PUBLIC HEALTH

REGIONAL CONTEXT

Climate change is anticipated to negatively affect the health of Angelenos in a variety of ways, most significantly through extreme temperatures, worsening air quality, more acres burned by wildfires, and an extended period of activity for certain vector-borne diseases. While all Angelenos will be impacted to some degree, certain segments of the population are more vulnerable to negative health outcomes. Low-income and minority populations in particular are more likely to be exposed to climate-related impacts and less likely to have the resources to adapt to them. These disproportionate impacts to already disadvantaged populations are a reminder that climate change is an important equity issue. As a result, the California Department of Public Health created a Health Equity Office to provide technical assistance and resource-sharing on climate and public health challenges affecting disadvantaged communities.

Climate change also presents an opportunity to create healthier, more resilient, and more equitable communities. Research has shown that framing climate change as a health issue is most likely to prompt support for climate change mitigation and adaptation strategies.[113] In addition, many of the goals, strategies, and actions outlined in the Framework represent what the Lancet Commission on Health and Climate Change (a multidisciplinary and international collaboration between academic centers in Europe and China) termed "no-regret" options that can be "win-wins" for the region across different fronts. Actions that reduce greenhouse gas emissions often have notable health co-benefits. For instance, promoting active transportation reduces vehicle miles traveled, improves air quality, and promotes physical activity, lessening the burden of chronic disease.[114] As a result, climate change can spur reforms that enable new pathways for partnerships, solutions, and funding opportunities across multiple sectors and agencies.

Public health agencies are also ideally situated to identify and prepare for climate change impacts on public health and, therefore, reduce health inequalities. Public health professionals work to promote healthy vibrant communities and mitigate any harm, illness, or injury for people.[115] They research and monitor diseases, educate policy makers, and perform outreach to communities to support healthy

behavior and environments. Using a public health lens provides an opportunity to reduce greenhouse gas emissions across multiple sectors and enhance climate resilience across communities.

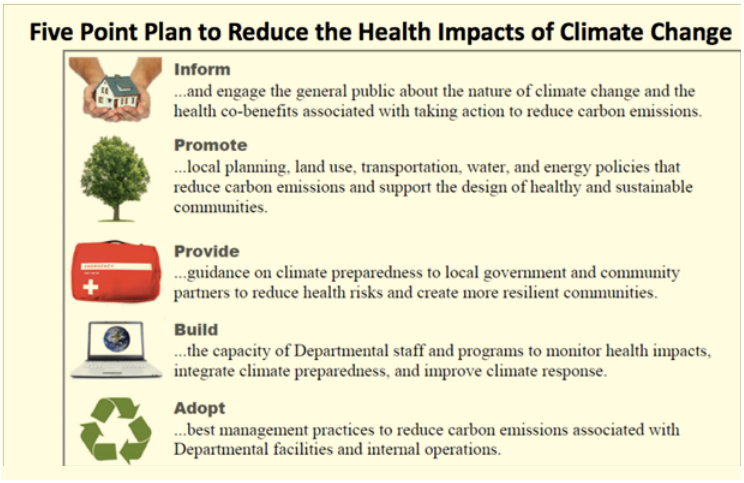
THE ROLE OF REGIONAL COLLABORATION

The Los Angeles County Department of Public Health (LADHP) is one of the most forward thinking in the nation, and addressing each part of the county and the interacting set of conditions that create public health threats is complex. Establishing new interagency/interdepartmental communication channels is important. For example, urban heat regulation lies in building codes as well as how streets are configured, pavement choices, and shading opportunities. Coordinated approaches to protect public health that use understanding from public health experts on the impacts of exposure to heat can inform transportation or public works department codes and construction specifications to reduce urban heat. Transportation policies that reduce reliance on internal combustion engines will also reduce urban heat. Finally, building energy use and retrofits should be targeted with the assistance of public health departments who may be able to best identify vulnerable populations.

