

Assessment of Farmworker Communities and Residential Sites for Risk of Heat Stress

A. Relevance to Priority Areas and Topics in this RFP

Primary area and focus: Food and society priority area focusing on farmworker and rural community well-being.

In July 2006 Central Valley daytime temperatures exceeded 100° F for two consecutive weeks and reached 115° F for multiple days in a row. This particular heat wave resulted in 50 reported deaths in the Central Valley, 140 deaths statewide. The fatalities were predominately the elderly, farmworkers, other outdoor laborers and isolated individuals and people living in poor housing conditions. During this same heat wave, the Imperial Valley in southern California reported many deaths of migrant workers living in tents and trailers far from town.ⁱ The number of heat-related deaths may have been underreported and some estimates indicate that more than 600 heat-related deaths may have occurred over the seventeen days of extreme heat. According to Margolis, et al (2006), 99% of the cases lived in zip codes where over 50% of residents were living below the poverty level.ⁱⁱ This statistic is significant as it reflects community attributes and the ability of residents, including farmworkers, to obtain services they need in the case of an illness.

After the 2006 heat wave, the California Department of Health and the Natural Resources Defense Council completed an evaluation of the heat-related effects of morbidity statewide with a specific focus on regional patterns by diagnosis, age, and race/ethnicity. The research team found “significantly increased rates of (emergency department) visits and hospitalizations for cardiac-related illnesses statewide... among Latinos/Hispanics...”ⁱⁱⁱ This finding is backed by a number studies demonstrating the linkage between days with increased temperature or periods of extended high temperatures and increased heat-related mortality, cardiovascular-cause mortality, respiratory mortality, heart attacks, and all-cause mortality.^{iv} This is further substantiated by the fact that calls to emergency medical services and hospital admissions during heat waves also increase.^v The implications of this extensive research are that many of the deaths due to heat illness may have been attributed to factors other than heat and will not be reported as occupational fatalities even though the source may be due to heat illness.

While these statistics report mortality rates for individuals due to heat illness, they do not account for many of the problems leading to heat-related mortality that are environmental in nature and can be found in non-occupational settings where farmworkers live. In fact, some studies have stressed the "accumulation" effect of heat. A detailed look at community vulnerability to heat-related morbidity and mortality showed that there are interrelated factors that combine to increase vulnerability of populations and individuals. Given that climate change will result in higher average temperatures, one study on the topic concluded that “A community’s overall vulnerability reflects that of its constituent populations, as well as the capacity of its public health and emergency response infrastructure... factors that may influence both biologic response and exposure.”^{vi}

If factors within the community are such that farmworkers are not able to dissipate internal heat (lack of shade, no air conditioning, cool water) or unable to access necessary services (no telephone or transportation), these must be considered in addition to on-farm exposure factors. According to Tracie White (2007), "It can take only 48 hours of uninterrupted exposure to intense heat before the body's defenses begin to break down.... The longer a heat wave continues the more susceptible the body becomes to illness." ^{vii} The 2006 heat wave is an example of what happens when there is no relief from the heat.

When considering occupational heat stress morbidity and mortality among farmworkers, research must be done on factors in the community that either increase or contribute to the risk to these workers; including the ability to cool off after work. Thus, the proposed research focuses on the social ecological factors that can lead to heat-related mortality that disproportionately affect farmworkers. These include factors that situate individual health in relation to intrapersonal, sociocultural, policy, and physical-environmental factors. ^{viii} Social ecology is an appropriate model for disease prevention and "provides a way of thinking about the planning of health promotion interventions that places a spotlight on the relationship between the environmental and behavioral determinants of health." ^{ix} Therefore, the relative health of individuals is shaped by a variety of institutional and policy sectors that determine how communities are planned, built, and whether support systems such as transportation, water quality, and medical response, among other forms of infrastructure, are put in place. By identifying and assessing environmental and behavioral determinants in residential sites and community settings, the research project will draw attention to existing environmental and policy barriers within these communities. At the same time we will be able to identify appropriate strategies to improve farmworker and rural community well-being that have implications for local policy and resource development. Moreover, the proposed research will utilize a social learning approach that includes feedback from farmworkers, knowledge and dissemination tools within farmworker networks to learn about disease prevention related to heat illness.

