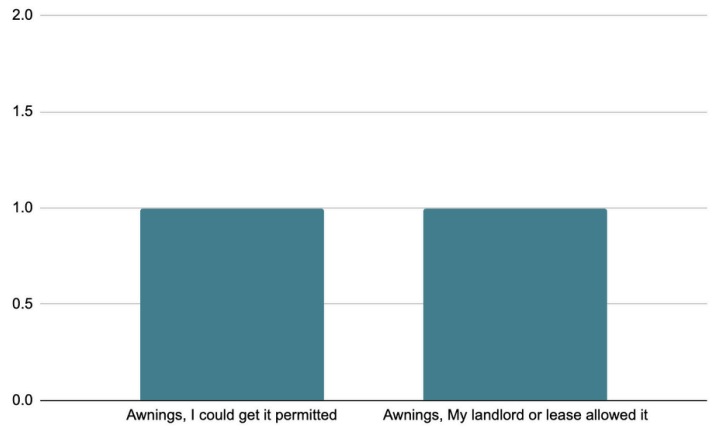
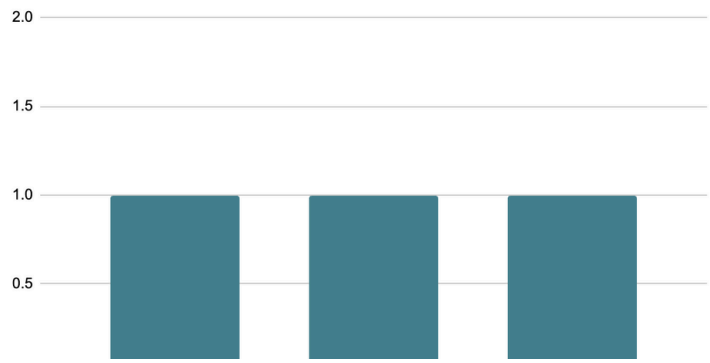
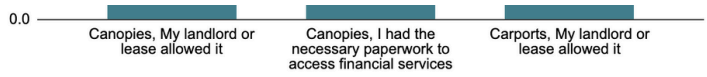
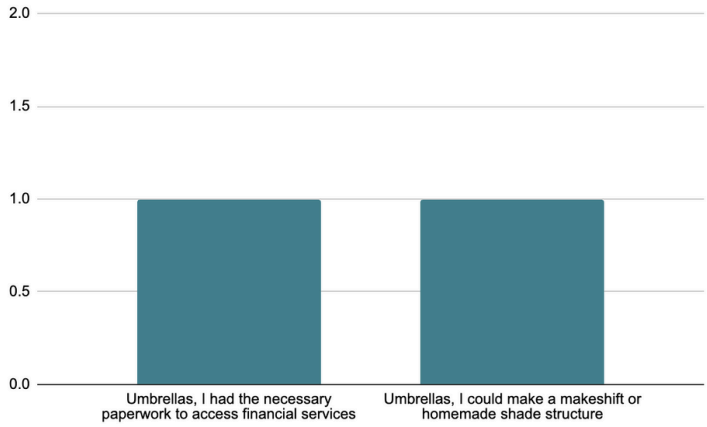
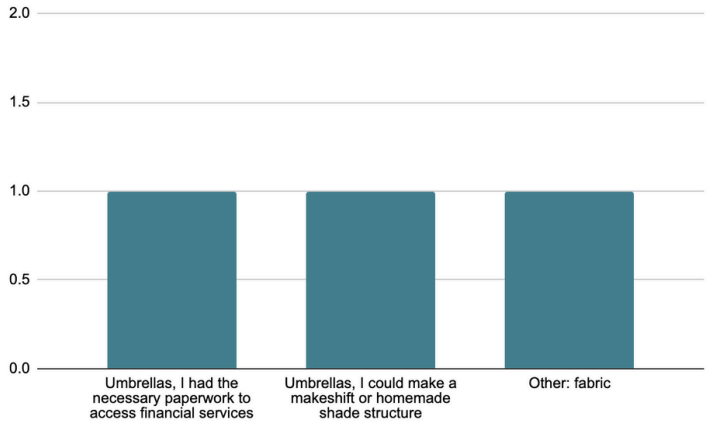
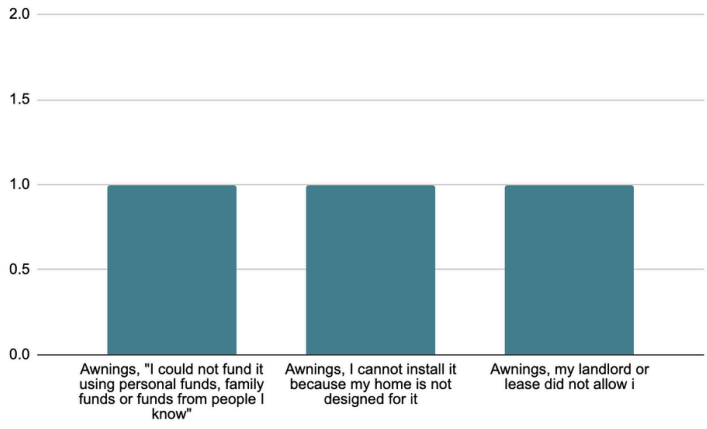
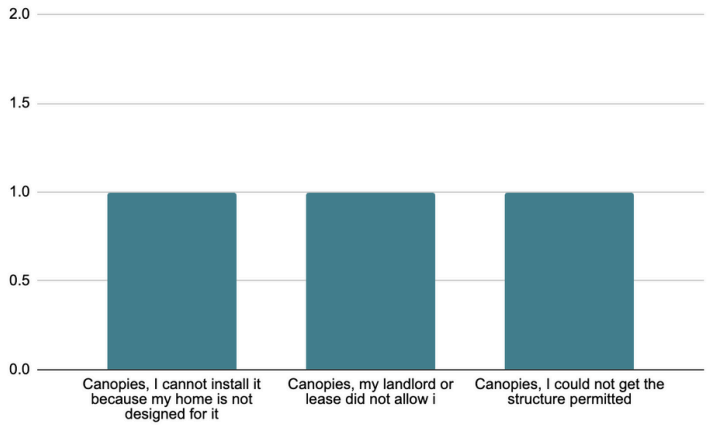
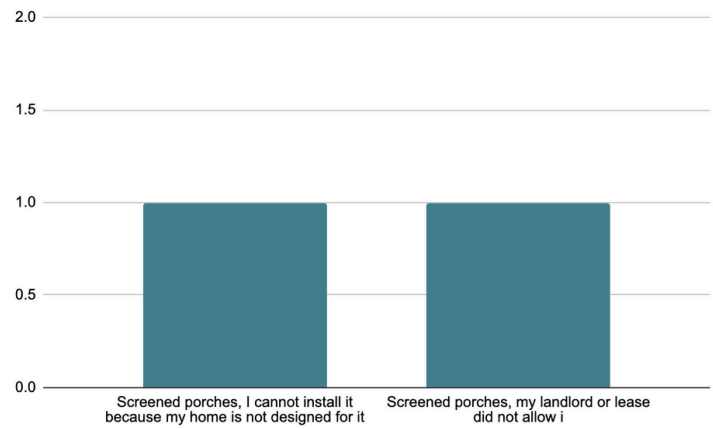
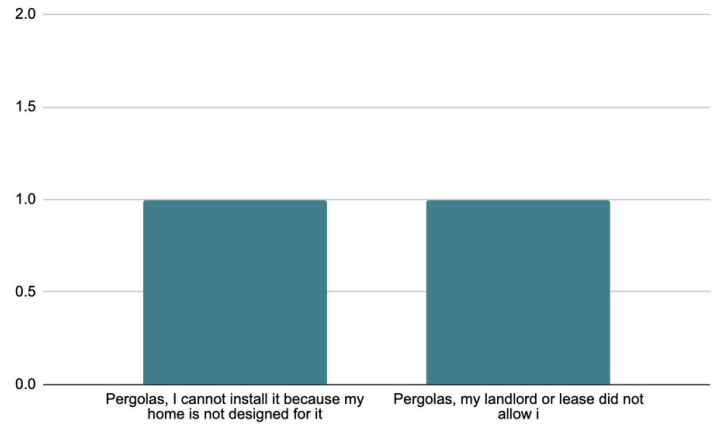
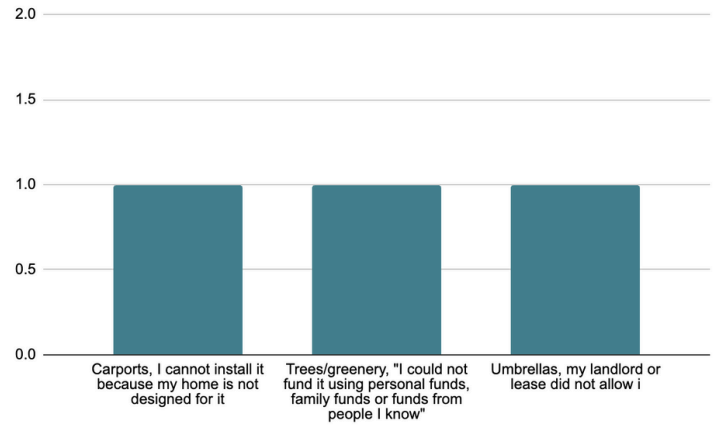
8	Did your mobile home have shade structures when you moved in? Circle all that apply	
9	In the last 5 years, did you install shade structures?	
10	If you answered ‘My home already had shade structures but I removed them’ or ‘I did but I removed all or part of my shade structure(s)’ to question 9, please answer this question, if not skip to question 14. Did you remove your shade structure because you were told to do so by a landlord?	
11	If you answered ‘yes’ to question 10, please answer this question, if not skip to question 12. Which of these interventions did your landlord ask you to remove? Circle all that apply:	
12	If you answered ‘My home already had shade structures but I removed them’ or ‘I did but I removed all or part of my shade structure(s)’ to question 9, please answer this	