To assist in this cross agency/departmental communication, the County should develop a climate mitigation public health task force that expands on the existing LADHP work group to include additional agencies.

POLICY LANDSCAPE

The region has made progress addressing the public health impacts of climate change. The Los Angeles County Department of Public Health developed a framework entitled "The Five-Point Plan to Reduce the Health Impacts of Climate Change"[116] (see below). This plan is an important tool for integrated climate change planning across different sectors. It utilizes a range of strategies including education and building capacity for (and adopting) best practices to improve regional climate response.



Los Angeles County Department of Public Health, 2014[117]

Additionally, the Los Angeles County Department of Public Health (LADPH), in collaboration with the UCLA Fielding School of Public Health, hosted workshops and developed curriculum to educate public health professionals on the impacts of climate change in the region. Subsequently, the LADPH released two reports entitled "Your Health and Climate Change in Los Angeles County" and "Framework for Addressing Climate Change in Los Angeles County."[118] The first report outlines regional climate change impacts and educates residents and communities on how to address them, while the second report calls for collaboration among local government agencies and provides examples on how best to integrate climate change plans across different sectors.

At the state level, the California Department of Public Health developed an implementation plan for the state's adaptation strategy, entitled *Safeguarding California: Reducing Climate Risk*.[119] It outlined how climate adaptation can be integrated into state public health planning and how public health can be improved by the work of other departments and agencies.

These state and local efforts notably emphasized collaboration and partnerships across sectors and organizations. For instance, Los Angeles County created a "climate committee" in 2014 to develop an Urban Heat Island Reduction Plan. Participants include the County Departments of Beaches and Harbors, Fire, Internal Services, Parks and Recreation, Public Works, and Regional Planning. Due to the interrelated nature of problems arising from greenhouse gas emissions (pollution, air quality, rising temperatures, health impacts, etc.), public health can, therefore, serve as the integrated lens to develop mitigation and adaptation strategies across sectors and agencies.

This Framework seeks to support and strengthen these collaborative efforts. Many of the recommendations in this section echo those of the "Safeguarding California: Public Health Sector Plan." This section outlines first a broader set of recommendations that reinforce and build upon collaborative practices already being conducted at the intersection of climate change and public health. It then provides more in-depth regional recommendations for reducing the urban heat island effect and ensuring Angelenos are prepared for higher incidences and intensity of extreme heat days, wildfires, and vector-borne diseases.

GOALS, STRATEGIES, AND ACTIONS

Climate impacts will affect the region differently from the coast to inland areas. However, all areas will face increased heat and vector borne disease impact. Ensuring that the public is educated about these hazards can be done at a regional scale.

The best practices compendium has additional information with case studies and implementation steps.

GOAL 1 — The LADHP, in collaboration with the county's Chief Sustainability Officer, should facilitate partnerships among local governments, academics and nonprofits to better understand and lessen the impacts of climate change on health

Building on the work conducted by the UCLA Fielding School of Public Health, in conjunction with the Los Angeles County Department of Public Health, this Framework recommends greater collaboration across universities, public agencies, and nonprofit organizations to ensure that solutions are defined and integrated by practitioners and experts in the field. Success depends upon incorporating these practitioners' ideas into climate change mitigation and adaptation strategies using existing resources. Los Angeles County Department of Public Health staff learned about climate change science and regional public health impacts and helped define implementation practices for the entire department. Given climate change's implications across all sectors, developing joint action plans will be critical to enhancing the resiliency of the region. This effort should be led by the LADHP, in partnership with the county's Chief Sustainability Officer. Partnerships and collaboration can be strengthened in the region in key areas, which we outline below, as well as actions to implement these strategies.