B. Relevance to Target Audience (Justification)

The results of the proposed research will have clear benefits for the target audience as farmworkers are disproportionately affected by heat illness.

California is by far the most productive agricultural state in the country. With 4% of the nation's farms, California generates 13% of U.S. farming receipts; grows more than half the nation's fruits, nuts, and vegetables; and leads the nation in production of more than 70 specialty crops. Within the state of California, the Central Valley generated 57% of the state's agricultural output in 2002. Six of California's top seven agricultural counties are located in the Central Valley (Fresno, Tulare, Kern, Merced, San Joaquin, Stanislaus). If the Central Valley were a separate state, it would rank first in agricultural production in the nation. ^x However, the highly productive Central Valley commonly has daytime temperatures in the summer at or exceeding 100° F, frequently in the month of July. "Nearly 60% of all heat-related deaths among crop workers occurred in July, and

most deaths occurred in the afternoon." ^{xi} There is an expectation that as climate change progresses the numbers of heat illness incidents will increase as a result of more frequent and more intense heat waves. ^{xii}

Currently the heat-related average annual death rate for crop workers is 0.39 per 100,000 workers, compared with 0.02 for all U.S. civilian workers.^{xiii} In California death rates are even higher at 0.49 per 100,000 workers. These statistics and the very real human loss in recent years led the state of California to implement the most stringent heat illness prevention standards in the US. However, heat-related illness and death among farmworkers are underreported, as was the shown in the state of Washington where the prevalence of heat illness has been studied using workers compensation records.^{xiv}

Despite the best efforts of regulators, heat illness is a recurring and avoidable condition that results in multiple deaths among farmworkers every year. The proposed research will bring attention to this health issue among Latino farmworkers and propose specific tools to assess and make changes in environmental and policy settings that affect the health and well-being of Latino farmworkers. The aim is to create a pragmatic assessment tool and provide policy-relevant research to support to the efforts of farmworkers, community organizations, and policymakers working to reduce the incidences of heat-related illness and death.

C. Goals and Objectives

The goal of this research is to create and field test a pilot tool for assessing community and residential site factors that can exacerbate farmworkers' exposure to heat, increasing the risks of heat illness. Commonly used for disaster planning, tools for community risk assessment empower communities to reduce their own risk.

Community risk assessment is used by many community based organizations around the world and is starting to be used to assess the risk of climate change in vulnerable populations. It is a participatory method to assess hazards and vulnerabilities in order to allow communities to reduce risk. These tools can help address environmental challenges by directly engaging the community. Assessment tools are also being used in community health promotion efforts, especially related to preventable diseases. For example, related to obesity prevention, these tools enable practitioners and local residents to identify barriers in the built environment that inhibit physical activity and mobility.

This project will assess off farm risk factors for heat illness among farmworker communities in the Central Valley. We will evaluate the ability of workers to cool and hydrate after work as well as their access to transportation, communications and health resources. CIRS will complete this work in collaboration with Dr. Michael Rios and Luis Magana. Working together we will create and pilot an assessment tool for residential site and community conditions related to heat stress illness and will field test it. This will include Post-Occupancy Evaluations (POEs), commonly used in environmental research, to determine environmental and behavioral factors related to heat exposure. Post Occupancy Evaluation involves systematic evaluation of opinion about the built environment, from the perspective of the people who live there. It assesses how well this

environment matches users' needs, and identifies ways to improve design, performance and fitness for purpose. The results of the POEs will be used to determine criteria for the development of the assessment tool. POEs will be conducted at a select number of residential sites to identify a range of conditions typically found in these locations. We will specifically look at lifestyle behaviors of farmworkers; physical conditions of residential sites such as shade structures, shade trees, and gathering spaces; access to cooling and clean water; occupancy density and access to communications and community services within farmworker networks; and other measurements to be identified through the post-occupancy evaluation. Within communities where farmworkers live we will enumerate cooling locations, access to water and emergency services, transportation and communications. We will research municipal heat response plans in communities throughout the Central Valley initially to determine the number and distribution of these plans and then to assess them.

