



Climate Change, Health, and Equity: Opportunities for Action



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“Climate change threatens our fragile existence on this planet.”

—Jim Yong Kim, World Bank¹

“For public health, climate change is the defining issue for the 21st century.”

—Margaret Chan, World Health Organization²

Authorship and Acknowledgements

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About this report

Climate change and health inequities are the greatest global health threats of the 21st century.^{3,4} In this report, we explore the many ways in which climate change, health, and equity are connected. With input from more than a hundred public health professionals and community health, equity, and environmental justice advocates and support from The Kresge Foundation, we developed a conceptual framework to help us see how these issues are linked, and to identify opportunities and recommendations for action.

We engaged in an eighteen-month process that included a review of the literature and prior reports on climate change and public health,^{5,6,7} qualitative research, a day-long convening of participants hosted by Public Health Institute in Oakland, CA, and an iterative peer-review process. We funded three pilot projects and developed relationships with other projects that are engaging with work on climate change, health, and equity to see what we could learn from them. Participants and resources informing the framework and recommendations are primarily California-based, so strategies and policies are reflective of a California context.

This report starts with a summary of the research we conducted. Next we describe the Framework shown in Figure 1, starting with the pathway between climate change and health impacts, followed by a summary of the pathway leading from the social determinants of health to health inequities. We discuss how people's health status and the community environments in which we live are among the most important factors in determining our ability to survive and thrive in the face of climate change. Then we look at interventions to promote better health outcomes and reduce health inequities, and approaches to address climate change. Here we find hope, for while climate change poses an existential threat, many actions to reduce the impacts of climate change can also have profoundly positive effects on our health and our communities. We look at how both climate change and health inequities are rooted in the same large systems that shape our daily lives, and at some of the core strategies that are required to change the social inequities and institutions that mold those systems. We share some examples and stories that show how communities and public health organizations are taking action on climate change and health. We end by providing a summary of the many recommendations that emerged through the course of this project, and our conclusions.

Climate change, health, environmental health, health equity, social justice, environmental justice, sustainability are each hugely important and complex issues in their own right. But we can't afford to address them separately. The stakes are too high, the need for action is too urgent, and there are too many opportunities for synergy if we act together on climate, health, and equity. Our hope is that the report will help people who are interested in climate change, in health, and in social and environmental justice understand why we must join together to demand the bold and urgent actions that are required to sustain the environment and climate that support our health now. Together we can work for health and equity, and for the sustainable and resilient communities that will provide health and opportunity for our children and grandchildren in the future.

Challenges and Opportunities for Intersectoral Work on Health and Climate Change

Public health engagement in climate change is extremely important. Public health agencies need to prepare for climate impacts, and to ensure that climate action strategies promote optimal health and reduce health inequities. The health sector can play an important role in helping the public and policy makers understand the magnitude of climate change impacts on human health and well-being, and the opportunities for health promotion in many climate actions. But public health engagement on climate change to date has been limited. Previous surveys have identified several reasons why, including inadequate information, training, funding and resources, and workforce capacity building.^{8,9,10,11,12,13} Little research explores these barriers in depth or identifies ways to advance intersectoral collaboration on climate change and public health.

We reviewed the literature and conducted qualitative research to help better understand the perceived barriers and opportunities for public health's engagement with climate change. We did semi-structured in-depth interviews and focus groups with 135 public health and climate change workers from governmental and non-governmental organizations, including public health workers who self-identify as working on climate change and those who do not. Most of our informants were from California, although about 10% were national experts on climate change and health. A full description of the study is in preparation.¹⁴

Informants described numerous barriers to engagement with work at the nexus of climate change and public health. Conceptual constraints include: (a) lack of information or understanding about how health and climate change are connected; (b) uncertainty about what role public health should play in addressing climate change due to lack of understanding of connections or solutions; (c) reluctance to talk explicitly about climate change and health due to concerns that climate change is too political, overwhelming, abstract, and/or complex; and (d) belief that climate change is not as urgent as other public health issues, nor important to communities that public health serves.

Interviewees reported numerous institutional or organizational barriers to engagement with health and climate change. Government organizations often operate in silos, fight for "turf" and authority, lack coordination or alignment across agencies doing similar work, and have different approaches and values. Also, because climate change has mainly been seen as an environmental issue, public health agencies do not usually have specific mandates or formal authority to address climate change or its health impacts. This compartmentalization limits the intersectoral collaboration and broad systems thinking needed to address climate change and public health.

Participants reported a profound lack of public health leadership on climate change, and an unwillingness to take or urge action on climate change; this tentativeness is due in part to the politicization of climate change, and related concerns that climate change is not seen by elected officials or the public as a valid issue for public health engagement. Additionally, many public health organizations are still in the early phases of moving from a focus on individuals and treatment (the biomedical model) to prevention, communities, and the social determinants of health. Interviewees noted that work on climate change impacts requires long-term prevention planning, and that work on climate change strategies with co-benefits for health requires efforts to improve the social determinants of health. Both require intersectoral collaboration. Substantial recent reductions in public health funding, resultant stresses on public health infrastructure, and a lack of specific funding for work on climate and health exacerbate these challenges.

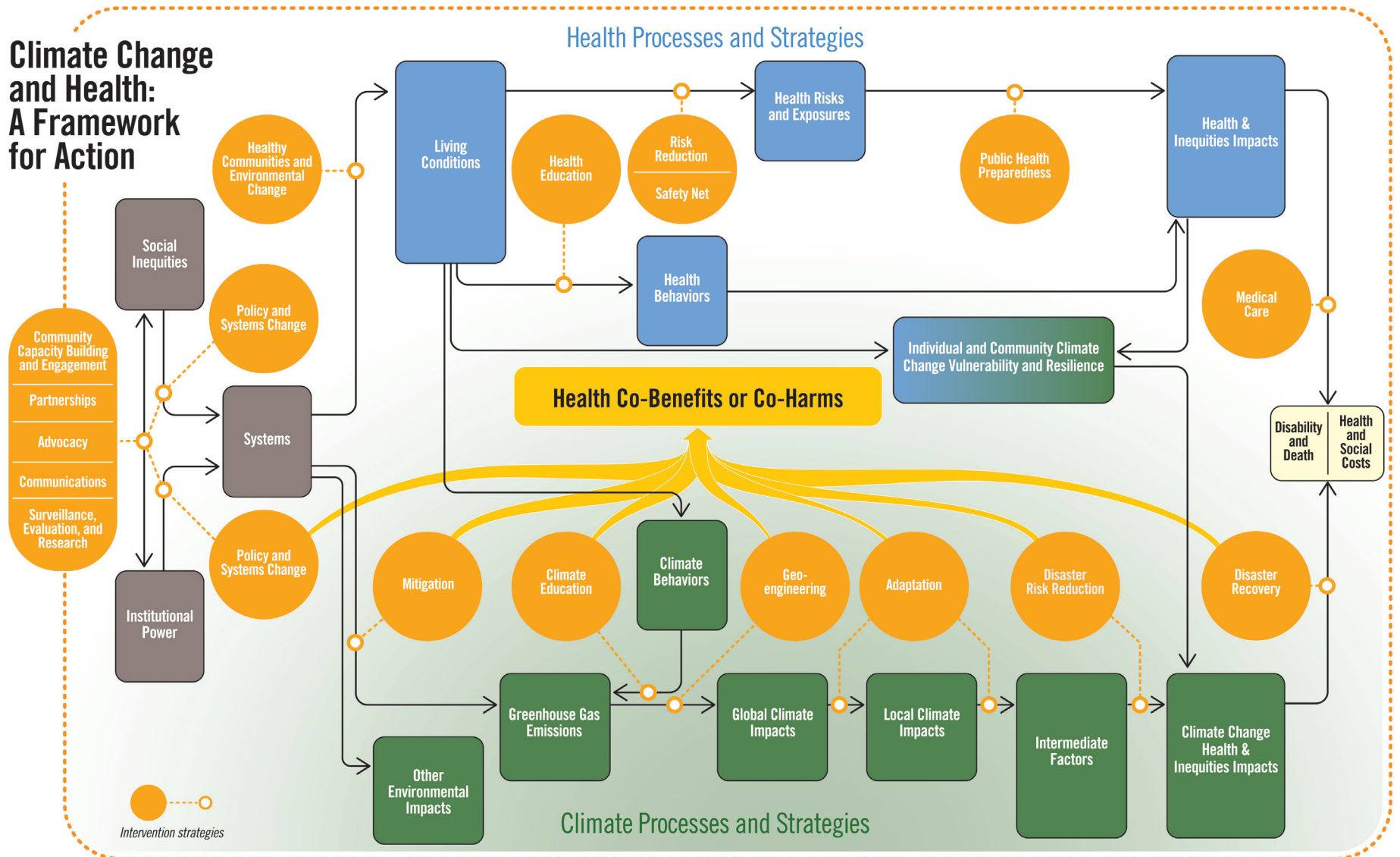


Participants also identified many opportunities for public health to shift practice and partner with other sectors on actions to reduce greenhouse gas emissions (GHGE) and promote health, equity, and climate resilience. Non-public health participants emphasized that they welcome the public health voice and knowledge, and were eager to partner with public health colleagues. Several key opportunities emerged:

- » Those working in public health organizations can participate in the many climate change policy and planning processes that are now underway in other sectors, to bring a “health lens” to the table and advocate for climate actions that promote health and equity. Climate change mitigation policies and strategies are especially important opportunities to prevent catastrophic climate change health impacts and shift attention to primary prevention and social determinants of health.
- » Traditional public health roles and skills can be used to impart information about and respond to climate change, including research, surveillance, and education. Incorporating climate change into current public health work, such as environmental health, chronic disease, and emergency preparedness, would leverage existing funding.
- » Public health professionals have credibility on prevention and health with the public and policymakers; they can communicate the importance of climate change and its human health impacts, and inform about the opportunities for health co-benefits. Participants believed that public health is a unifying frame for multiple climate change goals and counters the perception that climate change is too abstract. Messages should clearly explain and highlight current salient connections and co-beneficial solutions between health and climate change.
- » Public health organizations work with and serve many of the communities most vulnerable to climate change, providing an opportunity to mobilize residents and resources to address climate change and prepare for its impacts.
- » In the long term, strong public health leadership and dedicated funding is needed to develop a more holistic and coordinated strategy to build a movement for healthy and equitable climate change action.

Public health engagement is critical to ensure that the public health sector prepares for climate impacts, and that climate change strategies promote optimal health and reduce health inequities. Our research delves deeper into the complex barriers to this important work, and identifies a number of immediate opportunities for public health and partners to work together towards improved health, equity, and climate change outcomes. These research findings helped to guide us in development of the framework we present below and in our recommendations for action.

Figure 1: Climate Change, Health, and Inequities: Opportunities for Action



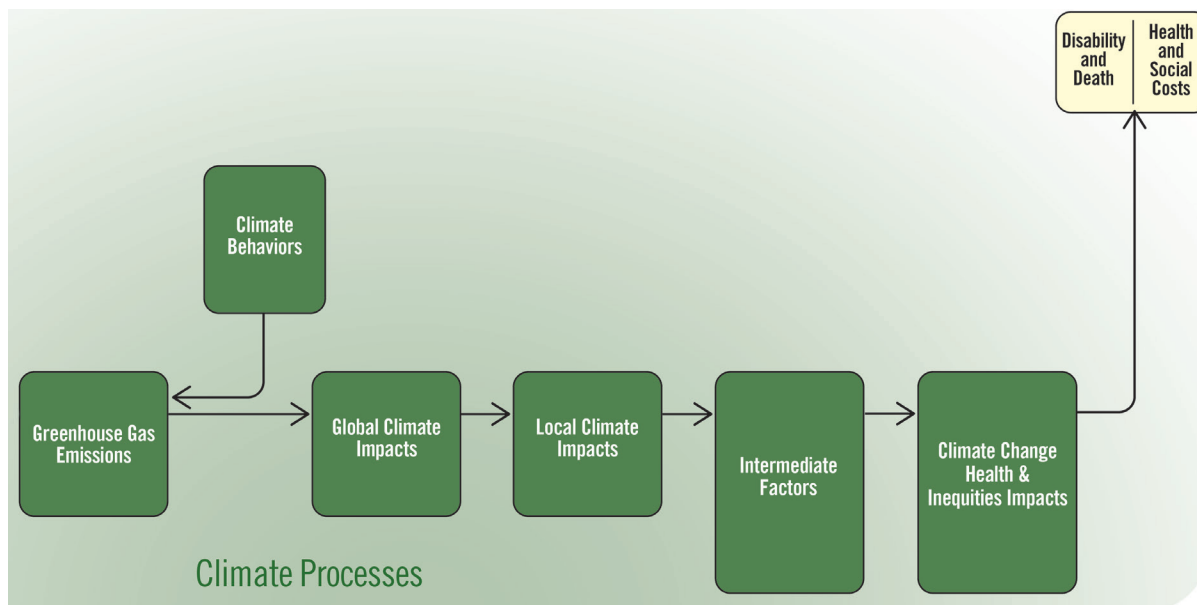
Developed by the Public Health Institute's Center for Climate Change & Health. © Public Health Institute 2014

Climate Change and Health: A Framework for Action

Climate Change and Health Pathway

To understand how climate change impacts health, it is helpful to understand a little bit about climate change itself, and its impacts on global and local environments. The climate change and health process in Figure 2 is based on a diagram developed by Dr. Jonathan Patz and Dr. Andrew Haines.^{15,16}

Figure 2: Climate Change and Health Pathway



Greenhouse Gas Emissions: Many natural and human influences shape the earth’s climate; the most significant cause of climate change is human activity that releases greenhouse gases (GHG) into the atmosphere. Greenhouse gases trap heat like a blanket around the earth, warming the earth’s atmosphere. Some of the most important GHG are carbon dioxide from the burning of fossil fuels (coal, gas, and oil), methane from livestock production and fossil fuel extraction, nitrous oxide from agricultural activities, and black carbon from diesel engines, wildfires, or household cook stoves.^{17,18}

Climate Behaviors: Individual behaviors also impact GHGE. The more miles we drive, the higher the GHGE from transportation; the more meat we eat (and people in the U.S. eat more meat than those in nearly every other nation), the more methane emissions from livestock production.¹⁹ Our consumption choices also impact GHGE from industrial production and from waste in landfills.²⁰

Global Climate Impacts: The warming of the earth's atmosphere has several important global impacts. As global temperatures rise, there is greater variability in the patterns of rain and snowfall around the world. Wet places are getting wetter, and dry places are getting dryer; the world is getting more rain and less snow. Higher temperatures also cause the glaciers to melt, and mountain snow packs to melt earlier in the spring. Melting glaciers cause the level of the sea to rise. Because warmer water expands more, the warming of the oceans also contributes to sea level rise. The seas also become more acidic as carbon dioxide from the atmosphere accumulates in the ocean, which is harmful to ocean ecosystems..