Strategy 1.1 — Increase research and surveillance on climate-related illnesses and deaths

Research by Dr. Alex Hall at UCLA has advanced the understanding of the specific impacts that climate change will have on the region. His team created a peer-reviewed climate model that provides a granular understanding of how and where climate change will affect the county.[120] In order to best incorporate these findings into mitigation and adaptation strategies on the ground, however, policy makers will need further research and surveillance, particularly on climate-related illnesses and deaths (such as heat cramps, heat exhaustion, heatstroke, and hyperthermia, among others).[121] Research must also correlate the health data with climate resilience and vulnerability indicators, such as transportation access and neighborhood heat indices, in order to develop comprehensive prevention and response tactics to prevent future illnesses and deaths. To that end, local agencies should formally define surveillance factors and determine which risks and outcomes should be mandatorily tracked and reported. In addition, public health officials and climate science researchers should collaborate on a permanent, on-going basis to ensure that they integrate up-to-date climate information into public health services and action.

Policy makers and researchers should consider the following actions to address these public health and environmental challenges:

Action 1.1.1 — Establish criteria for and implement routine surveillance of climate-related illnesses and deaths, as well as climate vulnerability and resilience, across the region (e.g. neighborhood heat indices, shade, social support, and transportation access); define the risks and outcomes to be mandatorily reported and set up reporting metrics.

Action 1.1.2 — Expand the use of syndromic surveillance (analysis of medical data to detect or anticipate disease outbreaks) of climate-related health effects to provide real-time information for public health action (e.g. real-time heat illness surveillance).[122]

Action 1.1.3 — Increase partnerships among public health practitioners and climate science researchers to integrate climate information and services into public health action (e.g. use of seasonal temperature and rainfall forecasts to implement heightened vector-born disease surveillance and interventions).

Strategy 1.2 — Connect climate change adaptation and mitigation strategies to health risk reduction programs and activities

As demonstrated by the success of UCLA and the Los Angeles County Department of Public Health's workshops, public health practitioners can begin implementing climate change adaptation and mitigation strategies into their practices by utilizing existing resources. They should find creative methods to integrate climate change mitigation and adaptation strategies into health risk reduction activities. Some of these include:

Action 1.2.1 — Incorporate climate change education, mitigation, and adaptation strategies into health risk reduction activities (e.g. combined home health and climate assessments, advancing heat mitigation strategies during household visits).

Action 1.2.2 — Incorporate health risk reduction factors into climate risk reduction activities (e.g. address indoor air quality in energy efficiency and weatherization retrofits).

Beyond these recommended cross-sectoral approaches to climate change, the Framework provides specific recommendations to address heat factors in order to support the region's current work to reduce the urban heat island effect.

CLIMATE CHANGE AND HEAT

Extreme heat constitutes one of the most significant impacts of climate change in the Los Angeles region. According to UCLA's "Climate Change in the Los Angeles Region" project, researchers project extreme heat days (days over 95°F) to increase by two to five times by the middle of the century under a business-as-usual scenario.[123] The heat will affect inland and mountain areas in particular, with neighborhoods in the northern San Fernando Valley expected to experience about 100 extreme heat days annually by midcentury (compared to about 55 days currently). Researchers even expect Downtown Los Angeles to be afflicted by nearly four times as many extreme heat days than currently experienced (23 days by midcentury, compared to about 6 days currently).[124] Under a medium-high emissions scenario, more than 8.2 million residents of Los Angeles County would be exposed to more than 38 days of extreme heat each year by the end of the century.[125] More than 80% of those people (6.7 million) would be living in areas of medium or high social vulnerability, as measured by a 19-indicator social vulnerability to climate change index.

Extreme heat has public health consequences, contributing to more deaths each year in the United States than floods, storms, and lightning combined.[126] California has not been immune to these impacts: 650 Californians died as a result of a 2006 heatwave, which also led to a reported 16,166 excess emergency room visits and 1,182 excess hospitalizations, for conditions such as acute renal failure, diabetes, cardiovascular disease, electrolyte imbalance, and nephritis.[127] Those residents most vulnerable to heat include the elderly (especially those who are socially isolated), young children, those with chronic medical conditions, outdoor workers, athletes, the homeless, low-income residents, residents without access to air conditioning or reliable transportation, and people in areas with minimal tree canopy and/or vegetation. Vulnerability factors are typically concentrated in low-income populations, whose members are more likely to suffer from existing medical conditions, live in areas with sparse vegetation, have neighborhoods with high concentrations of impervious surfaces (see the

description of the urban heat island phenomenon below), and avoid using air conditioning (if they have it) because they cannot afford the higher energy bills that would result.