D. Methods/Activities/Timetable

- 1) Complete a literature review to compile existing research on heat illness risk among farmworkers and off-farm environmental factors. Evaluate existing tools for community risk assessment and health promotion. Review existing Heat Action Plans in the Central Valley.
- 2) Create assessment tool
 - i) Conduct post-occupancy evaluations of select locations including site assessments and interviews with farmworkers.
 - ii) Create criteria to assess community factors that may contribute to heat illness in farmworker communities.
 - iii) Field test the pilot criteria at selected sites that represent typical conditions found in farmworker communities and residential sites.
 - iv) Refine the criteria for inclusion in assessment tool.
 - v) Validate the tool in at least two locations in the Central Valley
- 3) Compile resources list for Central Valley communities
- 4) Complete report
- 5) Evaluation based on logic model

Activity	Month	1	2	3	4	5	6	7	8	9	10	11	12
1. Literature review													
1.a. Compile and review existing research													
1.b. Compile Health Action Plans													
1.c. Create annotated bibliography													
1.d. Evaluate existing assessment tools													
2. Create assessment tool													
2.a. Conduct post-occupancy evaluations													
2.b. Create criteria													
2.c. Field test criteria													
2.d. Refine criteria													
2.e. Validate tool in 2 communities													
3. Create resources lists for communities													
4. Write final report													
5. Evaluation													

E. Products

The products completed during this project will include a report documenting the research results and a model community and residential site assessment tool. The report will fully review existing research on community factors increasing risk for heat stress in rural communities. The report will be posted online in a downloadable format. While much research has been completed on urban built environments and heat illness, rural communities seem to be underrepresented. We will compile an annotated bibliography of rural research on this topic, Heat Response and Health Promotion Plans and other relevant data, including existing community research assessment tools.

We will create a tool to assess risk in farmworker communities with the input of community members. The field tested assessment tool will be available to all participants in our pilot and online. In addition, we will outreach to community based organizations with whom we interact and offer the tool to them in an appropriate format. Our partners in this project will also make the tools and reports available to their students and constituents. We will keep our followers on social media up to date on the work as it progresses and encourage them to contact us if they would like more information on the tools and reports.