Local Climate Impacts: These global climate impacts in turn cause changes in local weather patterns, such as more frequent and more severe heat waves, flooding, drought, and wildfires. Not everyone is exposed to all of these local climate changes. There is considerable geographical variation in exposures to these hazards.^{21,22}

Intermediate Factors: Global and local climate changes in turn induce a wide variety of environmental changes.^{23,24,25,26,27} For example, higher atmospheric temperatures increase ground-level ozone, creating more smog and air pollution. Changes in rainfall and temperature can alter the distribution of disease-carrying vectors such as ticks and mosquitos. Drought, extreme heat, wildfire, and severe precipitation events can all damage crops. Sea level rise and melting permafrost erode land. All of these changes have social, political, and economic implications, such as increases in food and water prices, job loss, forced displacement and migration, and conflict over water, land or food.²³

Climate Change Health and Inequities Impacts, Disability and Death: Two recent reports by the Intergovernmental Panel on Climate Change and the U.S. National Climate Assessment summarize the effects of climate change on health now, projections that these impacts will surely increase, and the disproportionate impact of climate change on vulnerable populations and disadvantaged communities.^{28,29}

The direct health impacts of climate change are due primarily to heat-related morbidity and mortality, and injuries and fatalities associated with other extreme weather events such as flooding, severe storms, or wildfires. More than 70,000 people died in the European heat wave of 2003, and there were an estimated 655 excess deaths in California's 2006 heat wave; Hurricane Katrina caused over 1,800 deaths and more than 6,300 died in Typhoon Haiyan in the Philippines.^{30,31,32,33}

Of even greater concern, though, is that climate change threatens our life support systems. Humans cannot live without clean air, water, food, shelter, and security. Climate change threatens these all.

For example, consider the many different ways in which climate change increases the risk of respiratory and cardiovascular diseases:

- » Ground level ozone — a respiratory irritant — increases with rising temperatures. Higher ozone levels result in more asthma attacks, more heart attacks, decreases in lung function, and increased hospital admissions and deaths.³⁴
- » More frequent and intense wildfires will expose people to smoke that contains particulate matter (PM) and numerous chemicals, exacerbating asthma and other respiratory disease, and worsening heart disease. Wildfire smoke can travel thousands of miles; one study showed that about 2/3 of the U.S. population — nearly 212 million people — lived in counties affected by wildfire smoke in 2011.³⁵
- » Warming causes plants, like ragweed, to grow more and produce more pollen, and lengthens the pollen season. In some parts of the U.S., ragweed season is already about 3 weeks longer than it used to be, causing a big problem for people with allergies.³⁶

Here are some of the ways in which climate change threatens drinking water and food supplies:³⁷

- » Mountain glaciers and snowpack act as natural reservoirs, storing and supplying the drinking water for millions of people around the world. As higher temperatures cause earlier snowmelt and less snowpack, less surface water is available when we need it most during the dry season.
- » As sea level rises, salty water creeps into coastal groundwater aquifers; the increased water salinity makes the water less suitable for drinking and agriculture.
- » Extreme rainfall and flooding may cause contamination of drinking water supplies with untreated sewage or chemicals.³⁷
- » Ocean acidification contributes to the bleaching of coral reefs, and reduces the abundance of fish.³⁷
- » Extreme heat and weather events and drought contribute to declines in crop yields. As crop production declines, food prices increase, leading to greater food insecurity. In developing nations this may increase hunger and malnutrition; in developed nations, higher food prices encourages consumption of cheaper calorie-dense foods, which increases the risk for chronic illnesses such as obesity and diabetes.^{38,39}

Other impacts include increases in food- and water-borne diseases as warmer air and water temperatures cause higher levels of microbial contamination, and changes in the geographic distribution of mosquitos and ticks that carry diseases such as West Nile virus, Lyme disease, or malaria.^{36,40}

Climate change threatens to displace millions of climate refugees whose homes and land will no longer be habitable due to natural disasters or food and water shortages;⁴¹ Hurricane Katrina alone displaced more than 400,000 people in the Mississippi Gulf region, many of whom never returned, and some of whom are still in temporary housing many years later.⁴² Violence, civil strife, conflict, and associated displacement are all likely to increase with climate-exacerbated tensions over land and resources.⁴³

These climate impacts have serious implications for mental health. Rates of depression, anxiety disorders, post-traumatic stress disorders, substance abuse, and suicides are all expected to rise as the effects of climate change worsen. The effects will be felt most keenly among children, the poor, the elderly, and those with existing mental health conditions. Moreover, our current mental health system is woefully underprepared to deal with the scale and intensity of problems climate change is expected to bring.^{45,46}



“...climate change is a ‘threat multiplier’... [that] will intensify the challenges of global instability, hunger, poverty, and conflict.”

—U.S. Secretary of Defense
Chuck Hagel.⁴⁴

The California Drought

California is now suffering its most severe drought in recorded history, which scientists say is significantly exacerbated by climate change.^{47,48} The health and economic impacts have been serious and wide-ranging. Some examples of problems caused or exacerbated by the drought include:⁴⁹

- » Hundreds of rural residents can no longer get drinking water at home as their wells have run dry; some have reported that they do not have enough water to bathe or flush toilets.⁵⁰
- » California experienced an outbreak of West Nile virus (which is spread by a mosquito that thrives under drought conditions) in 2014, with 311 cases (more than twice as many as the previous year) and 12 deaths.⁵¹
- » California's economy is expected to lose \$2.2 billion, including 17,100 lost jobs, due to the drought.⁵²
- » Big increases in groundwater withdrawal cause greater land subsidence (drop in the elevation of the land) that could result in damage to critical infrastructure such as storm drains and sewers, roads, and levees, and increased risk of flooding.⁵³
- » Federal experts forecast a 3.5% increase in food prices nationwide, in part due to the toll of the drought on crops.⁵⁴
- » Tinder dry bushes and trees are making wildfires grow explosively, endangering firefighters and homes, and destroying thousands of acres of forest.⁵⁵
- » California and other dry states like Arizona are facing a "silent epidemic" of Valley Fever, a fungal disease carried on dust, with especially high risks for outdoor workers and African-Americans.^{56,57}
- » Tens of thousands of people in California's Central Valley rely on groundwater that is contaminated with pesticides, nitrates from fertilizer run-off, and industrial chemicals. As surface water becomes less available, more people rely on contaminated groundwater, and concentrations of contaminants may increase.^{58,59}
- » The stress of losing water supplies and livelihoods, and the financial impacts of job loss and rising food prices, create anxiety and depression.⁵⁹

Climate Health and Social Costs: The health, social, and economic costs of climate change are likely to be enormous.^{60,61} To date only a narrow range of the health impacts of climate change has been subject to economic evaluation. One study estimated the health costs of just six climate-related events to be about \$14 billion.⁶² Drought, extreme weather events, loss of coastal infrastructure, and adaptation will cost many billions of dollars, with ripple effects on funding for health and social needs.⁶³

Other Environmental Impacts: Of course, climate change isn't the only thing that is affecting the environment. There are many other causes of environmental degradation and damage to ecosystems, and each of these poses its own threats to health. These threats include air pollution, water contamination, deforestation, fisheries depletion and collapse, soil degradation and topsoil loss, dead zones in the ocean, wetlands destruction, biodiversity loss, and other environmental problems.⁶⁴ These problems may be exacerbated by climate change, but they are produced through the same dynamics that produce climate change and unhealthy living conditions. For example, automobiles, power plants, and industrial facilities emit not only GHG, but also other health-harming toxic pollutants that cause respiratory and cardiovascular disease and can cause harmful reproductive and neurologic effects. Ocean warming and acidification affect fisheries already impacted by overfishing and pollution. Feedback loops enhance the impacts of deforestation, wildfire, drought, and climate change. The cumulative impacts of climate change and ecosystems collapse exacerbate health impacts and threaten our long-term sustainability and survival capacity.

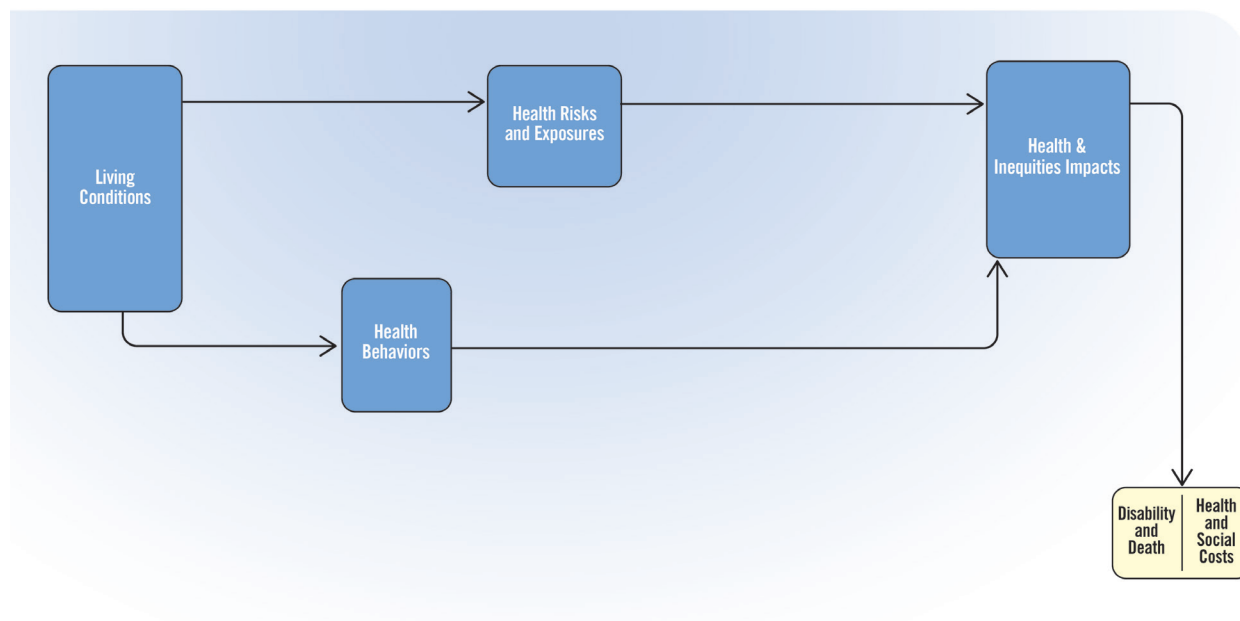
Sustainability is...“the ability to meet the needs of the present without compromising the needs of the future.”⁶⁵

—World Commission on Environment and Development

Health Outcomes and Health Inequities

Now let’s look at some of the pathways that lead to good or poor health (independent of climate change), and that contribute to health inequities. The pathway in Figure 3 is based on the “Public Health Framework for Reducing Health Inequities” developed by the Bay Area Regional Health Inequities Initiative (BARHII), a regional collaboration of nine local health departments.⁶⁶

Figure 3: Health Pathway



Living Conditions: Daily living conditions comprise the social, physical, economic, and services environments in which people are born, live, work, learn, play, and age.⁴ Social environments, strongly influenced by social norms and values, define our relationships with one another, including, for example, through family structure, social networks, and social cohesion. Physical environments are both natural (e.g. coastal or mountainous, temperate or tropical) and built (e.g. roads, buildings, parks and open space), and include attributes such as the cleanliness of the air, water, and soil. The economic environment is defined by employment, income, wealth, and the costs of living. The services environment refers to access to and availability of services such as health care, childcare, or retail and financial services.

Health Risks and Exposures, Health Behaviors: Living conditions engender exposures to health risks and access to health resources (e.g. air pollution near freeways, violence near liquor stores, quality of housing and schools).⁶⁷ Living conditions also shape health behaviors (e.g. well-maintained parks enable more physical activity and foster social connections; safe bicycle infrastructure facilitates bike commuting; and advertising increases tobacco use).

Health & Inequities Impacts, Disability and Death, and Health and Social Costs: Living conditions, health risks and exposures, and health behaviors together are the greatest contributors to adverse health outcomes that lead to disability, death, and associated health and social costs.^{68,69,70} Health inequities arise from differences in living conditions and access to health resources and opportunities, and are defined by the Centers for Disease Control and Prevention as “preventable differences in health outcomes that are the result of the systematic and unjust distribution of social determinants or conditions that support health.”⁷¹

We all know that place matters: some neighborhoods have more trees and parks, better schools, more grocery stores and farmers’ markets, fewer liquor outlets, less crime, less traffic, and higher employment than others. Too often, these “good” neighborhoods are predominantly white and wealthy, in comparison to neighborhoods with fewer amenities and resources, where residents are more likely to be low-income people of color. For example, people of color live in neighborhoods with more air pollution, low income people of color have less access to healthy foods, and pedestrians in low income neighborhoods are more likely to be hit and killed by a car while walking.^{72,73,74}

Chronic illness and injury account for a large proportion of inequities in life expectancy. Former Surgeon General David Satcher estimated that if blacks had the same death rates as whites, there would be about 83,000 fewer black deaths each year; another study found that correcting disparities in the death rates of those with less versus more education would have saved nearly 1.7 million lives over seven years.^{75,76} Health inequities also have severe economic impacts: recent research estimated that eliminating health disparities for minorities would have reduced direct medical care expenditures by about \$230 billion and indirect costs associated with illness and premature death by more than \$1 trillion for the years 2003–2006.⁷⁷ Addressing health inequities is cost effective, and the morally right thing to do.⁶⁸

“(The) toxic combination of bad policies, economics, and politics is, in large measure responsible for the fact that a majority of people in the world do not enjoy the good health that is biologically possible... Social injustice is killing people on a grand scale.”

—WHO Commission on the Social Determinants of Health.⁶⁷

Climate Change Vulnerability and Resilience and the “Climate Gap”

We have described how the environments in which people live, work, and play create resources or diminish opportunities for good health, leading to health inequities.

