Climate Change, Environmental Justice, and Human Rights in California's Central Valley: A Case Study

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California's 450 mile-long, 50 mile-wide Central Valley constitutes the agricultural backbone of a state that in 2006 produced roughly half of the 34 major vegetables grown in the United States, and in 2005 exported $US 9.3 billion of agro-food commodities.[2] The same agro-food industries that convert the Valley's natural wealth into economic wealth also produce some of the state's worst air and water pollution and most dangerous working conditions. These public and worker health threats overlap with some of the state's most severe poverty as a result of California's long history of racializing and marginalizing agricultural wage-laborers. The Valley's per capita income is 26% lower than the state average and half of its 6.5 million residents are unable to afford a median-priced two-bedroom rental unit.[3] Many of the people who live here lack access to clean air and clean water and, for those who work outside, adequate shelter and rest as well. This is particularly true for the over one million Central Valley residents who live in poverty and the over 600,000 farmworkers who labor in its fields.[4] While these environmental justice and human rights violations are mediated by federal, state, and local governments, climate change has already begun to exacerbate the ecological conditions upon which they are premised.[5]

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[2] USDA National Agricultural Statistics Service. (2006) "Quick Stats: U.S. & All States Data – Vegetables," accessible online at http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp. California Department of Food and Agriculture's Agricultural Export Program, Table 1 (California Agricultural Commodity Export Values and Rankings, 1995-2005) and Table 6 (Ratio of California Farm Quantity Exported to Farm Quantity Produced, 2005). Note that this export figure does not include the export of prepared foods. The data is accessible online at http://aic.ucdavis.edu/pub/exports.html.

[3] On population see: Public Policy Institute of California. (2006) Just the Facts: California's Central Valley. Accessible online at www.ppic.org/main/publication.asp?i=566 On income and housing see: Great Valley Center (2005) The State of the Great Central Valley of California: The Economy, 1999-2004. Modesto: GVC. On poverty see: U.S. Census Bureau. (2000) "Census 2000 Summary File 3." Accessible online at http://www.factfinder.census.gov

[4] Very roughly around one-quarter of these impoverished residents are farmworkers. On farmworkers see: U.S. Dept. of Health and Human Services. (2000) Migrant and Seasonal Farmworker Enumeration Profiles Study: California. Migrant Health Program, Bureau of Primary Health Care, Health Resources and Services Administration. Rockville, MD. Accessible online at http://bphc.hrsa.gov/migrant/Enumeration/EnumerationStudy.htm On farmworker poverty see: U.S. Dept. of Labor. (1993) California Findings from the National Agricultural Workers Survey. Washington, D.C. Accessible online at http://are.berkeley.edu/APMP/pubs/Cal-Naws/cal-NAWS.pdf

[5] California Government Code § 65040.12(e) defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of

Without the strong enforcement of existing air, water, and labor laws in the decades ahead, and with the Valley's population expected to double by 2040, climate change will undercut the health of millions of additional people who live and work in the Valley.[6] This case study outlines the key areas where climate change has already began to affect the health of farmworkers and low-income communities, and how these effects are likely to increase in the future.[7]

Extreme Heat Events

Extreme heat events will disproportionately affect low-income residents and especially those who labor outside, often one and the same. Agricultural workers have the worst health of any labor group in California or the nation.[8] They have an average death rate five times higher than workers in other California industries, and the first statewide health survey of hired farmworkers found that 4.6% had experienced a farm workplace injury in the prior 12 months.[9] Their occupation is dangerous not only because of machinery and pesticides, however, but because of prolonged exposure to intense heat. Workers may spend ten or more hours a day under the sun, often without clean drinking water (the statewide health survey found 21% of farmworkers lacking it), shade, and rest breaks.[10] These conditions cause heat exhaustion and stroke, heart attack, and death from dehydration. In July of 2005 an extended heatwave, with some cities in the southern Valley experiencing more than three consecutive weeks of daily temperatures over 100 degrees, killed five field workers – doubling the death toll of the past decade.[11] Governor Schwarzenegger responded promptly by issuing emergency regulations stipulating the provision of a quart of water for each hour of work and the provision of at least five minutes of shade for

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environmental laws, regulations, and policies." Article 23 of the U.N. Universal Declaration of Human Rights stipulates that "Everyone has the right to work, to free choice of employment, to just and favorable conditions of work and to protection against unemployment."