F. Evaluation

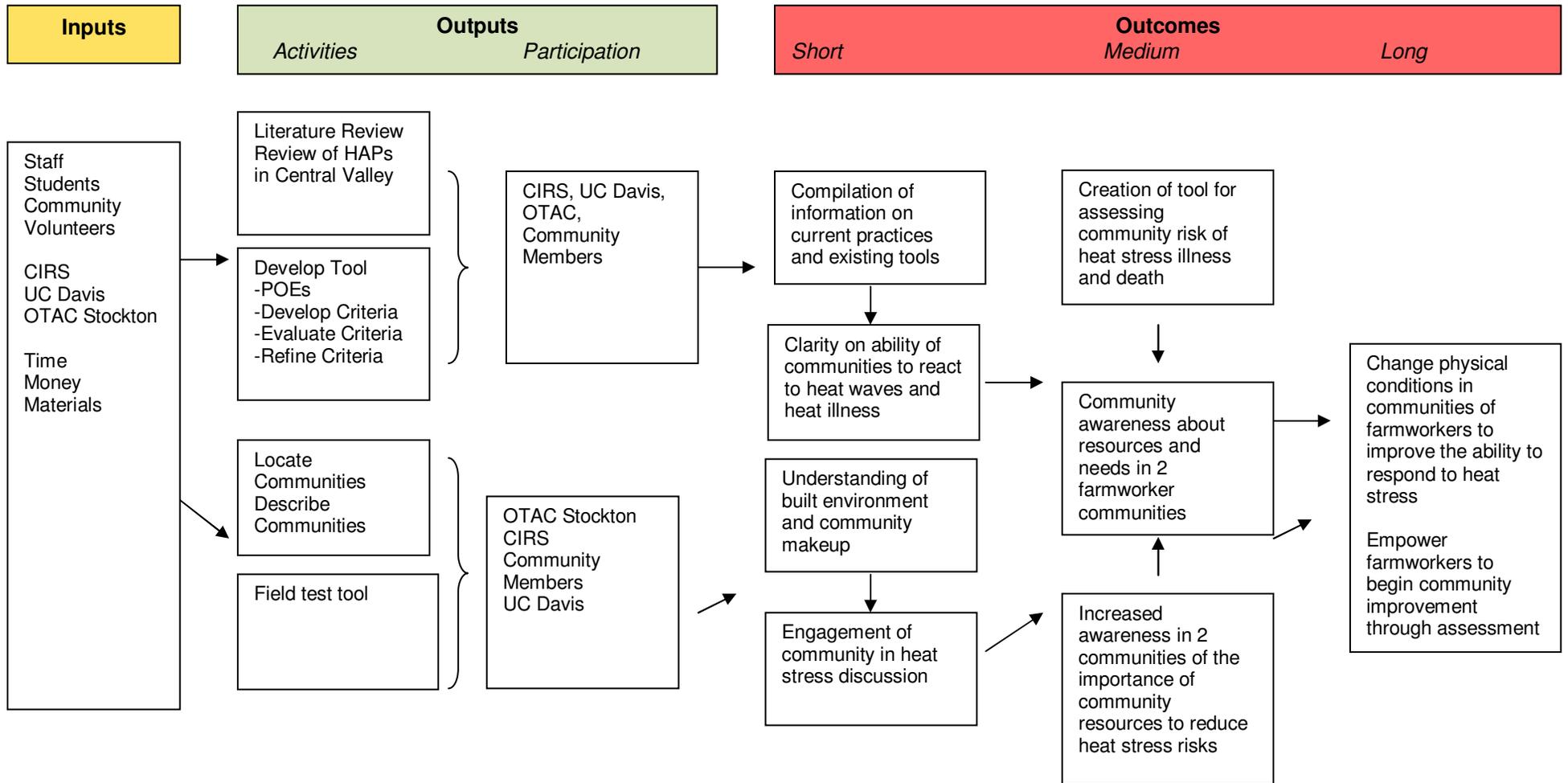
A simple logic model is attached. We expect to work in two farmworker communities in the Central Valley. We will perform pre- and post- project surveys of participants to make sure that:

- The importance of community resources for reduction of heat stress are understood
- Actions for reducing heat stress are understood
- Resources to alleviate heat stress within the community are identified
- Needs for improvement of resources are identified
- Participants are given tools for community assessment of heat stress risk

Throughout this project we will increase awareness about the role the built environment plays in the risk of heat stress in rural communities.

Program: Assessment Tool Logic Model

Situation: Central Valley Farmworker Communities Need Tools to Reduce the Risk of Heat Related Illness and Death



Assumptions: Community and residential site factors increase the risk of heat stress illness and death in farmworker communities of the Central Valley in California.

External Factors: Community is disempowered and fearful. These factors may limit the willingness of participation and change.

G. Capabilities of Investigators and Cooperators

CIRS is the lead organization and will be responsible for management of this project. We will guide the development of tools, making sure that the work is carried out according to standard procedures. Financial as well as project management will fall to CIRS including supervision of staff and contractors, development of contracts and scopes of work and staying on budget and on time. CIRS will be ultimately responsible for all products from this funding. Short bios and/or CVs of participants are attached.