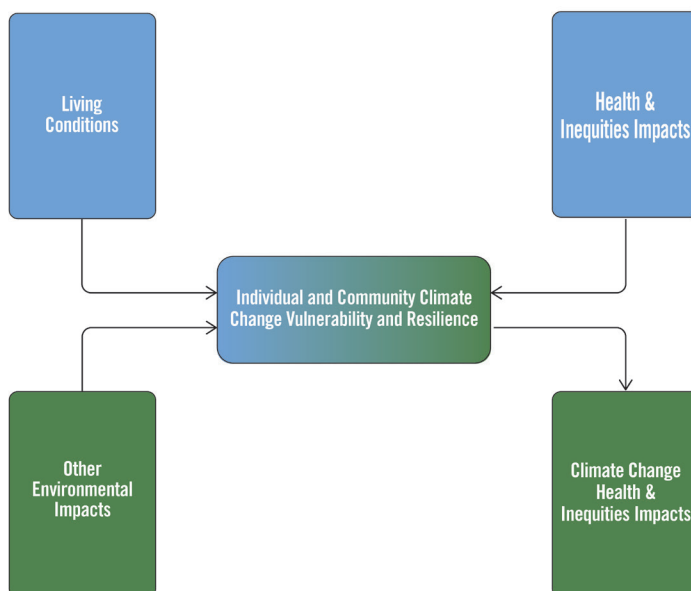
Something similar happens with the impacts of climate change.

Not all individuals or all communities are equally affected by climate change. Climate change vulnerability is the degree to which people and places are at risk from the impacts of climate change, and also takes into account how well they can cope with those impacts.⁷⁸ Climate change resilience is essentially the flip side of vulnerability. It is “the ability to survive, recover from, and even thrive in changing climatic conditions.”⁷⁹ Some aspects of resilience include physical and psychological health, social and economic equity and well-being, availability of information and effective risk communication, integration of governmental and non-governmental organizations, and social capital and connectedness.⁷⁹

Characteristics of vulnerability and resilience co-exist in individuals and communities. The intersection of these characteristics, risk exposures, and resources will determine the extent to which climate change impacts health and well-being.⁷⁸ Some places are more exposed to a particular climate risk simply because of geographical location; for example, all low-lying coastal communities are at risk due to sea level rise. In areas where natural wetlands or mangrove swamps that protect coastal areas from storm surges have been preserved, the risks of flooding are lower than in areas where that “green infrastructure” has been destroyed. The severity of any particular extreme weather event will also determine how well people fare in its aftermath.

But whatever the nature or level of risk exposure, those with more economic, social, or political capital are more likely to survive and thrive in changing climatic conditions. As Figure 4 shows, poor living conditions increase vulnerability to climate change and cause poor health status; poor health status even further increases climate vulnerability. Other environmental impacts may also increase vulnerability to climate change.

Figure 4: Climate Change Vulnerability and Resilience & Climate Health Inequities





Here are a few examples of how living and working conditions, underlying health conditions, and other environmental impacts can create more vulnerability or greater resilience to climate change health impacts:

- » Living in neighborhoods with high ambient pollution levels increases vulnerability to higher levels of ground-level ozone from rising temperatures.
- » Farmers and farm communities are at higher risk of drought impacts if soils are already depleted or local ground water is contaminated.
- » The risk of heat illness is greater in “urban heat islands” — urban neighborhoods with few trees and parks and lots of pavement; conversely, people in neighborhoods with lots of trees and green space are more resilient in the face of rising temperatures.⁸⁰
- » Limited access to public transit impedes evacuation during a hurricane. People with good access to public transit and well-maintained sidewalks are more likely to use active transportation, get more physical activity, and lower their risk of heart disease.^{81,82}
- » People with cardiovascular disease are at greater risk of heat illness; those with asthma are at greater risk from increased ozone levels, wildfire smoke, and increased pollen.⁸³

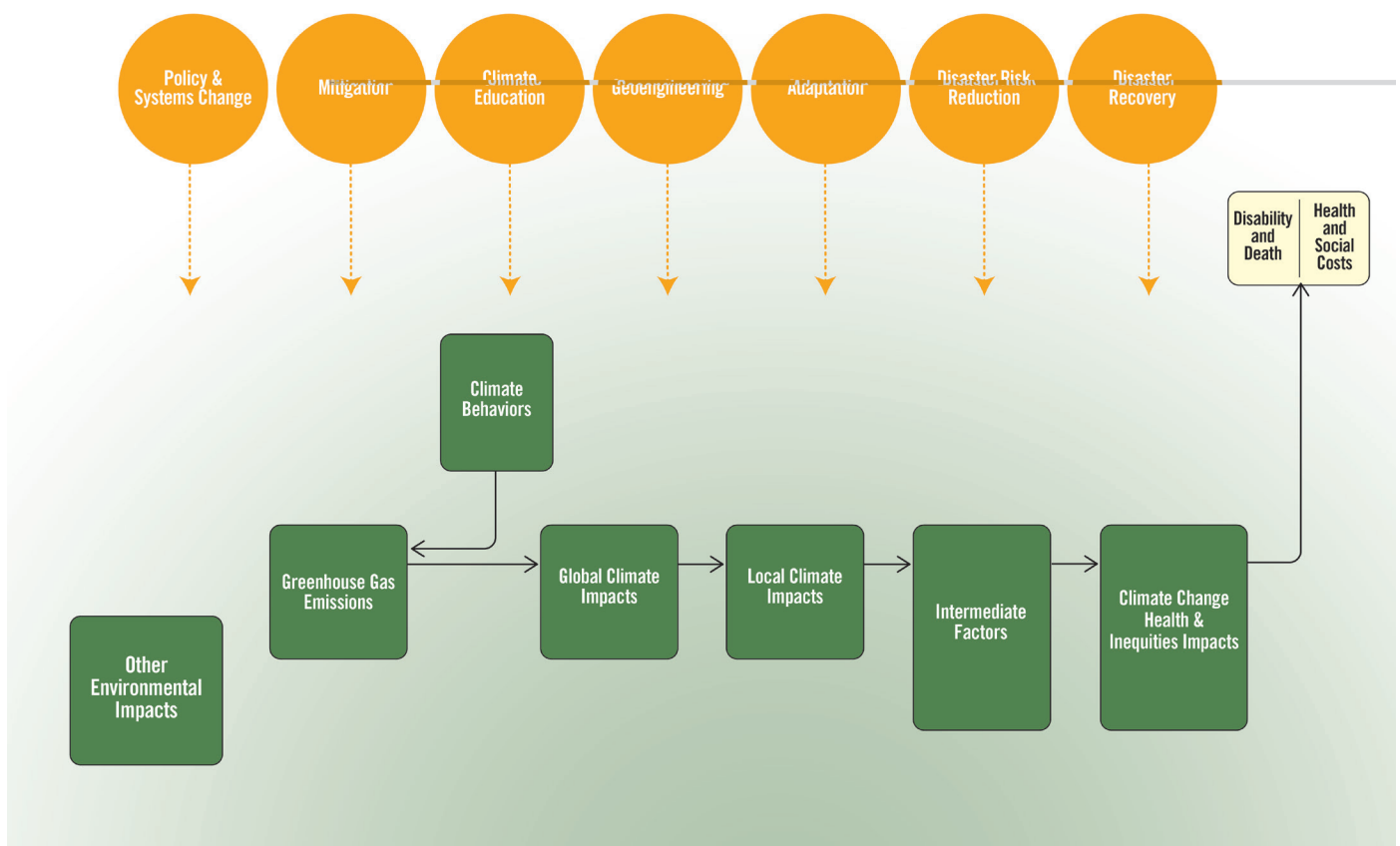
- » People who need medications are more vulnerable to disrupted medical care in a natural disaster.⁸⁴
- » Poverty reduces the capacity to absorb rising food, water, or energy prices. It is much harder for low-income communities to rebuild after a disaster, especially since fewer low-income people have insurance.
- » Farmworkers and other outdoor workers are at higher risk of heat illness.⁸³
- » Living in houses with screens can decrease the risk of vector-borne illnesses such as dengue fever.⁸⁵
- » People who live in neighborhoods with strong social networks are likely to do better after a natural disaster because they can rely on help from others.⁸⁶

The disproportionate impacts of climate change on individuals with pre-existing chronic illness and on socially disadvantaged groups threaten to greatly exacerbate existing health and social inequities, globally and within the U.S.^{87,88} Improving underlying health status and living conditions and strengthening the resilience and social cohesion of communities facing both climate impacts and health inequities can improve their ability to survive and thrive in the face of climate changes.

Climate Change Intervention Strategies

Figure 5 shows the wide spectrum of interventions available to reduce the magnitude of climate change and its impacts. These interventions can operate at many points along the climate pathway, with upstream interventions (to the left side of the diagram) having the greatest impact.

Figure 5: Climate Change Interventions



There are a range of climate change intervention strategies:

- » **Policy and systems change** spans many types of interventions, including changes in standards, regulations, and laws, funding distribution, financial and other incentives (such as subsidies, fees, or recognition awards), and changes in procurement and hiring processes. Examples of policy and systems change to reduce greenhouse gas emissions and transition to less carbon intensive systems include renewable energy subsidies, employee incentives to take transit to work, and shifting to the purchase of electricity from renewable sources. Zoning ordinances to limit building in flood plains, hiring community members to work on climate action plans, and requirements to use cool roofs in new construction are examples of policy and systems change to increase adaptive capacity and resilience.²³

- » **Climate change mitigation** strategies are those that slow climate change and reduce the long-term magnitude of climate change impacts by reducing greenhouse gas emissions or increasing carbon sinks (e.g. the use of renewable energy sources, preservation and expansion of forested areas).²³
- » **Climate education** provides information through multiple forums to increase individual and community knowledge about the science of climate change and its impacts, and strategies to address it, and to influence attitudes about climate change action.⁸⁹
- » **Geo-engineering** is “the deliberate large-scale intervention in the Earth’s natural systems to counteract climate change” through removal of CO₂ from the atmosphere (e.g. seeding of the ocean with iron filings) or solar radiation management (e.g. dispersal of sulfur dioxide particles in the atmosphere, giant mirrors to reflect radiation).⁹⁰
- » **Adaptation** is an “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (e.g. planting crops that are more drought or salt resistant, restoration of wetlands to reduce coastal flooding, installing home air conditioners).⁹¹
- » **Disaster risk reduction** seeks to reduce harm and damage from climate change through reducing exposure to hazards, increasing resilience, and improving warning and response capacity (e.g. setting up public cooling zones during heat waves, issuing weather warnings).⁹²
- » **Disaster recovery** comprises the steps taken following a disaster to rebuild infrastructure, restore services and resources, regain economic stability, and meet the housing and other needs of displaced persons (e.g. response, cleanup relocation).⁹³

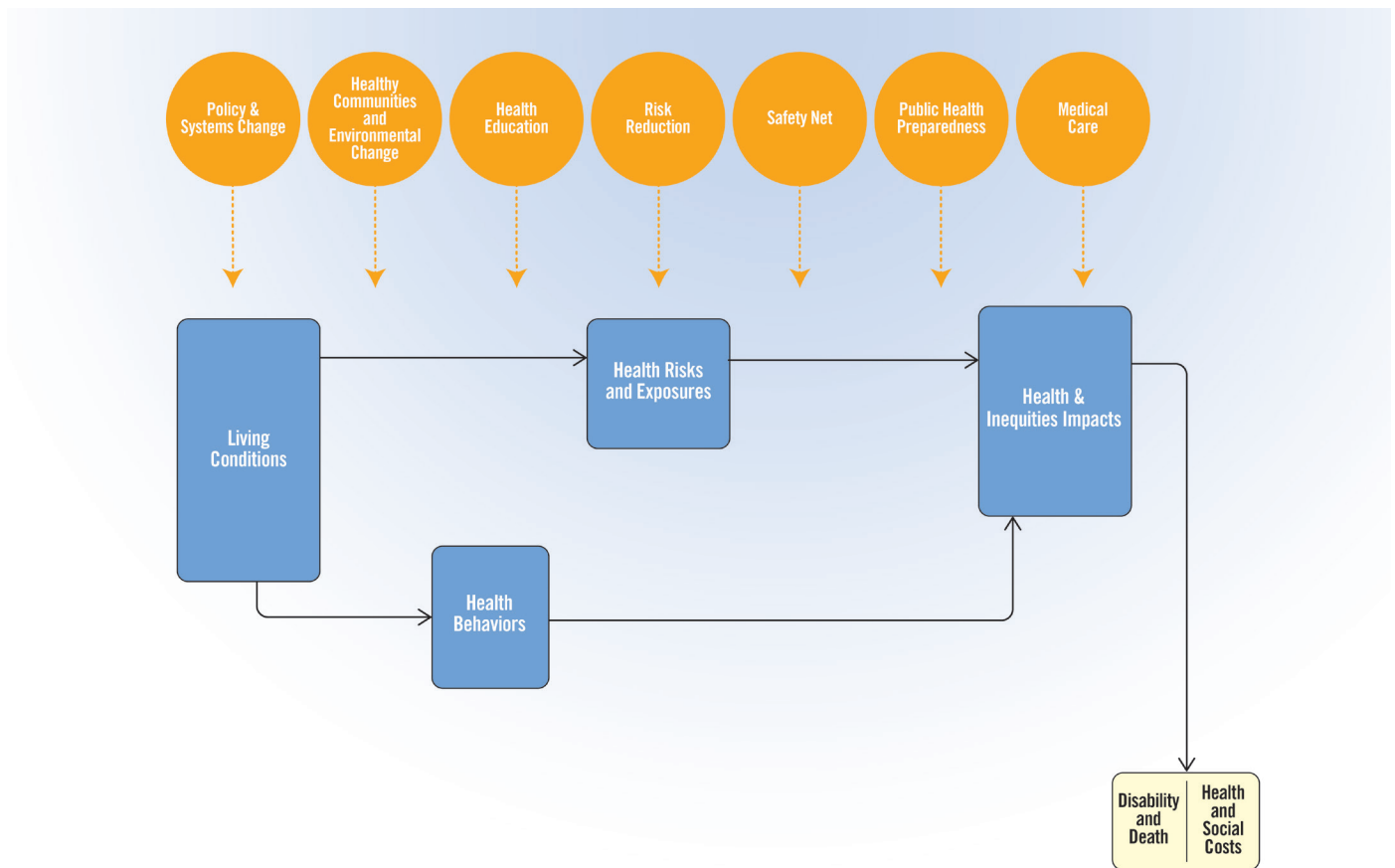


Hurricane Sandy debris in New Jersey

Public Health Intervention Strategies

Just as there are many actions we can take to address climate change, there is a wide “spectrum of prevention” across which many interventions — individual and community, medical and social — can prevent illness and injury and promote health and well being, as shown in Figure 6.