[6] PPIC (2006).

[7] The U.S. Department of Transportation defines a "low-income" individual as a person whose median household income is at or below the U.S. Department of Health and Human Services poverty guidelines (U.S. DOT (1997) "Order to Address Environmental Justice in Minority Populations," accessible online at http:// http://www.fhwa.dot.gov/environment/ejustice/dot_ord.htm). In 2007 the poverty threshold for a family of five in the contiguous 48 states was $24,130; the full DHHS guidelines are accessible online at http:// http://aspe.hhs.gov/poverty/07poverty.shtml.

[8] California Institute for Rural Studies. (2000) Suffering in Silence: A Report on the Health of California's Agricultural Workers. Sponsored by the California Endowment. Davis, CA. Accessible online at http://www.calendow.org/Collection_Publications.aspx?coll_id=14&ItemID=302#

[9] The comparative death rate is from Ahn, C., M. Moore, and N. Parker. (2004) "Migrant Farmworkers: America's New Plantation Workers." Food First (Institute for Food and Development Policy) Backgrounder 10(2). The statewide survey is California Institute for Rural Studies (2000).

[10] *ibid.*

[11] Official statistics from the California Department of Industrial Relation's Division of Operational Safety and Health were unavailable. The news sources used here are the Washington Post ("130 Deaths Blamed on California Heat Wave", July 29, 2006), the San Francisco Chronicle ("State Seeks to Halt Farmworker Deaths", August 3, 2005), and ABC News-Bakersfield ("Field Workers Death Prompts Heat Safety Campaign", July 20, 2005).

those suffering from the heat.[12] The regulations became permanent the next year, although three more farmworkers died of heat stroke, and with one more death in 2007 criticisms of inadequate enforcement have continued.[13] This same year researchers from the United Farm Workers, in Keene, CA, documented hundreds of cases across the state where employers did not fulfill their legal obligations to prevent heat-related illness.[14]

The extreme heat events projected to occur in California with climate change will immediately affect the health of farmworkers. Over the next century average temperature increases in California are projected to range from between 3 and 5.4˚F in lower emissions scenarios to between 8 and 10.4˚F in higher emission scenarios.[15] In parallel the number of extreme heat days in the Central Valley is expected to increase on average from less than 20 per year between 1961 and 1990, to between at least 40 (lower emissions scenario) and over 100 (higher emissions scenario) by the end of the century.[16] By virtue of working outdoors for extended periods in these conditions, farmworkers will be directly exposed to greater risks of heat-related illnesses.

Farmworkers have a minimal capacity to protect themselves from climate change-related health problems largely as a result of their position in the state economy. The 1993 National Agricultural Workers Survey found 48% of all California farmworker families living in poverty.[17] In the Central Valley farm labor accounts for 8.5% of all jobs, but pays the lowest wages of any industrial occupation in the area.[18] Two-thirds of the Valley's residents and 86% percent of its farmworkers live in its southern half, the San Joaquin Valley, which in 2002 produced 88% of its agricultural goods (based on market value).[19] Farmworkers here, however, are paid the lowest agricultural wages in the state.[20] Unauthorized farmworkers, which constitute around 9% of the total, make just half as much as those who are citizens, legal residents, or visa-holders.[21] In general farmworkers' lack of financial resources and transportation reduces their access to and ability to pay for the air conditioning, medical

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[12] Title 8, § 3395, California Code of Regulations.

[13] Fresno Bee (newspaper), "Heat Rules Ignored", July 20, 2007.