	question, if not skip to question 14. Did you remove your shade structure because you were told to do so by code enforcement?	
13	If you answered ‘yes’ to question 12, please answer this question, if not skip to question 14. Which of these interventions did county enforcement ask you to remove? Circle all that apply:	
14	If you have installed a shade structure in the last 5 years regardless of whether it has been removed or not, please answer this question, if not skip to question 15. Why were you able to install the shade structure? Check all that apply for each kind of shade structure installed.	
		
		

		
		
		
15	If you have never installed a shade structure in the last 5 years and if your home has never had a shade structure, please answer this question, if not skip to the next section. What are some reasons or barriers for why you did not install a shade structure? Check all that apply for each kind of shade structure.	
		

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Background of Knowledge:

Impact of Heat on Mobile Homes:

Mobile homes face several heat-related risks due to their unique characteristics and vulnerabilities. These risks include inadequate insulation and energy efficiency, leading to higher indoor

temperatures during hot weather. Additionally, the lack of central air conditioning in many mobile homes can exacerbate heat exposure for residents. Mobile homes are often located in areas with limited shade and green spaces, increasing their susceptibility to heat stress. Furthermore, the demographic profile of mobile home residents, frequently characterized by lower socioeconomic status and health disparities, can amplify the health impacts of extreme heat events. Overall, substandard construction, limited cooling options, and social vulnerabilities put mobile homes at risk during heat waves (Phillips, 2021).

To address the issue of "cooling" and the implementation of heat adaptation strategies, it's critical to look at these as immediate and longer-term interventions. For example, implementing carports, community resilience centers, and funding for generators to run AC can be seen as immediate interventions, whereas 1000+ new mobile home units or affordable housing units may be longer-term solutions. A few policy or project recommendations could include carports, outdoor water fountains, and splash pads as additions to be considered in affordable housing development projects in the community of Oasis. All in all, the issue of affordable housing is beyond the scope of this shade equity plan but plays a critical role in highlighting the urgent need for more housing in Oasis. Quality and resilient housing is needed to survive the consequences of climate change experienced in the community.