Figure 6: Public Health Interventions



Public health intervention strategies:

- » **Policy and systems change** seeks to change laws, rules, funding, and government and institutional processes to promote health (e.g. changes in school nutrition standards increase the nutritional value of school lunches; speed limits reduce motor vehicle fatalities; cigarette taxes lower rates of smoking).⁹⁴
- » **Healthy communities and environmental change** creates healthier communities through improving living conditions. These changes are often facilitated by policy and systems change, but require implementation at a local level (e.g. Complete Streets, farmers’ markets and community gardens, joint use of school playgrounds).^{95,96}

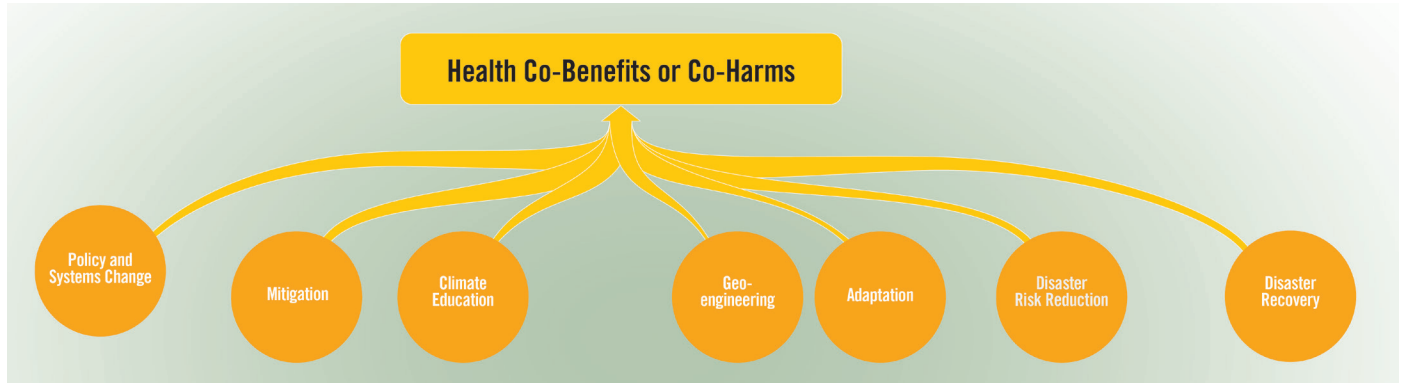


- » **Health education** provides “any combination of learning experiences designed to help individuals and communities improve their health, by increasing their knowledge or influencing their attitudes.”⁹⁷
- » **Risk reduction** acts to reduce exposures to hazards (e.g. mold or lead remediation in homes, seatbelts, high efficiency filters to improve indoor air quality).⁹⁸
- » **Safety net** services provide access to critical services (e.g. health care, supplemental food assistance, or energy assistance for low-income people).
- » **Public health preparedness** improves the readiness of communities and the public health system to respond quickly and effectively to public health emergencies (such as infectious disease outbreaks) and natural or human-caused disasters, through early detection, planning, and capacity building. Components of preparedness include health risk assessment, community response teams, and medical surge capacity.⁹⁹
- » **Medical care** provides treatment and support for individuals, to reduce the progression or impacts of illness and injury on function and well being.

Health Co-benefits and Co-harms of Climate Change Actions

In the sections above, we have talked about climate interventions and health interventions as though they are separate. But, just as there is a nexus between living conditions, health status, vulnerability/resilience, and climate impacts on health, there is also a nexus between climate interventions and health interventions: virtually every climate intervention has potential health co-benefits or co-harms. Many climate interventions *are* health interventions.

Figure 7: Health Co-benefits and Co-harms of Climate Actions



Climate change action strategies with health co-benefits provide opportunities to simultaneously reduce the risks and impacts of climate change and to improve the public's health. For example:

- » Reducing transportation GHGE by shifting to active transportation (walking, biking, and using public transit) can reap huge additional health benefits through increasing physical activity, including reductions in cardiovascular disease, diabetes, osteoporosis, depression, and some cancers.^{100,101}
- » Low carbon fuels and vehicle fuel efficiency standards will reduce both transportation GHGE and disease-causing air pollution from vehicle emissions such as particulate matter and NO_x.^{102,103}
- » Reducing GHGE from power plants (or switching to cleaner energy sources) yields significant reductions in ambient and household air pollution, with concomitant reductions in respiratory and cardiovascular disease and childhood mortality.¹⁰⁴
- » In developed countries and wealthier communities of developing countries, reducing meat consumption would have significant benefits for the environment and reduce cardiovascular disease and some cancers while reducing greenhouse gas emissions.^{105,106}



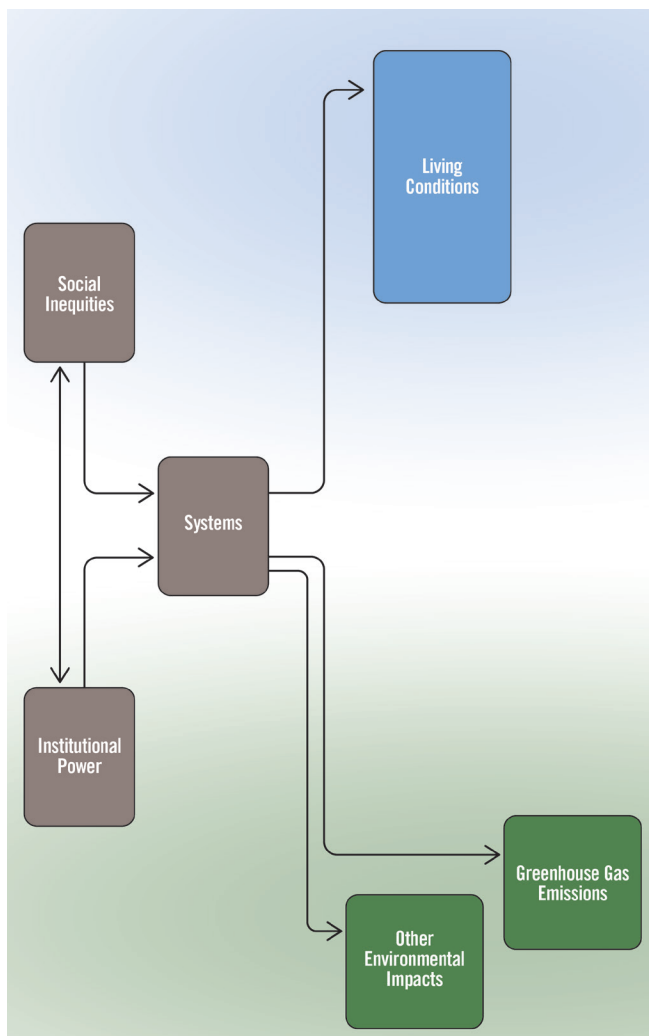
- » Urban greening and green infrastructure yield significant benefits on many fronts — reduced air pollution, ground water filtration and replenishment, reduced flood risk, lower energy expenditures, green spaces for physical activity and food production, lower crime rates and violence, and sequestration of CO₂.^{103,107,108}
- » Some preparedness programs have explicitly incorporated strengthening community social networks, with ancillary mental and other health benefits, and disaster recovery and rebuilding has in some cases fostered community engagement in efforts to reduce health inequities and racial segregation.^{109,110}
- » Revenues from policies that place a price on carbon can be used to invest in disadvantaged communities to foster community economic development and climate resilience and to improve living conditions to promote health and reduce health inequities.^{111,112}

A few climate strategies have potentially adverse consequences on health, called co-harms, or may exacerbate health inequities. For example, biofuels production from food crops may increase food prices or increase pressures on indigenous populations' access to land and water resources. Injecting SO₂ into the earth's atmosphere to produce global cooling could alter global rainfall patterns with significant food production impacts. Carbon cap-and-trade could perpetuate exposure of fence-line communities to stationary air pollution sources.^{103,113} And increased groundwater withdrawal as an adaptation to drought may lead to increased concentration of drinking water contaminants or land subsidence, and further limit options in a prolonged drought.¹¹⁴

Root Causes: Social Inequities, Institutions, and Systems

We have talked about the pathway from GHGE to the health impacts of climate change, about how living conditions impact health and equity, and briefly about the other environmental impacts that affect health. But what about the root causes — the upstream factors that foster the emission of greenhouse gases, shape people’s living conditions, and produce other environmental impacts? Figure 8 shows how the root causes of poor health, health inequities, environmental degradation, and climate change are fundamentally the same, and can be found in (a) social inequities, (b) powerful institutions, and (c) the systems that these together produce.

Figure 8: Root Causes: Social Inequities, Institutional Power, and Systems



Social Inequities: Social inequities refer to the unequal distribution of power, money, and resources that are often associated with class, race, ethnicity, place, immigration status, gender, and sexual orientation.⁶⁷

Institutional Power: Institutions such as schools, corporations, governments, school systems, and large NGOs have the power and authority to make decisions that impact the physical environment and shape the societal distribution of health-promoting resources and opportunities (e.g. parks, groceries, education, childcare, medical care, jobs). People in institutions are influenced by social values and mores that perpetuate inequities and thus perpetuate those inequities in their decisions and actions through those institutions.

Systems: A system is a collection of parts — physical structures, people, and organizations — that interact to provide an important function. For example, farms, farmers, packing plants, food inspectors, restaurants, and truckers all play a role in our food system. Systems change shifts the way that components of a system work, or how the parts of a system interact. Social inequities and powerful institutions interact to shape the systems that largely determine living conditions, human impacts on the climate, other environmental impacts, and health outcomes.¹¹⁶ These systems and living conditions also shape health and climate behaviors and define options for individual behavior change. Thus social inequities, institutional power, and systems — the social determinants of health — are the most significant drivers of the health and well-being of communities, inequities, and climate change.^{115,117}

Policy and systems changes can have far-reaching impacts over long time periods. For example, racism contributed to discriminatory mortgage lending and housing deed restriction practices that led to the racial segregation of neighborhoods across America. Greater racial segregation is associated with lower quality schools, fewer employment and economic opportunities, exposure to crime, substandard housing, exposure to toxins and pollutants, and isolation from broader social networks, all of which have been associated with poorer health. At the same time, federal transportation funding supported the development of a vast highway system that fostered suburban sprawl and furthered segregation; it also led to greater dependence on private automobiles, increased vehicle miles traveled (VMT), and thus increased air pollution and GHGE from automobiles.^{118,119,120,121}

Social and power inequalities may also be associated with weaker environmental policies. A survey of 50 US states found that states with greater inequalities in power distribution (measured by voter participation, tax fairness, Medicaid access and educational attainment levels) had less stringent environmental policies, greater levels of environmental degradation, and poorer health outcomes.¹²² Moreover, global social inequality may impede the development of effective international agreements to protect the climate.¹²³

Here are some more examples of how our large systems affect our health, the climate, and the environment:

- » Transportation systems determine how people and goods get from place to place, affecting physical activity, traffic injuries, air pollution, and GHGE. Fuel prices, pedestrian and bicycle infrastructure, and access to public transit influence driving behavior. Transportation systems impact access to jobs and services, and the loss of farmland and habitat.^{124,125}
- » Agriculture and food systems determine the cost of and access to different kinds of food and nutrition; what crops are grown, and how; water usage, soil health and depletion; deforestation, and biodiversity loss. Industrialized animal production generates methane from livestock manure, antibiotic resistance from the overuse of antibiotics to increase animal growth, and water contamination from the excessive application of nitrogen fertilizers and pesticides. Corn and soy subsidies reduce meat prices and increase meat consumption.^{23,126,127}
- » Energy systems provide for heating, lighting, and cooking, but the incomplete combustion of carbon also produces significant air pollution (e.g. from indoor cook stoves in poor countries, and from coal-fired power plants around the world). An estimated seven million deaths are associated with air pollution every year — one in eight of total global deaths.¹²⁸ Coal and uranium miners are at very high risk of occupational illness and injury, and mining often causes irreparable damage to water sources and natural habitats.¹²⁹ Electricity production contributes 32% of U.S. GHGE.¹³⁰
- » Economic systems distribute, allocate and determine access to wealth and resources, foster or alleviate wealth inequities, offer access to livelihoods and employment, and — in concert with social value systems — determine how much value we place on non-marketable resources such as clean air, clean water, and open space.¹³¹

“Health inequalities and the social determinants of health are not a footnote to the determinants of health. They are the main issue. But what we’ve shown in study after study, in country after country, is that there’s a social gradient. And by that I mean the lower you are in the hierarchy, the worse your health; the higher you are, the better your health.”

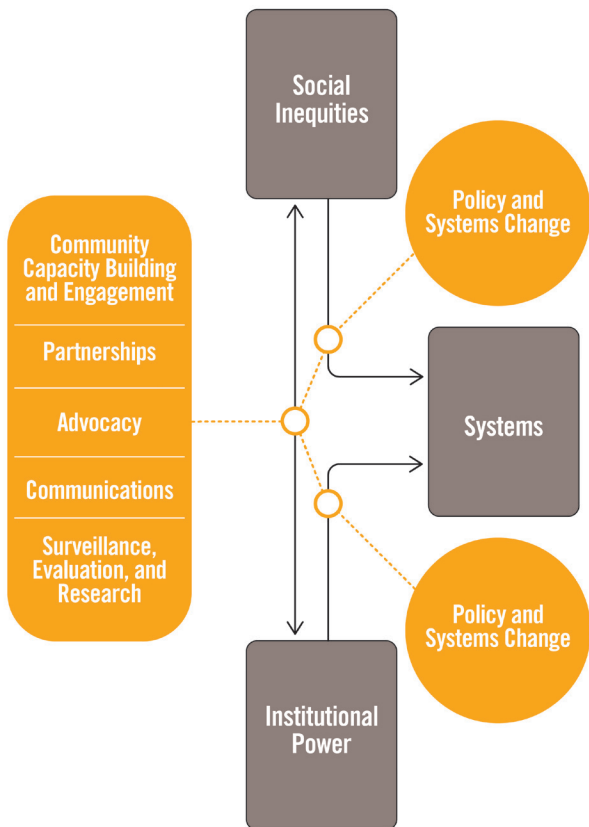
—Sir Michael Marmot¹¹⁵

Upstream Interventions for Health, Equity, and Sustainability

Earlier, we provided an overview of the broad spectrum of interventions that can impact the health or climate pathways, and how many climate action strategies also have health co-benefits. We also explored the upstream causes of climate change, other environmental harms, and the living conditions that most determine health outcomes. These are all rooted in complex human-created systems (e.g. transportation, agriculture, and so on) and the social inequities and institutional forces that shape them.