[14] United Farm Workers. (2007) "Water for Growers? Not while workers thirst!" Online campaign at http://www.ufwaction.org/campaign/waterandthirst?source=web. Dozens of press clippings on the issue can also be found on the UFW website at http://www.ufw.org/_board.php?mode=view&b_code=cre_leg&b_no=4&page=1&field=&key=&n=2

[15] California Climate Change Center. (2006) Scenarios of Climate Change in California: An Overview. This white paper is part of a series of 20 appendices, technical memoranda, and supporting documents produced to support the 2006 summary report, Our Changing Climate: Assessing the Risks to California. The report and all related materials are accessible online at http://www.climatechange.ca.gov/biennial_reports/2006report/index.html

[16] California Climate Change Center. (2005) Public Health-Related Impacts of Climate Change in California. "Extreme heat" can be defined as the 90 percent exceedance probability (T90) of the warmest summer days under the current climate. (Definition source: California Energy Commission, Public Interest Energy Research Program. (2007) Climate Change, Extreme Heat, and Electricity Demand in California. Accessible online at http://cacx.org/2007publications/CEC-500-2007-023/CEC-500-2007-023.PDF)

[17] U.S. Dept. of Labor, the University of California, and Aguirre International. (1993) California Findings from the National Agricultural Workers Survey: A Demographic and Employment Profile of Perishable Crop Farm Workers. San Mateo. Accessible online at http://are.berkeley.edu/APMP/pubs/Cal-Naws/cal-NAWS.pdf

[18] Great Valley Center (2005).

[19] Population proportion is from PPIC (2006). Farmworker proportion here is calculated from Dept. of Health and Human Services (2000). Agricultural production proportion is from Great Valley Center (2005).

[20] California Employment Development Department. (2006) Detailed Agricultural Employment and Earnings Data. Accessible online at http://www.labormarketinfo.edd.ca.gov/cgi/databrowsing/?PageID=4&SubID=158

[21] Dept. of Labor *et al* (1993).

assistance and health care needed to cope with extreme heat events. The aforementioned statewide health survey found that 70% lack any form of health insurance and 32% of male subjects had never visited a doctor or clinic.[22] Linguistic and educational barriers, as well as fear of retaliation by employers for lost time, also compound the challenge of accessing health care.[23]

Low-income communities in the Valley – clustered primarily in and around Fresno, Sacramento, and Bakersfield[24] – will also see their health risks increase. By the middle of the century, extreme heat events in such urban centers are expected to be more frequent, last longer, and be more severe than current events, and could cause two to three times more heat-related deaths than occur today.[25] In 2006 California's deadliest heat wave killed 140 people at minimum.[26] Five of the seven inland counties that together accounted for 80% of the deaths were in the Central Valley, and 90% of the victims resided in areas where more than 50% of the residents live in poverty.[27] Like farmworkers low-income community residents lack the resources to avoid excessive heat and obtain needed health care.

Air Quality

In California industrial farming has turned fields into factories not only in terms of how it organizes labor, but in terms of belching vast quantities of gaseous materials that harm surrounding residents.[28] Farm machines, pesticides, dust storms, rice farming, ruminants, field burning, and fleets of shipping trucks all contribute in their own way. From 2003 through 2005 the same Central Valley farming practices that produced some of the

[22] California Institute for Rural Studies (2000).
[23] On linguistic barriers see California Institute for Rural Studies (2000). On workplace intimidation see United Farm Workers. (2007) "Working under the Gun: It's Not Just an Expression." Online campaign at http://www.ufwaction.org/campaign/gun?qp_source=web
[24] U.S. Census Bureau (2000).
[25] California Climate Change Center. (2006) Public Health-related Impacts of Climate Change in California.
[26] Determining whether heat is the cause of death is medically challenging, and the Associated Press found that the number of deaths was 466 higher than the historical average for the month of July, prompting Governor Schwarzenegger to order the Department of Public Health to improve its assessment and reporting methods. "Schwarzenegger Acts on Heat Death Toll," USA Today, July 13, 2007. Accessible online http://www.usatoday.com/news/nation/2007-07-13-calif-heat-tolls_N.htm
[27] The official report is, Trend, R. (2007) Review of July 2006 Heat Wave Related Fatalities in California. Sacramento: California Department of Health Services. Accessible online at http://www.dhs.ca.gov/epic/publications/local/Heat%20Plan%20Assessment%20Final%20%20050407.pdf The national study is, Patz, J., *et al*. (2001) "The Potential Health Impacts of Climate Variability and Change for the United States: Executive Summary of the Report of the Health Sector of the U.S. National Assessment." Environmental Health Perspectives 108(4): 367-376. Accessible online at http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1638004
[28] McWilliams, C. (1939) Factories in the Field: The Story of Migratory Farm Labor in California.