The urban heat island effect contributes to significantly higher daytime and nighttime temperatures in Los Angeles than in surrounding rural areas. In fact, recent research has indicated that the Los Angeles area has the greatest urban heat island effect in California.[128] The effect is created by heat transmitted by internal combustion engines, a lack of shade, the proliferation of dark-colored and impervious surfaces (such as roads and rooftops) that absorb and re-emit heat. As a result, daytime temperatures can be on average 1 to 6°F hotter, with nighttime temperatures up to 22°F hotter than in nearby rural areas.[129]

Policies and programs can help reduce the urban heat island effect by increasing shade with minimal maintenance (including shade canopies, shrubs, and appropriate trees), transitioning away from internal combustion engines, and increasing the reflectivity of impervious surfaces. For example, cool roofs reflect rather than absorb heat, lowering building energy costs and cooling the surrounding neighborhood. Various studies have modeled the potential benefits of urban heat island reduction strategies, estimating a potential 0.5 to 2°C reduction in peak temperatures in the Los Angeles region, assuming aggressive adoption of cool roofing and possibly increased tree canopy and shade structures.[130] According to one report, if all Los Angeles rooftops became cool roofs, the resulting cooling of the atmosphere could "offset the warming caused by…nearly 80% of the city's total annual greenhouse gas emissions" for one year.[131]

Following the City of Los Angeles's lead, the Framework focuses on cooling the region as one of the top strategies for tackling the most harmful effects of climate change. The City of Los Angeles is the first in the U.S. to set a temperature target, and the greater region should adopt similar strategies to multiply the benefits beyond the city's borders.

GOAL 2 — Reduce urban-rural temperature differentials

Measures that reduce the urban heat island serve both climate mitigation and adaptation goals. In terms of mitigation, cooling neighborhoods – and cooling specific buildings through the use of cool roofs and/or shade structures as well as trees and shrubs – reduces air conditioning use and, therefore, reduces energy consumption and associated emissions. In terms of adaptation, neighborhood temperature reductions may help offset some of the temperature increases that climate change will bring to Los Angeles. At the same time, reducing the use of the internal combustion engine and exhaust heat from combustion to heat and cool buildings also have a great impact on daytime urban heat islands. Areas with high roadway density have a higher local air temperature.[132]

The California Department of Public Health's *Preparing California for Extreme Heat* report recommends expanding urban greening, the use of cool roofs, and cool and porous pavements in order to address the urban heat island.[133] Additionally, the County of Los Angeles is developing an Urban Heat Island Reduction Plan, which may include components related to maintaining and expanding the urban forest, cool roofs, and cool and permeable pavements. The Framework echoes these strategies for the region and also strongly recommends the transition away from internal combustion engines and

improved building thermal properties to reduce the use of heating and cooling whose exhaust heat also significantly contributes to the urban heat island.

Strategy 2.1 — Expand and maintain the urban tree canopy, where tree maintenance and potential for trapped heat do not outweigh the benefits, and appropriate shade structures, including planting native bushes that provide canopy

Tree cover and vegetative cover provided by native tall bushes across the county vary widely. Many areas lack sufficient trees, such as the San Fernando Valley, Lancaster, and Palmdale vicinities, and South and East Los Angeles, contributing to hotter temperatures and an increased heat island effect. Sufficient studies have not been conducted to understand the impact on urban heat islands of reducing thermal heat from internal combustion engines and heating and cooling as well as change in urban albedo in contrast to increased trees and vegetation. However, reducing thermal heat caused by fossil fuel burning would have the significant additional benefit of reducing air pollution.