Interventions that impact those upstream root causes thus have the most potential to simultaneously promote health, equity, and sustainability (see Figure 9). These upstream interventions must be an important focus of our work, because they are likely to have the greatest and broadest impact for healthy people, healthy places, and a healthy planet. These strategies should be incorporated at all stages of planning, development, implementation, and evaluation to increase effectiveness across the spectrum of both health and climate interventions (as shown by the dotted line that encircles the diagram in Figure 10). For example, community engagement in preparedness planning can identify the most effective ways to communicate with residents during an emergency, while advocacy is required to maintain funding for safety net services, open up school grounds for joint use, or pass laws regulating GHGE.

Figure 9: Interventions that Address Root Causes



These core interventions will be required to build the political power and public will to transform our social gradient, our institutions, and our systems to support health, equity, and sustainability:

- » **Community capacity building** increases the ability of residents to analyze and address problems using their own and external resources and to strengthen social cohesion. In order to help build capacity, public health partners can provide information, technical assistance, and support for assessing what health and climate vulnerabilities and assets exist in the community. Public health practitioners can also encourage and support communities' involvement with institutional and political processes and decision-making — especially for the vulnerable groups and disadvantaged communities most at risk of climate-related health impacts.¹³² Many local health departments and community-based organizations (CBOs) are already working with residents to build community capacity, and some are incorporating climate change into that work.
- » **Community engagement** processes provide avenues to work “collaboratively with and through groups of people” to address issues of concern to them, with the goal of increasing community decision-making and control.¹³²



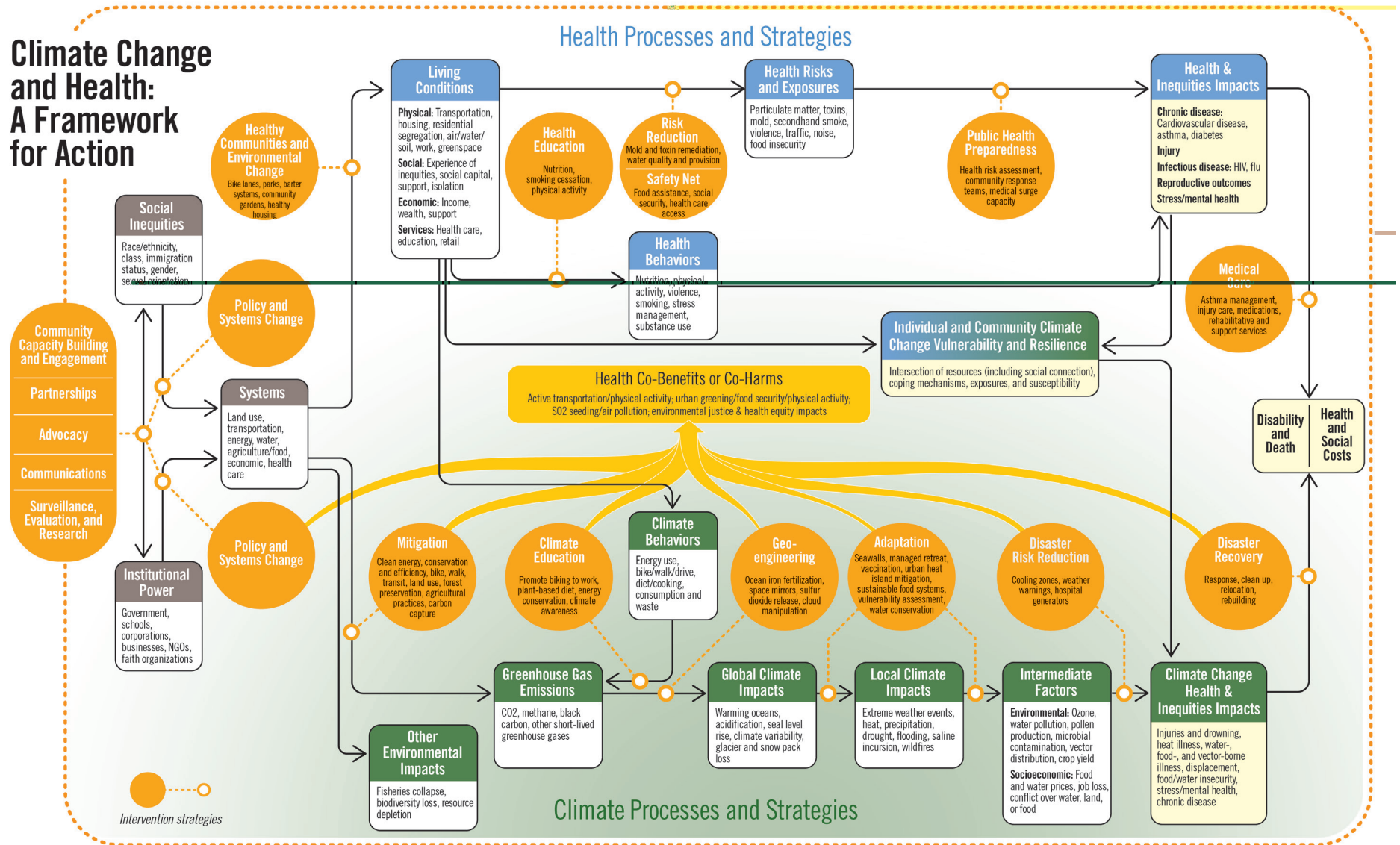
- » **Partnerships and collaboration** across multiple sectors and organizations are necessary to address the complex systems and interrelated issues of health, equity, and sustainability. Working toward mutual goals and finding win-win solutions, such as the health co-benefits of active transportation, are important elements of collaboration.¹³³
- » **Advocacy** is required to influence the decision-makers to change policies, practices, and systems, often in contested areas involving powerful interests.¹³⁴
- » **Communications** help to inform individual and collective decisions and change social norms through campaigns that address values, define problems, and identify solutions. Social marketing incorporates marketing principles and considers product, place, price, promotion, and policy in efforts to influence behavior, attitudes, and practice.¹³⁵ Developing appropriate messages and media requires research on prevailing knowledge, attitudes, and behaviors.¹³⁶
- » **Surveillance, evaluation, and research** are vitally important tools that use data to inform communities and policy makers, prioritize actions, and assess and improve health and climate change interventions.¹³⁷

In order to make lasting changes, the integration of health, equity, and climate considerations will need to be institutionalized, through a “Climate, Health, and Equity in All Policies” approach. Priority should be given to those strategies that provide health and equity co-benefits and minimize health and equity co-harms.

“Washing one’s hands of the conflict between the powerful and the powerless means to side with the powerful, not to be neutral.”

—Paulo Freire ¹³⁸

Figure 10: Climate Change and Health: A Framework for Action



Developed by the Public Health Institute's Center for Climate Change & Health. © Public Health Institute 2014



Putting It All Together

In our work on community health, equity, and climate change, we often focus on specific issues, populations, and interventions, but collectively we work across the spectrums of intervention described above. Understanding the nexus between climate, health, and equity (shown in Figure 10) and working to strengthen our collaborations around that nexus, we can together build a movement for healthy people, healthy places, and a healthy planet.

In 2013, Public Health Institute funded three community-based organizations — the Social Justice Learning Institute (SJLI), the Environmental Health Coalition (EHC), and the Adaptation and Resilience Committee of the Oakland Climate Action Coalition (OCAC) — to undertake one-year pilot projects designed to make the climate change-health connection in their communities. Local health departments — such as the Los Angeles and Fresno County Departments of Public Health — are also starting to explore how they can be a part of the climate change solution. These are just a taste of the many ways in which public health and community partners *can* take on climate change in ways that make a difference, for our health now and for the future health of our children and the planet. Next we look at some of these examples of the exciting work at the nexus of health and climate change.



Community Clinics Link Climate Change and Health in San Diego

The Environmental Health Coalition (EHC) has been fighting for environmental justice in the San Diego/Tijuana region for decades, working in low-income communities like City Heights and National City that are the home to immigrants and refugees from over 60 countries.

EHC partnered with La Maestra Community Health Centers to provide training and materials to clinic staff and clients about the connections between climate change and health. At this southernmost border of

California, climate change is already causing record-breaking heat waves and more frequent and severe wildfires, worsening air quality, and threatening water supplies.

EHC developed accessible and engaging bilingual educational materials about air pollution, the “invisible threat” of climate change, and climate impacts on health, including brochures, posters, and a curriculum for *promotoras* highlighting actions that people can take in their home and in their community. EHC trained over 50 La Maestra clinic staff and *promotoras*, using a “deep education” approach that starts with immediate individual and family concerns and works out to larger community, regional, and global issues. In the case of climate change, for example, EHC staff showed *promotoras* how families could save money by reducing their energy usage, teaching them to track kilowatts, turn off lights, and change light bulbs. Immediate electricity cost savings were linked to community efforts to reduce air pollution and to global efforts to reduce greenhouse gas GHGE that cause “*calentamiento global*” [global warming].

EHC and La Maestra conducted more specialized training with medical staff, preparing them to deliver key messages to the public and government officials about the importance of addressing climate change. The clinic also plans to add two questions about climate change to their intake forms: 1) *Do you have air conditioning?* 2) *Do you live near a “Cool Island”?*

All of these actions are then linked to the importance of advocating for community action, such as a stronger San Diego Climate Action Plan (CAP). EHC has found that the testimony of residents together with medical professionals can make a big impact. The EHC–La Maestra partnership provides a strong voice for a Climate Action Plan that addresses the needs and health concerns of all families and communities.

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>





Climate Change is a Social Justice Issue in Inglewood, California

Inglewood, California sits at the intersection of two freeways and right under the flight path of the Los Angeles International Airport, one of the busiest airports in the world.

The community, which is over 80% people of color, is exposed to high levels of air and noise pollution and arsenic in the soil. For Inglewood, climate change is a significant social justice issue. In 2012, the Social Justice Learning Institute (SJLI) launched the Healthy and Sustainable Inglewood Collaborative to help the community get involved in local planning processes that could make a difference, such as the long-overdue update to the city's General Plan.

A Public Health Institute pilot project grant provided the support the Collaborative needed to bring different partners together, including residents, CBOs, local businesses, and local government agencies to develop a Health and Climate Action Plan that could be included as an element of the Inglewood General Plan.

Over 14 months of an inclusive community-based process, SJLI facilitated monthly meetings of the Collaborative, including community needs assessment workshops, a forum to develop a broad community vision, and informational meetings that garnered input from across many parts of the Inglewood community. Through this process, SJLI identified nine key areas to address: transportation, urban greening, energy, waste, water, air quality, land use, zoning, and food. The Collaborative members reviewed local data and maps developed by SWA Architecture & Design, drew upon a review of similar efforts across the US, and brought their understanding of local needs and issues to the table.

Key partnerships strengthened the process. For example, the Los Angeles County Department of Public Health worked with SJLI youth over the summer to conduct a more in-depth community assessment using tools from Communities of Excellence in Nutrition, Physical Activity and Obesity Prevention.¹³⁹ TreePeople helped co-lead the planning, bringing a wealth of expertise on urban greening and water issues. The Inglewood City Planning department was engaged from the start.

A comprehensive draft Health and Climate Action Plan was completed in October 2014, centered on strategies to improve health equity, reduce GHGE, and address community needs. The Plan is under review, but has already served as the basis for an active transportation grant that will provide joint funding to the city and to SJLI to start making the Collaborative's vision for Inglewood a reality. Next, SJLI plans to conduct an education and promotion campaign to build support for the formal adoption of the Health and Climate Action Plan. From building partnerships, to providing well-researched background information, to ongoing community outreach, SJLI established a process for creating a Health and Climate Action Plan that would be widely embraced, implementable, and effective.

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>



Oakland's Community Collaboration to Build Climate Adaptation and Resilience

The West Oakland community in Oakland, California has many reasons to be concerned about climate change.

More smog from warmer temperatures will worsen already high asthma rates due to air pollution from freeways and the busy Port of Oakland. The community is heavily impacted by toxins from nearby industry. The lack of parks and trees creates urban heat islands, putting people at risk during heat waves. The neighborhood is close to sea level, and its aging infrastructure is vulnerable to the effects of flooding. Many residents grapple with poverty, unemployment, and limited access to healthy foods. At the same time, West Oakland has a long history of strong social networks and activism for social justice, and is home to numerous community-based organizations that support urban agriculture and greening, anti-displacement efforts, and other community justice and resilience efforts.

The Resilience and Adaptation Committee of the Oakland Climate Action Coalition (OCAC) is working to address the threats of climate change with locally-scaled solutions that build on community strengths and improve residents' quality of life. With pilot project funding from the Public Health Institute, the Committee mapped out a plan to help city agencies and West Oakland residents collaborate more effectively on climate resilience and adaptation. The goal is to connect residents to the information they need to build resilience within the community. With a strong emphasis on policy, community education and engagement, the group is working to incorporate resilience and adaptation into land use and transportation plans, and into the city's Climate Action Plan.

The Resilience and Adaptation Committee convened an interactive workshop and health fair to increase residents' understanding of the climate change impacts most relevant to West Oakland — flooding, heat, poor air quality, and wildfires — and guided participants to identify relevant community assets and strengths. The Climate Change Survivor game made it engaging for residents to learn about climate impacts, and how to protect themselves and their families.¹⁴⁰ Using sticky dots and a map of the community, workshop participants mapped their social networks within the neighborhood, launching a robust discussion about the importance of such networks to surviving adverse impacts. Other activities drew out the links between immediate concerns — such as the costs of energy and water — and climate change strategies such as energy efficiency and water conservation.

The Resilience and Adaptation Committee also convened over 50 city, county and regional agency staff, and community organizations to provide training on how to reach community residents, build trust, and work toward effective collaboration. The meeting helped agency staff to see more clearly how their own effectiveness can be strengthened through strong relationships with a prepared and connected community. The great promise of the Resilience and Adaptation Committee's approach is that by focusing on *community*-based resilience, there is the opportunity to improve quality of life in disadvantaged communities, even while preparing for and adapting to the threats of climate change.