world's most valuable foods produced five of the United States' ten most ozone-polluted counties.[29] All but one of these were in the San Joaquin Valley. Three of these same southern counties also reached the national top ten lists for short-term and year-round particulate matter, which are more dangerous than ozone. Altogether just under six million people in these counties – 92% of the Central Valley's population – were exposed to unhealthful levels of air pollution. In Kern County this meant spending on average more than a quarter of the days breathing unhealthful amounts of ozone, with each day placing people at risk for decreased lung function, lung inflammation, respiratory infection, and aggravation of respiratory diseases; long-term exposure may also cause lung damage. During the 40 days that particle pollution exceeded short-term allowances in Kern and Fresno Counties, people were placed at increased risk of asthma attacks, lung damage, heart attacks, strokes, and death.

Climate change is expected to increase concentrations of ozone and particulate matter (2.5) in several ways.[30] Higher temperatures increase biogenic volatile organic compound (VOC) emissions from vegetation, increase rates of atmospheric chemical reactions, increase demand for cooling energy and hence the emission of nitrogen oxides, and increase emission of VOCs from fuels, solvents, and coatings. As a result the frequency of summer ozone air pollution events is likely to increase. However, public health effects will be non-uniform because site-specific concentrations within a basin will also be dependent on precipitation, relative humidity, orography, wind speed, and mixing height.

Increased concentrations of ozone and particulate matter associated with climate change will place the health of millions of Valley residents at risk. Residents are already worried about air quality. A recent survey found that 45% of residents considered air pollution a big problem in the Valley, and that 49% said they or a family member suffers from asthma or respiratory problems.[31] In the coming decades farmworkers in particular will face immediate and direct health risks given that they labor outdoors in the fields and along the roads where this pollution is generated and ozone concentrations are highest. For the same reasons outlined earlier, they will have difficulty in obtaining health care when necessary. In addition, as mentioned in the previous paragraph, ozone aggravates respiratory diseases like pediatric and adult asthma, chronic bronchitis, and emphysema.[32] Increased concentrations are thus likely to significantly affect poor and minority communities, which have the highest statewide rates of asthma-related hospitalization and death.[33] Many of those affected will be young: in thirteen of the Valley's eighteen counties the rate of children and adolescents diagnosed with asthma is already equal to or exceeds the 14.8% state average.[34] At minimum, then, some 289,000 Valley youth who suffered from this disease in 2003 will be placed at increased risk of asthma attacks and hospitalization.

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[29] All the citations in this paragraph come from American Lung Association. (2007) State of the Air: 2007. New York. Accessible online at http://lungaction.org/reports/stateoftheair2007.html

[30] Ozone is created when carbon monoxide, nitrogen oxides, and volatile organic compounds like methane react in the presence of sunlight. PM (2.5) refers to particulate matter less than 2.5 micrometers in aerodynamic diameter.

[31] Public Policy Institute of California. (2006) Special Survey of the Central Valley. San Francisco. Accessible online at http:// www.ppic.org/content/pubs/survey/S_606MBS.pdf

[32] *ibid.*

[33] California Department of Health Services, Environmental Health Investigations Branch. (2007) The Burden of Asthma in California: A Surveillance Report. Sacramento, CA. Accessible online at http://www.californiabreathing.org

[34] California Department of Health Services, Center for Health Statistics. (2003) "Asthma in Children and Adolescents in California Counties, 2003." Sacramento, CA. Accessible online at http:// www.dhs.ca.gov/hisp/chs/OHIR/reports/countyhealthfacts/asthmachild2003.pdf

Water Quality, Flooding and Water Affordability

Industrial water pollution is another product of industrial agriculture. The Central Valley has some of the worst groundwater quality in the state: in 2005 its 18 counties (of the state's 58) accounted for 51% of the state's reported Maximum Contaminant Load violations, including 78% of those involving nitrate.[35] Contamination derives primarily from the use of agricultural fertilizers and pesticides, and from wastes associated with confined animal facilities and food processing. Nonetheless around 95% of the hundreds of small rural communities in the Valley depend on groundwater for drinking purposes. The 2005 water quality violations exposed over 390,000 people (49% of the total affected by all violations) to risks of cancer, bone disease, and cardiovascular, blood, developmental, endocrine, immuno-, kidney, gastrointestinal, liver, reproductive, neuro-, and respiratory toxicity, and – for infants – even death.