Research Team Members:

California Institute for Rural Studies

Gail Wadsworth, Executive Director, Project Management

Lisa Kresge, Research Analyst, Research, Tool Design

UC Davis

Michael Rios, Associate Professor, Tool Design and Student oversight

George Hubert, Graduate Student, Field Research, Tool Assessment

Vallerye Mosquera, Graduate Student, Field Research, Interviews

Organization de Trabajadores Agrícolas de California

Luis Magana, Organization de Trabajadores Agrícolas de California (OTAC), Community Outreach, Advising

The California Institute for Rural Studies is a nonprofit research institute based in Davis, California. In existence since 1977, CIRS conducts applied social science research promoting a rural California that is socially just, ecologically balanced and economically viable. Our two main program areas focus on improving farmworker health and well-being and promoting a more sustainable food system. CIRS' landmark study "Suffering in Silence," represents the first large-scale baseline study of farmworker health in the US and laid the groundwork for The California Endowment's \$50 million Agricultural Worker Health Initiative. CIRS conducted follow-up research on farmworker food security in Fresno and the Salinas Valley, based on findings regarding the prevalence of diet-related disease among California farmworkers and data from the California Health Interview Survey (CHIS), which indicated several of the top agricultural producing counties have some of the highest levels of food insecurity out of all of the counties in the state. This project represents a key component to our recent efforts in farmworker health, creating an intersection between two distinct projects focusing on heat illness and housing and health. CIRS, with strong connections with farmworker communities throughout California, will play a leadership role in conducting this assessment and will be responsible for its success.

UC Davis

Michael Rios, Principal Investigator

Dr. Michael Rios, Associate Professor of Environmental Design, will lead the UC Davis team to create the assessment tool. Professor Rios will assist CIRS with the literature review and be the primary person representing UC Davis on the research team.

Professor Rios is project director of the Sacramento Diasporas Project, a multi-year study focusing on the cultural and political landscapes of (im)migrant and refugee populations in the Sacramento Region. His research focuses on community planning

and design with a special focus on citizen participation in marginalized communities. Michael's recent work includes research on participatory planning and design in Latino and multi-ethnic communities, and health promotion through environmental design. Prior to coming to UC Davis, Dr. Rios was the inaugural director of the Hamer Center for Community Design in the School of Architecture and Landscape Architecture at The Pennsylvania State University (1997-2007), president of the Association for Community Design (2003-2005) and a founding member of the Pennsylvania Advocates for Nutrition and Activity (2001-2007). He earned a doctorate in Geography from Penn State and has Master of Architecture and Master of City Planning degrees from the University of California, Berkeley.

George Hubert, Graduate Student Researcher

George Hubert will be responsible for coordinating the residential site assessments, assisting in the development and field-testing of the assessment tool. Mr. Hubert is a Ph.D. student in geography where his work focuses on farmworker housing and environmental health, and the intersection of rural development and agroecology. He has design experience in affordable housing for migrant families in the colonias of southern New Mexico and six years experience as an intern architect working on hospital, school, residential, and community development projects. Mr. Hubert earned a Master of Architecture degree from the University of New Mexico and a Bachelor's degree in Political Science from Reed College.

Vallerye Mosquera, Graduate Student Researcher

Vallerye Mosquera will be responsible for conducting interviews with farmworkers and assisting in the post-occupancy evaluation. Mrs. Mosquera is a master's student in community development and was Dr. Rios's research assistant for a study of immigrant and refugee serving organizations in the Sacramento region. She is also a part-time Bilingual Sexual Assault Victim Advocate for the Sexual Assault Domestic Violence Center in Yolo County. Previous to coming to UC Davis, Ms. Mosquera's previous work experience has included outreach and environmental advocacy to Spanish-speaking communities in the United States and Latin America. Between 2005 and 2006, Mrs. Mosquera earned a Bachelor's degree in Biology from the New College of Florida which led to a Fulbright research scholarship in Quito, Ecuador where she was responsible for evaluating social and environmental policies related to solid waste disposal. Mrs. Mosquera is fluent in Spanish and Portuguese.