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>

A Residential Climate Change Intervention with Public Health Nurses



Nurses for Cool and Healthy Homes
October 9, 2014

Nurses for Cool and Healthy Homes

A CDC field assignee in the Fresno County Department of Public Health in California and a nursing student studying abroad learned about the important services provided by public health nurses and community health workers in low-income communities.

The pair teamed up as graduate students at the University of Michigan Public Health, Urban Planning, and Natural Resources programs and decided to figure out how to integrate climate change and public health work. They found enthusiastic partners in the Fresno County Department of Public Health (FCDPH), where staff already knew that increased extreme heat events could be a big problem for the department's clients. They submitted a proposal to co-direct "Nurses for Cool and Healthy Homes" to a contest sponsored by Health Care Without Harm, and received \$10,000 to implement their ideas.

Fresno, the nation's largest fruit and vegetable producer, is getting hotter as a result of climate change. Fresno already experiences 92 days each year over 104°F, and climate scientists project that will increase by 22–30% by 2050.¹⁴¹ Fresno is both diverse and low-income; nearly 50% of residents are Latino, over 8% are Asian, 5% are African-American, and over 22% live in poverty. Many of the poorest families live in crowded, low-quality housing without air conditioning, and can't afford to spend more of their already-tight budgets on energy costs for cooling their homes.

The project collaborators thought it might be feasible to incorporate a heat risk assessment into nurse home visits, but knew it would have to be simple and quick because public health nurses have many topics to cover in each home visit. With help from nursing students at Fresno State University, they reviewed the literature about heat, the home environment, climate change, and health. They also reached out to the Pacific Gas and Electric (PG&E) Sustainable Communities manager, who led them on a field trip to see how PG&E technicians do home energy assessments, and provided information on a variety of PG&E programs for low-income residents (e.g. for repairs or energy bill assistance). Using home asthma assessments as a template, they developed a Home Heat Risk Assessment, in the form of a short checklist with items such as window condition, presence of working air conditioner, and barriers to use of the air conditioner such as high utility bills. The checklist also includes a key and information to make it easy for the nurses to make appropriate energy referrals and health referrals based on client responses. It takes less than three minutes to go through the checklist.

Next, the students developed short informational materials and trained nurses and other FCDPH staff who provide home-based services on climate change, heat and health, and trained them on how to use the checklist and make referrals. The nurses shared stories about how this could help some of their clients, and after testing in the field, provided feedback to make the checklist even easier to use. Implementation of the checklist and referral process is now underway, and the team will soon conduct an evaluation to see if this is a good way to identify and prepare Fresno residents who are heat-vulnerable.



Building Local Health Department Capacity for Climate Change Action

In 2008, the Director of Environmental Health in the Los Angeles County Department of Public Health (LACDPH), organized an Executive Workgroup on Climate Preparedness and Mitigation.

The director had spent four decades addressing traditional environmental health issues, but increasingly saw climate change as the biggest environmental health problem. He recognized that bringing a health lens to climate change could increase public awareness of the threat, and motivate greater collaboration across the many county agencies that have a role to play in climate action. The Workgroup developed a *Five-Point Plan to Reduce the Health Impacts of Climate Change*:

- **Inform** and engage the general public about the nature of climate change and the health co-benefits associated with taking action to reduce carbon emissions.
- **Promote** local planning, land use, transportation, water, and energy policies that reduce carbon emissions and support the design of healthy and sustainable communities.
- **Provide** guidance on climate preparedness to local government and community partners to reduce health risks and create more resilient communities.
- **Build** the capacity of departmental staff and programs to monitor health impacts, integrate climate preparedness, and improve climate response.
- **Adopt** best management practices to reduce carbon emissions associated with departmental facilities and internal operations.

LACDPH then partnered with the University of California, Los Angeles Fielding School of Public Health, which developed the 16-session *Climate & Health Workshop Series* for LACDPH staff. From Fall 2013 to Spring 2014, staff in Environmental Public Health, Veterinary Public Health, and Public Health Nursing piloted the course; now 120 staff across all programs in LACDPH are enrolled in the series. The classes feature climate projections specific to the Los Angeles region, and are structured to foster discussion about how LACDPH can address climate change across the department.

Last month, LACDPH released two reports to broaden understanding that climate change is an urgent health issue. *Your Health and Climate Change in Los Angeles County* introduces people to the many ways in which climate change impacts health, and some action steps that individuals and families can take.¹⁴² *Framework for Addressing Climate Change in Los Angeles County* provides a model that other local government jurisdictions and agencies can adopt to help broaden their role in climate change mitigation and adaptation.¹⁴³

Building on strong inter-agency partnerships forged in the development of county-wide Healthy Design initiatives, LACDPH is now collaborating with many other agencies to develop and implement climate preparedness and mitigation initiatives. With such efforts, LACDPH aims to bring a public health voice to climate decision-making in the LA region, to effect positive change for all County residents.

Recommendations for Public Health Actions to Address Climate Change

This section provides recommendations, categorized by the public health strategies mapped out in the Climate Change and Health Framework. These recommendations suggest ways that the public health community can participate in climate change planning activities, and ways that those working on climate change in other sectors can help bring climate considerations into on-going public health work. Given that there are innumerable opportunities for such synergistic work, the examples we provide are illustrative rather than exhaustive.

Community Capacity Building and Engagement

Community knowledge about climate, health, and equity conditions is crucial to the development of climate change strategies that address community needs and build on community strengths. Some strategies to support robust community capacity building and engagement include:

» Increase community capacity:

- Strengthen the skills, knowledge, and abilities of communities to participate in and influence decision-making processes;
- Provide leadership training for members of communities facing climate impacts;
- Facilitate learning that increases community members' understanding of how to analyze and participate in decision-making around climate change, health, and equity, including the ability to plan, organize, fundraise, and take action within the decision-making context;
- Support and strengthen community social networks and other assets to build climate resilience (e.g. engage schools, faith-based communities, neighborhood-based groups and businesses in climate resilience planning).

» Promote Engagement:

- Partner with community groups and leaders to inform and mobilize community members around climate change, health, and equity issues
- Fund, encourage, and support community-based organizations, community members, and leaders to engage in all stages of climate change and public health planning, decision-making, and implementation.

» Provide Relevant Information:

- » Translate climate science and information about climate action strategies to make it locally relevant and accessible for community members, and highlight health, climate, and equity impacts and opportunities.
- » Provide data and technical expertise to community-based organizations and facilitate asset mapping and climate vulnerability assessment.

In Youth Action Labs organized by the **Alliance for Climate Education (ACE)**, high school students develop the leadership skills they need to take action to address the impacts of climate change in their communities. Action Labs have helped students understand and educate their communities about the relationships among climate change, food systems, and health. California's Central Coast is dotted with small farmworker communities whose residents labor in the fields that produce much of the nation's berries and lettuce. Work in the fields is already hot and dusty, and climate change brings higher temperatures and drought, increasing the risk of heat illness and Valley Fever. Drought also means unemployment for many farmworkers, who have few job protections; and the combination of low wages, job loss, and rising food prices due to the drought means that farmworker families face even higher levels of food insecurity. Students quickly recognized that farmworkers and their families are likely to be especially hard-hit by climate change.

With support from ACE, students took the lead on organizing the first ever *Central Coast Farmworker Appreciation Day* in Salinas, California last June 14th. Partners who came together to plan the event — youth, farmworkers, community leaders, local organizations, and businesses — also drafted a platform addressing the environmental and economic issues that affect the health of communities in the Central Coast region. While *Farmworker Appreciation Day* brought people together to honor the farmworkers of California's Central Coast, the students know that organizing and community building can't stop with this one event. These youth plan to continue working together toward a healthier, more resilient community.

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>

In 1975, the United Farm Workers marched to a large winery in Modesto energized the successful push for laws to protect farmworkers' rights. More than 30 years later, **Valley Improvement Projects (VIP)** is carrying on the fight for social and environmental justice. VIP advocates for smart growth, alternative transportation, clean water, and better air quality — issues that are all linked both to climate change and to a better quality of life for the people.

VIP's 5 Point Platform includes pushing for environmental justice and public health by emphasizing natural and sustainable agriculture and environmental practices; and empowering and serving "the underrepresented and marginalized," including youth and diverse community members, homeless and those without stable living conditions, and tenants and workers. Ensuring accountability from law enforcement, prison, and immigration systems is another key pillar of their work. VIP has a vision of a sustainable community with clean air, water, and soil, powered by renewable energy; they know that vision can only be achieved through empowering people who live in the community to unite in the fight for justice and equality.

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>

Partnerships

Integration of climate, health, and equity goals into climate action requires strong partnerships amongst and across:

- » Communities most impacted by climate change;
- » Non-governmental organizations and government agencies, at the local, regional, state, and national levels
- » Various sectors (e.g. energy, health, transportation) both within and outside of government;
- » Public and private entities.

In 2008, Hurricane Ike destroyed or badly damaged 70% of Galveston, Texas, whose residents were disproportionately poor, and faced multiple health problems. The hurricane destroyed physical and communications infrastructure and much of the health and safety network, leaving people even more vulnerable. The **Center to Eliminate Health Disparities** at the **University of Texas Medical Branch** partnered with a broad array of agencies, civil rights organizations, community centers, neighborhood associations, and others to build a disaster recovery approach that leads to a healthier, more equitable and more sustainable community. Health Impact Assessments have been incorporated into recovery planning, and many lessons have been learned about the challenges of incorporating the needs of disenfranchised communities into disaster recovery processes.¹⁴⁴

Advocacy

Advocacy is required to promote adoption and implementation of policies and programs that integrate climate, health, and equity.

» Inform and educate:

- › Inform legislators and decision makers in government and other institutions about the relationships among climate change, health, and equity.

» Advocate:

- › Provide support for policies and programs to reduce greenhouse gas emissions, strengthen community resilience; protect people from the impacts of climate change; and incorporate the consideration of health, equity, and sustainability in all policies.

» Build coalitions:

- › Build coalitions to strengthen support for or opposition to specific administrative and legislative proposals.

California's Senate Bill (S.B.) 375 requires each region in the state to develop a Sustainable Communities Strategy that integrates land use, housing, and transportation planning with the goal of reducing vehicle miles traveled to reduce greenhouse gas emissions. Advocates such as the **Six Wins for Social Equity Network** sought to ensure that health and equity were integrated into climate change solutions. The Six Wins network provided policy analysis, watchdogging, and community mobilization to ensure that the San Francisco Bay Area's Sustainable Communities Strategy brings benefits to and reduces burdens on low-income communities of color, by increasing health and safety, affordable housing, and public transportation opportunities.¹⁴⁵

Many environmental justice activists have opposed emissions trading programs, because of the risk that these "cap-and-trade" programs will result in continued release of toxic pollution into communities near refineries and power plants, or even increase the amount of pollution. In California, the **SB 535 Coalition** — a coalition of social and environmental justice groups — successfully organized and advocated for the passage of SB 535. This bill requires that 25% of cap-and-trade revenues be allocated to benefit disadvantaged communities, and that another 10% fund projects located within those communities. Now, the SB 535 Coalition is advocating for specific types of expenditures that will provide jobs and promote health and economic benefits to the residents of disadvantaged communities.^{146,147}

Communications

Mobilizing communities and decision makers to take aggressive action on climate, health, and equity will require a comprehensive communications strategy:

» **Tailor Communications:**

- Develop varied educational materials for diverse populations (e.g. vulnerable communities, school-age children, clinicians, business, labor) that focus on the health impacts of climate change and opportunities for health co-benefits.
- Craft inclusive and appropriate outreach and communications strategies to reach diverse and vulnerable populations (e.g. outdoor workers, immigrants). Use audience-appropriate language, media, and dissemination strategies.

“OutsideIn SLO: We Take Health and Climate Change Personally” is the first climate change and health communications campaign in California, launched by the San Luis Obispo County Public Health Department with help from the California Department of Public Health. SLO Health Promotion Division Manager Kathleen Karle realized that “Public health departments were already providing education on related subjects — eating healthy local foods, increasing physical activity levels, discussing transportation options — and we thought, couldn’t we just incorporate climate change into what we were already doing?” The health department brought in the county obesity prevention coalition, the Air Pollution Control District, the regional transportation planning agency and planning department, a local bike coalition, the food bank, a homeless assistance nonprofit, and others to develop the campaign. They also added an OutsideIn SLO climate change class to their WIC educational classes. “Because WIC clients are disproportionately affected by climate change — for instance, the California drought will likely lead to increased food prices, a particular financial burden for clients — it’s important they understand the ins and outs of the issue,” says Karle. “If we can do this with limited resources, then any jurisdiction can. Just find your partners, and find your champion.” (Excerpted from NACCHO Stories from the Field)¹⁴⁸

» **Communicate to the Health Care Sector:**

- Focus communications and outreach to the health care sector on the health impacts of climate change, actions this sector can take to mitigate and adapt to climate change, and prevention and management of climate-related illnesses.

» **Advocate for Strong Communications on Climate Change from Public Health Leaders:**

- Urge U.S. public health leaders, including the Surgeon General, leadership at the Centers for Disease Control and Prevention, and state public health department leadership to make a “call to action” on the urgent need to address climate change.

» **Highlight Relevance and Values:**

- Make the link between climate change and other issues people care about (e.g. economic issues, cost of living, social issues such as violence), and use climate related events as teachable moments (e.g. extreme heat events, floods, drought, rising food prices).
- Incorporate commonly held values such as family, community, corporate accountability, and environmental preservation.¹⁴⁹

» Use Existing Education and Outreach Platforms:

- Incorporate climate change messages into existing health education and media outreach efforts (e.g. public health advisories on heat or West Nile Virus).
- Incorporate health messages into existing climate change education efforts.

In 2010, an initiative designed to undo much of California’s Global Warming Solutions Act was placed on the ballot. With millions of dollars in contributions from Texas oil companies, the oil companies’ campaign tried to convince voters that taking action to fight global warming would lead to higher unemployment. But public health agencies, hospitals, health organizations, medical professionals, and hundreds of volunteers joined the **“No on 23 Stop Dirty Energy”** campaign to beat back the initiative and support strong measures to reduce greenhouse gas emissions. Polling found that the strongest message was: “Dirty energy means more air pollution, more asthma, and more heart disease; don’t let Texas oil companies harm our health!” The initiative suffered a resounding defeat, making it clear that California residents support the State’s continued leadership in fighting climate change.¹⁵⁰

Surveillance & Research

Surveillance and research are required in order to understand the health impacts of climate change in the various communities and regions across the country. Health departments already collect data on many other risk factors and diseases, but we need routine surveillance of climate related illnesses and deaths and factors that affect climate vulnerability and resilience.