Climate change is likely to negatively affect groundwater by indirectly promoting increased contamination. This is because changes in average temperatures and temperature extremes will expand the ranges of agricultural weeds, as well as alter the abundance and types of many pests. While some species may cope poorly, this is likely to lengthen pest breeding seasons and increase pathogen growth rates.[36] Under such conditions the frequency, volume, and area of herbicide and pesticide treatments will likely increase, in turn further degrading regional water quality.

The risk of flooding in the Valley is also expected to increase. This hinges upon how increased temperatures will affect the Sierra Nevada snowpack. Although modeling projections do not consistently show a decrease in total annual precipitation for the state, warmer temperatures will cause precipitation in the Sierras to fall increasingly as rain rather than snow. As a result, by 2100 the snowpack is projected to lose between 30% and 60% of its snow-water

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[35] The percent of rural California communities dependent on groundwater comes from Klinosky, L. (1997) Layperson's Guide to Drinking Water. Sacramento: Water Education Foundation, cited in Environmental Justice Coalition for Water. (2005) Thirsty for Justice: A People's Blueprint for California Water. Oakland, CA. Accessible online at http://ejcw.org/our_work/blueprint.html. Contamination figures come from the State of California Department of Health Services, Drinking Water Program. (2006) "Annual Compliance Report for California Public Water Systems, Calendar Year 2005." Accessible online at http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Publications.aspx It is important to note that the total number of reported MCL violations – 921 – was fewer than the number of cases where reporting requirements were not fulfilled – 1,285 – which includes hundreds of noncompliance cases in the Valley. It is also worth noting that, in contrast with the Valley, Los Angeles County – encompassing 9,948,000 people – had 6 violations exposing 1,900 people to risk during 2005.

[36] California Climate Change Center. (2006) An Assessment of the Impacts of Future CO_2 and Climate on Californian Agriculture.

equivalent under lower emissions scenarios, and 90% under higher scenarios.[37] These same changes will cause peak streamflows to occur earlier in the year (a trend which has already been observed) and will also increase the risk of flooding, as precipitation runs off immediately instead of being stored as snow that is slowly released during the spring and summer. This is a major concern for the state capitol Sacramento, cities like Stockton, and dozens of other smaller cities and towns in the Valley that are protected by levees. As in New Orleans low-income communities, like the many clustered in and around the capitol (169,784 people), will have fewer resources available to respond to and recover from flooding.

Freshwater coastal aquifers used for drinking will also face increased risk of saltwater contamination. In the past century sea levels along the state's 1,100 miles of coastline have risen seven inches, and under medium or higher emissions scenarios are projected to rise anywhere between an additional 7 to 35 inches by the end of the century.[38] The corresponding saltwater intrusion is of little concern for most of the Valley's residents, but it is of major concern for the half million residents of the Sacramento-San Joaquin River Delta – the estuary that drains the 10 rivers of the Central Valley into San Francisco Bay – who use groundwater for drinking.