Landowners:

Mobile homeowners often own their units but not the land on which they reside. As a result, they do not have complete control over infrastructure improvements, let alone shade screens and window cooling units. According to an Oasis Leadership Council member, residents at Mountain View Estates are prohibited from putting up shade structures or altering the unit in any way due to strict lease agreements. Moving forward it is important we navigate both bureaucracy and homeowner interest as it pertains to shade infrastructure.

Mobile Homes and Zoning Regulation:

Due to the majority of the Eastern Coachella Valley being unincorporated, regulations and zoning codes fall under Riverside County. Under the Riverside County general plan, Eastern Coachella is mostly classified as A-1 (Agricultural). Pursuant to the provisions of Chapter 17.216 in the Counties zoning code, mobile homes may be installed on a foundation on any lot in the unincorporated area of the county of Riverside that is zoned to permit the construction of a conventional single-family dwelling, subject to development standards of that zone; provided, that when the subject lot is adjacent to property containing a place, building, structure or other object listed on the National Register of Historic Places, a mobile home shall be permitted, provided approval of a plot plan shall first have been obtained at a public hearing.

Riverside County has a clear set of guidlines for shade infrastructure in new builds. However, the County has little explanation or a streamlined process of permitting for pre-existing homes. A more streamlined permitting process for adding shade structures to pre-exisitng mobilehomes and parks needs to be created. For Additional and more in-depth rules and regulations for the State and County land can be found here: https://docs.google.com/document/d/1LBpT_75rsTXrGt1-sOg2mAkO2AAAXUmg52mIpXCJz6k/edit?usp=sharing

Case Studies & Possible Interventions:

To inform our recommendations and interactions with community members we incoproated examples from communities beyond the Eastern Coachella Valley:

Legislation in Arizona:

A new rule, House Bill 2146, unanimously adopted by Arizona's House of Representatives, would prohibit landlords from denying mobile homeowners the ability to implement cooling modifications such as installing window air-conditioning units, skirting around units, or planting trees (Britton, 2024). The bill, which will now head to the Arizona senate, is in response to the practice of denying requests to install aforesaid modifications from mobile homeowners by landlords. Through our discussions with members of the OLC, we have found similar situations in Oasis where landlords prevent tenants from adapting to extreme heat conditions, such as prohibiting awnings or window air-conditioning units. As part of our recommendations, new legislation be it at the county or state level, could likewise be implemented to fully allow residents to take the initiative to adapt to high temperatures. A similar rule already exists in the neighboring city of Palm Springs, which prohibits rooms from reaching a temperature above 80 degrees and mandates air-conditioning indoors. As Oasis is an unincorporated community, a county or statewide rule may have to be proposed. Through California Assembly Bill 2597, statewide proposals have been made to require agencies to adopt building cooling standards and to set a maximum indoor temperature. The bill, however, failed in the Senate.

Abu Dhabi Cultural Design and Engineered Shade:

Abu Dhabi incorporates both cultural design and climate adaptation to combat the hot desert climate through pedestrian walkways known as "sikkas" (Government of Abu Dhabi, n.d.). These structures are a historical part of the streetscape and can be expanded to ensure pedestrian comfort while also incorporating cultural architecture. Similar to louvers, "sikkas" can also incorporate wind capture structures to provide further cooling.

City of Los Angeles Emergency Heat Management:

The City of Los Angeles has taken several initiatives to combat extreme heat. These include the opening of cooling centers mostly located in Recreation and Parks facilities, including pools and splash pads, and public libraries (City of Los Angeles, n.d.). The city claims these centers are connected to residents via local air-conditioned bus lines on LA Metro and DASH. In addition, the city has installed hydration stations at various points around the city, and aims to add or refurbish 200 hydration points in time for the 2028 Olympics. During periods of extreme heat, the city will also send phone notifications via the NotifyLA app.

Furthermore, the creation of the Climate Emergency Mobilization Office (CEMO) and the position of a Chief Heat Officer sets the stage for the City to take heat seriously and ensure the safety of all residents of Los Angeles on top of the aforementioned measures. We recommend a similar program that can be adapted to Riverside County and take into consideration the program and policy actions required to take heat seriously in rural Eastern Coachella Valley.