In 2015, the State of California awarded City Plants, a public-private partnership among the City of Los Angeles, nonprofits, and local businesses, $3.3 million in funding from the cap-and-trade auction proceeds to plant and maintain over 4,000 trees. The program will plant these trees primarily in areas with the least amount of canopy including South Los Angeles, Pacoima, Sun Valley, and San Fernando. They will be planted and maintained along streets and in open spaces and yards. Maintenance will have to be addressed so that they can achieve their purported benefits. Great attention will have to be paid to planting the right trees in the right places so as to not increase the maintenance burden on communities and requirement for additional water resources. Further, shade structures should be encouraged as well.

Beyond their cooling effect, planting and maintaining appropriate trees in urban areas can beautify areas, contribute to well-being, and help replenish groundwater basins. Following the city of Los Angeles's example, policy makers and other leaders should consider the following actions:

Action 2.1.1 — Adopt a tree-planting ordinance and native canopy-providing shrubs pertaining to Los Angeles County unincorporated areas that prioritizes low-maintenance and drought tolerant trees and shrubs.

Action 2.1.2 — Pursue funding for planting appropriate trees and shrubs in low-income neighborhoods.

Action 2.1.3 — Streamline procedures to request tree and shrub planting in public rights-of-way.

Action 2.1.4 — Secure funding for maintenance of new, drought-tolerant trees and shrubs by government agencies.

Strategy 2.2 — Increase reflective surfaces such as cool roofs and cool and permeable pavements, after considering the negative potential impacts of increased localized heat during the day

To reduce the heat island effect, regional leaders should prioritize cool roof ordinances and continue expanding research to identify potential and future projects for green streets and cool and permeable

pavements. In 2013, Los Angeles became the first large city to pass a cool roofs ordinance (Ordinance No. 183149), requiring cool roofing materials to be used on new roofs and retrofits or replacements of over 50% of existing roofing material. Other local jurisdictions have also taken action, with the City of Burbank offering a refund program to offset the cost of roofing permits when cool roofs are installed and the City of Pasadena providing recommendations for new developments regarding roofing materials. Notably, however, cool roof and pavements may increase heat in daytime but will dramatically contribute to reduced nighttime heat.

These measures can have other demonstrated benefits to the region, including helping to replenish groundwater basins that have lower recharge rates due to a proliferation of asphalt. These measures also expand the potential for urban farms that can create healthier and resilient urban environments. Regional leaders should prioritize projects according to need such as by geography, population, and infrastructure characteristics. The Framework recommends the following actions to address this goal:

Action 2.2.1 — Adopt cool roofs ordinances in Los Angeles County cities and unincorporated areas.

Action 2.2.2 — Explore potential for cool and permeable pavements, particularly for parks, playgrounds, parking lots, and alleys.

Action 2.2.3 — Identify priority areas for reducing urban heat island based on population, sociological demographics, and infrastructure characteristics.

Strategy 2.3 — Reduce incidence of heat-related illness as well as excess emergency room visits during extreme heat events

Extreme heat events lead to spikes in heat-related illness and death, as well as surges in emergency room visits and hospitalizations, as described above. To protect public health during extreme heat events, the California Department of Public Health's *Preparing California for Extreme Heat* report recommends improving outreach strategies for vulnerable populations as well as adopting strategies that improve social cohesion in neighborhoods. Other health departments around the country promote similar strategies; for example, the Minnesota Department of Health's *Extreme Heat Toolkit* recommends improving outreach to vulnerable populations, such as through organizations that serve or employ them.[134] For example, government entities could develop a database of social service agencies, senior living centers, daycare centers, schools, and companies that employ outdoor workers, in order to provide messaging to those organizations before and during heat events. Government entities can also work with neighborhood councils, other community groups, and utilities to implement programs that encourage residents to check on vulnerable neighbors during extreme heat events. In addition to outreach, infrastructure improvements should be made to improve the availability of and access to cooling centers. Specific strategies can include increasing the number of official cooling centers and improving public transportation options to them.