» Develop Health and Climate Change Indicators:

- Build on the work of the Council of State and Territorial Epidemiologists Environmental Health Indicators for Climate Change, and other climate change indicator projects, such as the *California Indicators of Climate Change in California* report.^{151,152}
- Provide opportunities for community input to develop indicators that identify community assets and concerns.

In the 2006 California heat wave, the **San Francisco Department of Public Health** was surprised to find that residents were very vulnerable to heat, because San Franciscans are not acclimated to heat and most don’t have air conditioners. SFDPH developed the Heat Vulnerability Index to predict and map which neighborhoods are likely to face high risks during an extreme heat event; the department also conducted a “gap analysis” to assess capacity to prepare for and respond to more frequent and severe heat events.¹⁵³

» Provide Surveillance Resources and Training:

- State and federal government and agencies should provide increased funding and training to strengthen the capacity of health departments to conduct surveillance of climate change health impacts, and to support community involvement. Explore feasibility and resources to:
 - Implement routine surveillance of climate-related illnesses and deaths, and climate vulnerability and resilience (e.g. neighborhood heat indices, tree canopy, social support, transportation access); develop

formal epidemiologic surveillance definitions and explore mandatory reporting for selected risks and outcomes.

- Expand the use of syndromic surveillance of climate-related health effects to provide real-time information for public health action (e.g. real-time heat illness surveillance).¹⁵⁴
- Increase capacity to utilize climate information and services for public health action (e.g. use of seasonal temperature and rainfall forecasts to implement heightened vector-borne disease surveillance and interventions).^{155,156}
- Expand the Electronic Death Reporting System for the continuous monitoring of climate and health impacts, such as heat-related deaths.
- Upgrade the existing Safe Drinking Water Information System, which provides information about public water systems and their violations of EPA's drinking water regulations to ensure safe and reliable public water resources.

Wilmington, California is home to two of the largest U.S. ports, four major oil refineries, four asphalt refineries, a large oil field, and many other industrial facilities; it is also surrounded by three major freeways and crossed by the Alameda train corridor. Over 85% of Wilmington's 70,000 residents are Latino, 35% live in poverty, and many grapple with respiratory illnesses and cancers from living in an area that has been referred to as the "Diesel Death Zone".^{157,158} Greenhouse gas emissions from the ports, goods movement, transportation corridors, and energy industries in this area are among the highest in California.

In 2001 Jesse N. Marquez, a lifelong Wilmington resident who lives four blocks from the Port of LA, founded the **Coalition for a Safe Environment**, a community-based organization that seeks to improve environmental health and justice in the harbor communities near the Ports of Los Angeles and Long Beach. Earlier this year, CFASE launched the "LA Community Environmental Enforcement Network," installing an air-quality monitor on the roof of a family's home at the fence line of the Phillips 66 refinery. The solar-powered device gathers real-time data on the levels of air pollution that Wilmington residents are breathing in, and the results will be posted online.^{159,160}

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>

» Conduct Practical, Applicable Research:

- Fund and conduct expanded research on:
 - The health impacts of climate change and the potential health co-benefit or co-harms of various climate action strategies;
 - Local impacts of climate change on health, using downscaled climate modeling and projections; and
 - The economic cost benefits/return on investment of climate action in relationship to health, and the health costs of inaction.
- Strengthen working relationships among health researchers, climate scientists, social scientists, and other disciplines and sectors.

Policy and Systems Change, and Healthy Communities and Environmental Change

Policy and systems change strategies are often required for the implementation of healthy communities and environmental change. Here we include recommendations by sector for strategies that provide co-benefits for health and climate change.

» Transportation

- › Formally incorporate a health lens into local and regional transportation planning.
- › Routinely integrate health co-benefits and co-harms (e.g. chronic illness, bike injuries) into transportation models used in planning (e.g. I-THIM).¹⁶¹
- › Support and promote active transportation, including through support of increased funding for pedestrian and bicycle infrastructure, through programs such as Complete Streets and Safe Routes to School, and through incentives (e.g. tax breaks, transit subsidies).
- › Promote pedestrian and bicycle safety through lower speed limits and better road design.
- › Support public transit use by providing funding for public transit systems and infrastructure and discount transit fees (e.g. free school bus passes).
- › Support vehicle emissions reductions in transportation and goods movement through:
 - › Mandatory vehicle fuel efficiency standards.
 - › Low carbon fuel standards that incorporate mechanisms to ensure that biofuel crops do not displace food crops or lead to displacement of farmers.
 - › Expanded use of electric vehicles (EV), including EV subsidies and funding for EV infrastructure; EV support should not threaten or supplant funding for active transportation, and should ensure access to EV for low-income individuals.
 - › Requirements that reduce diesel emissions (e.g. incentives and requirements for retrofitting of trucks, anti-idling rules).

When the **Southern California Association of Governments (SCAG)** was developing its 25-year long-range transportation plan, community and Safe Routes to School program leaders realized that only a tiny fraction of funding was set aside for active transportation. The **Los Angeles County Department of Public Health** calculated the actual cost of building walkable and bikeable communities for the region's needs.¹⁶² "We saw an excellent role for our public health department to play," said Jean Armbruster, director of the Policies for Livable, Active Communities and Environments Program within LACDHP's Division of Chronic Disease and Injury Prevention. Presentation of this analysis to SCAG leadership, coupled with advocacy throughout the planning process, resulted in a tripling of funding for active transportation in the plan's budget. SCAG has since hired dedicated staff to work on active transportation and public health, and it plans to include Complete Streets and Safe Routes to School in future projects.

Residents of communities living near large ports have long suffered from premature death, asthma, cancer and heart disease associated with diesel pollution that also causes global warming. Truck drivers, residents, public health and community advocates have come together to push to clean up the 110,000 diesel trucks that haul containers to and from our ports, often among the oldest and most polluting on the roads today. As a result, many major ports have initiated programs to reduce emissions from port trucks. For example, since adopting the LA Clean Truck Program in 2008, the Port of Los Angeles has banned more than 10,000 heavy polluting trucks, leveraged more than \$600 million in private investment for 10,000 clean diesel and natural gas fuel trucks, and reduced diesel pollution by about 80%. The trucking industry is fighting these changes. The **National Coalition for Clean and Safe Ports** is now advocating for legislation that would permanently curb the harmful diesel-truck pollution that causes climate change and health risks to millions of American who live and work in port regions.¹⁶³

Santa Clara, County, home to Silicon Valley, received a “D” in two out of three air quality indicators in the American Lung Association’s 2014 State of the Air report. Diesel emissions from truck and buses are a major contributor to smog and to greenhouse gas emissions in California. **Breathe California** (Breathe CA) in Santa Clara County, together with a diverse cross-sector team of partners, is piloting an electric school bus with a plan to create a solar-powered bus fleet for the Gilroy School district that could spark change around the country.¹⁶⁴

The first bus, converted from a regular yellow diesel school bus, is now transporting Gilroy students, and eliminates their exposure to diesel emissions *inside* the school bus that other children regularly breathe. Soon, up to 25% of the bus’s power needs will come from a solar grid at a school site. Currently, the school district spends about \$17,000 per bus per year on fuel. Going electric will cut that bill significantly, and the installation of solar grids will further boost savings, which schools will be able to redirect to other pressing needs. The plan is to convert the school district’s entire fleet.

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>

» Land use

- Promote integrated local and regional land use, transportation, and housing planning that reduces social, environmental, and economic harms such as sprawl, displacement/gentrification, traffic, noise, air pollution, and loss of agricultural land and natural habitat.
- Support healthy neighborhood design that incorporates mixed-use, mixed-income neighborhoods with access to transit, jobs, affordable housing, and key amenities.
- Promote infill and transit oriented development with protections against displacement.
- Promote consideration of health and climate in planning and infrastructure decisions and processes (e.g. General Plans, Environmental Impact Assessment, zoning).

» Buildings, Housing, and Other Infrastructure

- Subsidize energy efficiency upgrades and weatherization for low-income homeowners and renters.
- Advocate for development of energy-efficient multi-unit and low-income housing.
- Support required energy upgrades for buildings at point of sale.
- Update and incorporate green building standards and efficiency standards in state and local regulations, codes, and industry practices.¹⁶⁵
- Develop an urban heat island effect index, and use it to set quantifiable goals for heat reduction.¹⁶⁵

- Plant trees and use vegetation (such as green walls and green roofs) to lower indoor temperatures and alleviate the urban heat island effect.¹⁶⁵
- Review and improve access to low-energy indoor cooling strategies, such as building shade. Secondly, improve access to and use of air conditioning, with attention to ways to offset the economic impacts on seniors and low income groups and consideration of the energy use implications.¹⁶⁵

In December 2013, **Los Angeles** became the first major city to mandate **cool roofs for all new residences** and refurbished homes. A cool roof uses material that naturally reflects sunlight instead of absorbing the sun's heat; cool roof surfaces can be more than 50°F cooler than regular roofs on a hot summer day, cooling the inside of a building by several degrees. The LA Department of Water and Power is offering cool roof incentives that make the difference between a cool and hot roof cost neutral. Says Jonathan Parfrey, Director of **ClimateResolve**, "Cool roofs are a win-win for the people of LA. Keeping temperatures down on extreme heat days will protect lives; energy efficiency will save millions of dollars; and cool roofs will help LA combat global climate change at the local level."¹⁶⁶

- Promote incorporation of climate change considerations in infrastructure planning, funding, and design.¹⁶⁷
- Support prioritization of infrastructure funding in low income and vulnerable communities, especially in areas where aging infrastructure is at risk from climate change.
- Promote climate adaptive infrastructure (e.g. cool pavements) and "green infrastructure" that uses elements of natural systems (e.g. bioswales for stormwater management or oyster beds for coastal protection).¹⁶⁸

» Energy

- Support strengthening of building and appliance standards for energy efficiency.
- Support policies that promote clean renewable energy (i.e. wind, solar, and geothermal).

The **Baltimore Energy Challenge** teaches low to no cost ways to save energy through a grassroots effort in neighborhoods and schools that provides a free energy saving kit to low-income persons. Lower energy bills means more money available to meet other important needs.¹⁶⁹

- Support policies that hasten and encourage transition from fossil fuels, such as ending fossil fuel subsidies.
- Support mandatory GHG emissions caps for new and existing power plants.

On June 2, 2014, the **U.S. Environmental Protection Agency**, under President Obama's Climate Action Plan, proposed a commonsense plan to cut carbon pollution from power plants. The **Clean Power Plan** will maintain an affordable, reliable energy system, while cutting pollution and protecting our health and environment now and for future generations. The Clean Power Plan will lead to climate, economic, and health benefits worth an estimated \$55 billion to \$93 billion in 2030, avoiding 2,700 to 6,600 premature deaths and 140,000 to 150,000 asthma attacks in children, and reducing GHGE from the power sector by 30% from 2005 levels.¹⁷⁰

- Oppose expansion of fossil fuel based energy production (e.g. through supporting moratoriums on fracking).
- Regulate methane leakage from natural gas extraction, production, and distribution. Implement "right to know" policies (e.g. about the chemicals used in fracking or the transport of oil and coal through communities).
- Implement actions to reduce the use of fossil fuel based energy in health care systems operations.

» Agriculture and Food

- › Strengthen local and regional food systems by supporting and creating incentives for establishment of urban and peri-urban agriculture, “farm to fork” programs, farmer’s markets, and school and community gardens, for example through zoning changes.
- › Advocate for the preservation of agricultural land and natural habitat.
- › Support and promote sustainable agricultural practices such as water conservation, better management of livestock production (e.g. manure ponds), and practices that reduce soil degradation and the use of fossil fuel based inputs such as pesticides and synthetic fertilizers (e.g. a fee on nitrogen fertilizers).
- › Advocate for reduced subsidies for commodity crops (e.g. corn and soy) at the federal level.

Portland is joining a handful of other cities — such as San Francisco, Seattle, Philadelphia and Kansas City — to reduce zoning barriers and encourage the growing and selling of **food in urban spaces**. Although these activities have been allowed on a temporary basis within existing open spaces and empty parking lots, the objective is to amend zoning codes to make these uses permanent, create additional opportunities for access to new sources of food, and mitigate any negative impacts.¹⁷¹

- › Support purchase of local and sustainably produced healthy foods in federal and state food and nutrition assistance programs (e.g. SNAP, WIC, National School Lunch Programs) through farmer’s market coupons, incentives and expanded use of EBT at farmer’s markets, etc.
- › Encourage procurement of healthy and sustainable foods by institutions such as hospitals, schools, businesses, and government agencies.

» Community Greening and Urban Forestry

- › Increase parks, gardens, and shade trees, targeting disadvantaged communities and communities with few trees and parks.
- › Balance the need for drought-tolerant, flowering, and fruiting plants, with the need for shade, food, fire resistance, and open space for physical activity, taking into account the prevalence of allergies and asthma.
- › Restore urban streams.¹⁶⁵
- › Use trees to provide shade for parking lots, parks, walking and bike paths, and tracks.¹⁶⁵

The greening project at **Grandview/ḡuuqinak’uuh Elementary in Vancouver**, British Columbia is one of the most ambitious in the country. It includes a dissipation pond and a swale that enhance storm water infiltration; a First Nations longhouse for celebrations and gatherings; a butterfly garden; a community vegetable and herb garden; and an ethno-botanical garden. Together these elements form a landscape that offers diverse learning opportunities, builds climate resilience, and strengthens social networks all at once.¹⁷²

Urban Releaf is an urban forestry organization in Oakland, California that strives to meet the needs of under served low-income communities that have little to no greenery or tree canopy. The organization provides free trees to thousands of community members, conducts weekly tree-planting events, and organizes tree care and maintenance workshops. Urban Releaf also engages youth in urban forestry through volunteer and internship opportunities for young people and experiential and educational programs in schools.¹⁷³

» Water

- Promote water conservation.
- Ensure clean drinking and household water for all.
- Protect groundwater from all sources of contamination.
- Develop green infrastructure and other strategies for flood protection, including use of permeable pavements.
- Assess health and environmental consequences of water storage and transportation strategies (e.g. energy use and waste from desalination plants, tunnels, dams).