Structural Insulated Panels (SIPs):

We propose the installation of Structural Insulated Panels (SIPs). SIPs are building materials composed of rigid foam materials that are sandwiched between structural panels. Their design offers numerous benefits that will help provide shelter from the desert climate. Of the benefits, SIPs' durability offers strength against harsh conditions, such as sand storms. In addition, their design provides insulation allowing cool air to stay trapped in the home. Lastly, SIPs are fairly versatile, with Yaneth Andrade, Director of Community Capacity Building with Pueblo Unido, stating that SIP Panels can also be used in manufactured housing.

Our Recommendations:

Moving forward in the implementation of the Eastern Coachella Valley shade plan, we propose the following:

- Rezoning, particularly near existing infrastructure, to allow for housing to be built - emphasis on inclusionary plans
- Cooling centers for temporary relief
- Ensure heat-resilient infrastructure for new affordable housing
- *Permit the unpermitted mobile home parks and facilitate a permitting program despite permit status*
  - Grandfather in all the existing/non-conforming use allowance
  - Fees waived or grants
  - Pre-approved plans
  - Mobile-home/shade heat resilient program (first initiative for something bigger like a CEMO)
- Explore Eastern Riverside County pre-approved plans similar to ADU development inventory to ensure it meets the needs of a desert community

Funding Sources

To successfully implement our ideas the following funding sources should be considered.

Transformative Climate Communities (TCC):

Several sources of possible funding include the Transformative Climate Communities (TCC) grant, Manufactured Housing Opportunity & Revitalization (MORE), Enhanced Infrastructure Financing Districts (EIFDs) and the Preservation and Reinvestment Initiative for Community Enhancement (PRICE). TCC is a state grant given to community-driven climate adaptation projects, including unincorporated communities. Grantees are awarded up to $35 million in implementation funds, although given a statewide budget shortage, TCC remains an extremely competitive grant process. TCC funds, however, could be used to fund projects such as shade structures or community microgrids if found to reduce greenhouse gas emissions.

***MORE*:**

MORE is a state funding program that can be used for the acquisition, conversion to resident organization ownership, rehabilitation, reconstruction and replacement of mobile home parks, as well the remediation of health and safety items of both parks and individual mobile homes. Eligible applicants typically must be a resident organization, qualified nonprofit housing sponsor, or local public entity. Private mobile home park owners and nonprofit corporations are eligible to apply under limited circumstances outlined in the current NOFA.

The federal PRICE program is slated to receive $225 million aimed at preserving and rejuvenating manufactured housing. Over five years, these funds will be allocated through competitive grants to various entities, including states, local governments, resident-owned manufactured housing communities, cooperatives, nonprofits, community development financial institutions, Tribes, and others designated by HUD. To access these grants, recipients must provide a 50 percent match for the federal funds. While this program may not provide full funding, it may help provide a way to fill funding gaps.

***PRICE*:**

PRICE grants are intended for use in homes located outside of manufactured housing communities or within communities owned by resident-controlled entities or those mandated to maintain long-term affordability. Eligible purposes for the funds encompass infrastructure improvements, planning, resident and community services (including relocation assistance and eviction prevention), resiliency measures (such as reconstruction, repair, or replacement to safeguard residents' health and safety, addressing weatherization, and enhancing energy efficiency), and support for land and site acquisition. While the funds can facilitate the replacement of pre-1976 mobile homes, they cannot be utilized for repairs. HUD is directed to prioritize applications benefiting low- or moderately low-income residents, aiming to sustain long-term housing affordability within manufactured housing or communities.

Enhanced Infrastructure Financing Districts (EIFDs):

Enhanced Infrastructure Financing Districts (EIFDs) allow municipalities to use future increases in property tax revenue from a specific area to fund projects within the district without raising property taxes. The Eastern Coachella Valley (ECV) EIFD is a proposed EIFD adopted in 2018 to fund comprehensive projects like water, transportation, and utilities. ECV EIFD was projected to begin in 2023.