Climate change will also threaten agriculture in the Delta and statewide water supplies. The combination of a one foot sea level rise by 2100 – projected under medium emissions scenarios – with more rapid storm runoff means that the 100-year floods of the last century will become this century's 10-year events.[39] This will increase the risk of catastrophic levee breaching (i.e., 30 or more simultaneous failures) in the Delta, where 1,115 miles of aging "levees" are actually dikes protecting 57 "islands" around the clock from tidal inundation. This nearly happened during floods in 1986 and 1997. If it were to happen 300 billion gallons of saltwater would flow into the Delta from the Bay in the first few days, contaminating Delta irrigation water supplies and disrupting the export of freshwater from the Delta to one million acres of farmland in the San Joaquin Valley, and 23 million people in southern California and the Bay Area. Depending on the duration of the outage, subsequent precipitation, and alternative supply availability, water shortages could cost the San Joaquin Valley between $100 million and $1.3 billion in farm profits, and cost urban users between $1.8 and $14 billion.[40] Low-income communities in all three of these areas – totaling over 742,897 people in the San Joaquin Valley, 471,147 people in the Bay Area, and 2,848509 in Southern California – would have fewer resources available to mitigate the water quality, livelihood, and water affordability impacts associated with such a shortage.[41]

Finally, climate change could also cause shortages of another type. With the state's water supply already over-allocated, and demands expected to increase as the state's population grows from the current 36 million to a projected 60 million by 2050, these changes could, depending on

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[37] California Climate Change Center. (2006) Scenarios of Climate Change in California: An Overview.
[38] California Climate Change Center. (2006) Projecting Future Sea Level.
[39] *ibid.*
[40] California Climate Change Center. (2006) Economic Impacts of Delta Levee Failure due to Climate Change: A Scenario Analysis.
[41] Note that the number of people in poverty in the Bay Area listed here does not include those in San Francisco and Marin Counties, whose water supplies are not linked to the Delta. Likewise the number of people in poverty in southern California listed here only includes those in counties which receive water from the Delta through Metropolitan Water District (MWD). MWD is the largest water supplier in the state, serving 18 million people Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties. County poverty rates are from U.S. Census Bureau. (2000) "Census 2000 Summary File 3." Accessible online at http://www.factfinder.census.gov

water management operations, result in regular summer water shortages.[42] The danger for low-income Central Valley residents is that these shortages will increase the cost of drinking water. Researchers at the Environmental Justice Coalition for Water, in Oakland, CA, found that many low-income families in the Valley already pay between two and six percent of their income for water, while others drive 30 to 50 miles a week to buy bottled water, adding the cost of transportation to their water bill.[43] Depending on how water gets allocated as the climate changes, many low-income communities may not be able to afford this basic resource and be compelled to move to other parts of the state, if they have the financial resources to do so.

Policy Recommendations

California leads the nation in working to reduce greenhouse gas emissions, protect farmworker health, safeguard air quality, and plan for future water supplies. Even so, much remains to be done to help the people who live and work in the Central Valley avoid, respond to, and mitigate the amplification of health threats that is likely to occur with climate change. Many of the reports cited in this case study provide nuanced recommendations for addressing the environmental justice and human rights issues identified above, and readers should refer to them for more information. A few general recommendations include:

(1) Better enforce existing farmworker heat illness regulations.
(2) Expand the federal Migrant Health Program to include regular health service visits to farmworker labor camps.
(3) Educate low-income residents about how to stay cool during a heatwave.
(4) Establish a grant program to help low-income residents purchase air conditioners.
(5) Require the San Joaquin Valley Air Pollution Control District to meet attainment standards by the federal deadline of 2013, rather than the 2024 deadline it set for itself.
(6) Require that the Central Valley Regional Water Quality Control Board meet state water quality standards.
(7) Ensure the implementation of the comprehensive Central Valley Flood Protection Plan legislation signed by Governor Schwarzenegger in October 2007.
(8) Support integrated pest management as an alternative to pesticide application.
(9) Support the improvement of levees in the Central Valley (proposals are currently being debated in the California Legislature).

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[42] Population estimates come from State of California, Department of Finance. (2007) "Population Projections for California and Its Counties, 2000-2050." Sacramento, CA. Accessible online at http://www.dof.ca.gov/html/DEMOGRAP/ReportsPapers/Projections/P1/P1.asp. The risk of water shortages is discussed in California Climate Change Center. (2006) Climate Warming and Water Supply Management in California.

[43] Environmental Justice Coalition for Water. (2005) Thirsty for Justice: A People's Blueprint for California Water. Oakland, CA. Accessible online at http://ejcw.org/our_work/blueprint.html.