In the **State of Hawaii**, the **Department of Health's Clean Water Branch** is planning to conduct studies to examine the effects of changing weather patterns and ocean chemistry as a result of climate change as it works to update its water quality standards. Also, to help alleviate future water supply uncertainties related to the changing climate, the Wastewater Branch is working on updating its **Guidelines for the Treatment and Reuse of Recycled Water** to promote increased water reuse for activities such as landscape irrigation, which reduces the amount of drinking water used for these purposes. This is particularly important because some of Hawaii's drinking water wells have already experienced an increase in salinity as sea levels rise, and water reuse helps to reduce the pressure on drinking water supplies.¹⁷⁴

» Economics

- Promote incentives for reducing the extraction, production, and use of fossil fuels, with careful attention to equity implications:
 - Advocate for carbon tax and fees to disincentivize activities or systems that harm the climate (e.g. vehicle usage fees, nitrogen fertilizer fees).
 - Advocate for a "polluter pays" system in which those who produce pollution bear the full costs of managing it to prevent damage to human health or the environment, to eliminate the shifting of costs to taxpayers and society at large.
- Advocate for divest/reinvest strategies that disinvest from fossil fuel companies and reinvest in clean energy and healthy communities.
- Advocate for targeted distribution of cap and trade or carbon tax revenue for health and equity programs and interventions, especially in health- disadvantaged communities.

In November 2006, **Boulder, CO** voters passed the **Climate Action Plan (CAP) Tax**, the nation's first tax exclusively designated for climate change mitigation. In November 2012, voters approved renewal of the carbon tax to support continuing climate action.¹⁷⁵

A 2014 article in the **British Medical Journal** called on healthcare organizations to remove all their investments from fossil fuel companies "as soon as possible." Said the authors, "Those who profess to care for the health of people perhaps have the greatest responsibility to act." The **British Medical Association** followed that suggestion, and voted to transfer all its investments in fossil-fuel producers to renewable-energy companies. In the US, Gunderson Health System has started taking similar measures, vowing not to invest any more funds in companies that extract fossil fuels such as coal, gas and oil.^{176,177}

» Government

- › Integrate climate, health, and equity considerations into all policies and processes.
 - › Integrate health and equity into climate change policies and programs.
 - › Integrate climate change and equity into health policies and programs.

Incorporating health and equity into decision-making requires intersectoral collaboration as well as changes in government organizational structures and processes. Health in All Policies is a collaborative approach to improving the health of all people by incorporating health, equity, and sustainability considerations into decision-making across sectors and policy areas. The **California Health in All Policies Task Force** brings together over twenty state government agencies with a common goal to support a healthier and more sustainable California.¹³³

Contra Costa Health Services (CCHS), the county health department for California's Contra Costa County, has long been a leader in addressing environmental issues and health inequities. The county is home to four oil refineries and 39 other industrial facilities that handle large amounts of hazardous materials, making this an important part of CCHS work. When the County began to develop a Climate Action Plan to reduce greenhouse gas emissions, health department staff saw an opportunity to look for climate action strategies that would also *improve* conditions for county residents. A small workgroup analyzed 10 mitigation strategies, looking at health benefits, the potential to reduce health disparities, and whether the strategy also offered some adaptation benefit. Their goals were two-fold: a) support passage of the Climate Action Plan, by helping county supervisors and the public understand the connection between climate change and health; and b) make sure that the plan prioritized strategies that benefited people's health and reduced health inequities. Many of the CCHS recommendations have been incorporated into the plan, though formal adoption is still pending. Meanwhile, the analysis has helped form new relationships and laid the groundwork for further efforts on climate change and health.¹⁷⁸

Learn more at <http://climatehealthconnect.org/solutions/stories-from-the-field/>

- › Support establishment of local, regional, state, national, and international GHG targets and caps that will limit greenhouse gas emissions to prevent temperature rise greater than 2°C.
- › Review and revise procurement and contracts policies to ensure they support health, equity, and sustainability.

As part of the First Lady's Let's Move Initiative, the US Department of Health and Human Services (DHHS) recently unveiled their new **Health and Sustainability Guidelines for Federal Concessions and Vending Operations**. Developed by a DHHS — General Services Administration collaborative team, the Federal Health and Sustainability Team, the Guidelines are meant to assist contractors in increasing healthy food and beverage choices and sustainable practices at federal worksites. The Guidelines will be applied in HHS cafeterias, concessions and vending machines, and sponsored conferences and other events.¹⁷⁹

- › Allow and push for greater flexibility in the use of federal and state public health funding to enable all relevant programs to address climate change and health (e.g. preparedness, chronic disease prevention).
- › Revise occupational health and safety standards to identify occupations at risk due to climate change.

California already has one of the strongest **Occupational Heat Standards** in the nation, but farmworkers continue to die of heat-related illness every year. **Worksafe**, a California-based coalition of unions, workers, community, environmental and legal organizations, and scientists, is advocating for a truly protective heat standard. The coalition is pushing to require all employers to implement a "heat illness prevention plan", expand worker training rules, improve requirements for access to shade and free clean cool water, and mandate paid 10-minute recovery breaks for agricultural workers every two hours when temperatures are high.¹⁸⁰

» Waste

- Support policies and programs to achieve zero waste through reducing, reusing, and recycling.

Community Health Education

- Integrate climate messages into health education where relevant (e.g. nutrition, physical activity, asthma, allergies, emergency preparedness).
- Integrate climate change and health into curricula for K–12, public health, medical, and other professional schools, and community health worker (e.g. *promotora*) trainings.
- Integrate health impacts and benefits into climate change materials where relevant.

Risk Reduction/ Safety Net

» Connect Climate and Health Risk Reduction

- Integrate climate change considerations into health risk reduction activities (e.g. heat mitigation, combined home health and climate assessments).
- Integrate health risk reduction into climate risk reduction activities (e.g. address indoor air quality in energy efficiency and weatherization retrofits).¹⁸¹

» Protect Vulnerable Populations

- Identify vulnerable individuals and populations and take steps to reduce climate-related risks (e.g. use a heat island index to identify neighborhoods at risk)
- Take steps to reduce risk for those most vulnerable (e.g., heat mitigation in urban heat islands).
- Ensure protection for the most vulnerable during extreme events (e.g. utility bill assistance resources and shut-off prevention in heat waves, management of outdoor work during heat events, transportation for evacuations or to cooling centers).

Medical Care/ Case Management

» Health Care System Capacity

- Strengthen health care systems' capacity to prepare and respond to climate change events (e.g. power outages and hospitals closures) and provide continuity of medical care following extreme events (e.g. access to medication and medical records).
- Strengthen health care systems' capacity to respond to climate change health impacts (e.g. outreach to vulnerable populations during heat event or emergency response).

After Superstorm Sandy forced the closure of five acute care hospitals and the emergency evacuation of almost 2,000 patients, the **New York Building Resiliency Task Force** was charged with assessing vulnerabilities and recommending strategies to ensure that N.Y. City hospitals can withstand the extreme weather events of the future.¹⁸²

» Educate Providers and Patients

- Educate health care providers about the health impacts of climate change and locally relevant climate impacts (e.g. introduction of disease-carrying vectors into new regions).
- Counsel vulnerable patients on appropriate actions to protect themselves from local climate effects (e.g. add use of air quality alerts in asthma action plans).¹⁸³
- Advise patients to use active transportation and reduce red meat consumption to improve individual health and reduce GHGE.¹⁸⁴
- Counsel patients on simple ways to conserve energy, such as switching to energy efficient light bulbs or adjusting the thermostat. Explain that while these efforts may not have a health impact on the patient personally, they will help protect others in the future and may lower electricity costs.¹⁸⁵



» “Green” the Hospital

- Reduce the carbon footprint of health care systems and facilities (e.g. renewable energy and local sustainable food procurement).¹⁸⁶

Gundersen Health System of La Crosse, Wisconsin projects that before the end of this year, it will achieve total energy independence, making it the first U.S. health care system to do so. Gundersen has systematically implemented energy conservation, an array of renewable energy sources (including solar, wind, and biofuels) for electricity generation, and building energy-efficient buildings. The result is an estimated \$6.5 million and 583 billion Btu of fossil fuel saved since 2008. Says CEO Jeffrey E. Thompson, “We asked how we are causing harm and one of the ways is by using fossil fuels. So, we came up with a plan to decrease our impact on the environment with particulate matter, carbon dioxide and lots of other things.”¹⁸⁷

» Clinical-Community Linkages

- › Incorporate climate change into Community Health Needs Assessments.
- › Provide integrated health, equity, and climate assessment during case management and home visits (e.g. home safety, energy and water use, food security, access to healthcare, and urban heat islands).
- › Link to other departments and organizations providing services that improve climate resilience (e.g. community gardens, cooling center, energy efficiency efforts).

In **Seattle**, the public health department found that combining weatherization and healthy home interventions (e.g., improved ventilation, moisture and mold reduction, carpet replacement, and plumbing repairs) with **Community Health Worker** asthma education significantly improves childhood asthma control, while also addressing energy usage.¹⁸⁸

Public Health Preparedness

» Develop mechanisms to incorporate climate data and projections into public health preparedness, including:

- › Incorporate climate projections into hazard mitigation and public health preparedness planning, including training and exercises.
- › Develop plans for anticipated impacts such as sea level rise, saline intrusion into drinking water, heat waves, wildfires, floods, drought, etc.
- › Develop more robust heat warning systems coupled with existing heat emergency response plans. Release heat response and other climate change response information to the media, local organizations, and community groups.

Baltimore City has instituted a **Code Red** program to protect its residents from heat waves. People can call 311 for assistance, pools and cooling centers are open longer hours, and social media messages encourage people to take care of elderly and vulnerable friends and family members who are elderly and not on social media.¹⁸⁹

Conclusions

Climate change and health inequities are the greatest health challenges of this century. Climate change is a health emergency that demands urgent and transformative action across multiple sectors and at all levels of governance, yet health sector engagement has been relatively limited to date. People in the U.S. and around the world are already experiencing the effects of climate change, and these effects will undoubtedly get worse unless we act now to reduce our greenhouse gas emissions.

“Climate change threatens hard-won peace, prosperity, and opportunity for billions of people. Today we must set the world on a new course. Climate change is the defining issue of our age. It is defining our present. Our response will define our future. To ride this storm we need all hands on deck.”

—United Nations Secretary-General Ban Ki-moon¹⁹⁰

The GHG that are in the atmosphere now will persist for hundreds to thousands of years, so some amount of climate change is locked in already, demanding that we prepare and adapt. But if we do not significantly reduce our GHGE very quickly, it is likely that future generations will experience catastrophic climate change, climate change for which adaptation and disaster response will not be sufficient in the face of catastrophic human and ecological impacts.

According to a 2013 report by the Intergovernmental Panel on Climate Change, 800 billion metric tons is Earth’s “carbon budget”, the amount of carbon dioxide that we can pump into the atmosphere before average global temperatures rise more than 2 degrees C.¹⁹¹ That is the upper limit of warming that scientists think will prevent climate catastrophe. Given that we are seeing so many serious climate impacts when the average temperature has thus far risen only 1.5 degrees C, many believe that even 2 degrees is too much.

Our current actions are not consistent with staying within our budget. At our current rate of GHGE, we will exceed our “carbon budget” limit in the next fifteen years. GHGE continue to rise, and now hover close to 400 ppm, a level higher than that seen on the planet in at least the last 800,000 years. In other words, human beings evolved on a planet that is different than the one we now inhabit.¹⁹²

“The disease is our unbridled dependency on fossil fuels, which shows no sign of abating.”

—Christina Figueres, Exec Sec of the UNFCCC, as cited in Godlee, 2014.¹⁹³

This is the “decade of responsibility”. We need to do all that we can to reduce the pace and severity of climate change, and to increase preparedness and resilience in the face of climate change that is already locked in. Each month of delay significantly increases the risks of catastrophic “run-away” climate change and the risk that our children will be unable to adapt. The costs of needed actions and the cost of response to climate impacts will increase greatly with each passing year of inaction, and our options diminish.

Health professionals and health organizations have a critical role to play in addressing climate change, in collaboration with those in many other sectors. It is our professional and moral responsibility to take decisive, aggressive, and immediate action to address climate change. Failure to act now will consign people around the world to ever-worse health impacts of climate change and diminished capacity of the health sector to respond effectively to protect health.

Fortunately, there are a great many opportunities to simultaneously reduce the health harms from climate change and other environmental damage and to promote equity and improved health. Actions that address the root causes of both climate change and health inequities are paramount in order to achieve the transformation necessary to avert both climate and public health crises. Integrating and prioritizing health and health equity in climate action planning is a critical strategy to ensure that the challenges of climate change, health, and inequities are addressed in concert. Consideration of the health and equity impacts of various climate change interventions is required to optimize co-benefits and minimize co-harms to health, particularly for vulnerable populations.

“Climate Change and Health: A Framework for Action” highlights critical intersections among the social determinants of health, health inequities, and climate change and its health impacts:

- » Powerful institutions, social inequities, systems, health processes, and climate processes interact in complex ways to impact health and the environment.
- » The root causes of poor health outcomes and inequities (the social determinants of health), climate change, and other adverse environmental impacts are largely the same.
- » The impacts of climate change on health and health inequities are moderated by individual and community vulnerability and resilience. Interventions that improve the social determinants of health and population health and reduce health inequities can significantly reduce vulnerability and increase resilience to climate change, at the individual and community-levels. Increasing resilience to climate change will require investing significantly in the public sphere, including in social determinants of health and in public health infrastructure.
- » There is a broad spectrum of opportunities for public health intervention to prevent adverse health outcomes, slow and prepare for climate change, and to prevent catastrophic climate disruption.
- » Acting on the root causes of climate change and health will bring about the most significant benefits for human health and the environment. There are opportunities to improve health and reduce the impacts of climate change across a wide spectrum of public health and climate change interventions.

- » Many climate actions bring significant health co-benefits, but some may have significant adverse health consequence and/or increase health inequities. Some health interventions also have climate co-benefits. Thoughtful implementation of actions to reduce greenhouse gas emissions and adapt to climate impacts will help maximize co-benefits and minimize co-harms.

While the risks are great, we find hope and inspiration in the many ways in which actions to address climate change offer opportunities to better our society, our health, our quality of life, and our environments. People in all sectors must join together to demand that bold and urgent actions are undertaken now. Together we can work for sustainable, equitable, and resilient communities that will provide health and opportunity for generations to come.

“Climate change could be ‘the biggest global health threat of the 21st century’, but by working together, we can turn it into this century’s greatest opportunity for public health.”

—Nick Watts, Convener, Global Climate and Health Alliance¹⁹⁴

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