Strategy 2.4 — Improve outreach to vulnerable populations before and during extreme heat events

As with the recommendations above, planners should consider heat-related illnesses and deaths in targeting populations most at risk. Outreach leaders can improve information efforts for vulnerable populations by implementing the following actions:

Action 2.4.1 — Develop maps of vulnerable populations and of geographic incidences of past heat-related illness and death to inform planning.

Action 2.4.2 — Use the "reverse 911 system" (a public safety communications system to communicate with groups of people in a defined geographic area) or a voluntary notification system to alert vulnerable residents before and during extreme heat events.

Action 2.4.3 — Develop a system through which organizations that serve or employ vulnerable populations receive targeted messaging during extreme heat events.

Strategy 2.5 — Improve infrastructure to serve vulnerable populations during extreme heat events, including conservation measures in residential buildings

Beyond outreach, vulnerable communities will need improved infrastructure and access to cooling centers, decent housing, and health centers or hospitals in case of increasing emergencies. The following actions can address this challenge:

Action 2.5.1 — Designate official cooling centers in neighborhoods that are currently lacking them.

Action 2.5.2 — Improve access to official cooling centers, via public transit or other options.

Action 2.5.3 — Update and retrofit housing in vulnerable areas to be more resilient to heat.

Action 2.5.4 — Develop programs to provide air conditioners to those individuals most vulnerable to serious heat-related health impacts and without economic resources.

Action 2.5.5 — Provide vouchers through ridesharing companies to those with health conditions during heat emergencies.

Strategy 2.6 — Reduce the use of internal combustion engines and fossil fuel-generated heating and cooling

Action 2.6.1. Accelerate the transition to electrification throughout the region and the adoption of electric vehicles and electric public transportation systems.

Action 2.6.2 — Accelerate alternative transportation options from bicycle lanes to walkability to alternative intermediate share vehicles such as electric bicycles and small electric vehicles.

Action 2.6.3 — Increase thermal comfort of buildings through whole-house retrofits to reduce the need for heating and cooling.

GOAL 3 — Reduce building in fire-prone ecosystems

Curbing development in fireprone areas is a direct way to reduce wildfires, while building in fire-prone ecosystems is largely responsible for the increase in wildfires in these areas.

Strategy 3.1 — Reduce building in the urban/wildland interface through policies such as density bonuses, transfer of development rights, and zoning and building codes that inhibit further fragmentation and intrusion of development in fire-prone wildlands

Action 3.1.1 — Prohibit further development in the urban-wildland interface, responsible for accelerating wildfires, through transfer of development rights or other mechanisms.

Action 3.1.2 — Ensure native habitat is preserved in the urban-wildland interface to ensure ecosystem and habitat resilience, water infiltration, and flood protection.

Action 3.1.3 — Enable the greater use of controlled burning to reduce fire risk in the surrounding National Forest.

CONCLUSION

Los Angeles County faces significant increases in urban heat as the climate changes. This change will pose serious public health threats, especially for vulnerable populations. However, effective mechanisms exist to both mitigate urban heat and establish coordinated policies and programs to protect the most vulnerable. Addressing the contributors to the urban heat island, including the use of fossil energy in transportation, heating, and cooling, and the use of dark surfaces in construction and road building, can significantly reduce the impact of high heat days. Increasing the thermal comfort of existing building through whole-house and building retrofits will be important as well. Aditionally, increasing urban shade through shade structures and carefully chosen vegetative material will be important. Finally, LADHP should coordinate with the Los Angeles County Chief Sustainability Officer, as well as other sustainability programs across the region, to create coordinated and integrated responses to heat that include not only emergency responses during high heat incidents but long-term integrated programs to reduce the urban heat island.

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