H. Budget

Budget Category	Requested Funds	Matching Funds*	Source
Personnel			The California Wellness Foundation
Gail Wadsworth, Executive Director @ 5% FTE	3,600	3,600	
Lisa Kresge, Research Analyst @5% FTE	2,500	2,500	
Benefits @ 25%	2425	2425	
Total Personnel	8,525	8,525	
Supplies & Expenses			
Travel @ \$0.50/mile	1,475	4,000	
Subcontracts	25,000	0	
Total Request	35,000	12,525	

Although we do not anticipate needing matching funds for this work, they are available if necessary from a grant from The California Wellness Foundation to cover general operating costs.

ⁱ 2006. Silvia Chiang, "Heat Waves, the 'Other' Natural Disaster: Perspectives on an Often Ignored Epidemic." American Medical Student Association, Global Pulse

ⁱⁱ 2006 Margolis, HG, A Gershunov, T Kim, P English and R Trent. California Heat Wave High Death Toll: Insights Gained from Coroner's Reports and Meteorological Characteristics of Event.

ⁱⁱⁱ Environmental Health Perspectives, "The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits" Kim Knowlton^{1,2}, Miriam Rotkin-Ellman³, Galatea King⁴, Helene G. Margolis^{4,5}, Daniel Smith⁴, Gina Solomon^{3,6,7}, Roger Trent⁸, Paul English⁴

^{iv} 1998. Chestnut LG, Breffle WS, Smith JB, Kalkstein LS . Analysis of differences in hot-weather-related mortality across 44 U.S. metropolitan areas. *Environ Sci Policy* 1:59–70; 2002. Curriero, Frank, Karlyn S. Heiner, Jonathan M. Samet, Scott L. Zeger, Lisa Strug and Jonathan A. Patz. Temperature and Mortality in 11 Cities of the Eastern United States . *American Journal of Epidemiology*, 155 (1): 80-87; 2006.

Medina-Ramon, M., Zanobetti, A., Cavanagh, D.P., Schwartz, J. Extreme temperatures and mortality: assessing effect modification by personal characteristics and specific cause of death in a multi-city case only analysis. *Environ. Health Perspect.* 114, 1331–1336; 2007. Giuseppe Mastrangelo , Ugo Fedeli , Cristiana Visentin , Giovanni Milan , Emanuela Fadda and Paolo Spolaore. Pattern and determinants of hospitalization during heat waves: an ecologic study. *BMC Public Health* 2007, 7:200; 2001. Braga ALF, Zanobetti A, Schwartz J. The time course of weather-related deaths. *Epidemiology.* 2001;12:662–667.

^v 2006. Dolney TJ, Sheridan SC. The relationship between extreme heat and ambulance response calls for the city of Toronto, Ontario, Canada *Environ Res* 101(1):94–103; 2006. Mastrangelo G, Hajat S, Fadda E, Buja A, Fedeli U, Spolaore P. Contrasting patterns of hospital admissions and mortality during heat waves: are deaths from circulatory disease a real excess or an artifact? *Med Hypotheses.* 2006;66:1025–1028.

^{vi} Climate Change Public Health Impacts Assessment and Response Collaborative, California Department of Public Health and the Public Health Institute

^{vii} 2007. Tracie White. Silent inferno California's summer disaster: 138 dead. *Stanford Medicine Magazine*, Spring 2007

^{viii} 1997. J. F. Sallis and N. Owen 1997, Sallis, James F., and Neville Owen. Ecological Models of Health Behavior. In *Health Behavior and Health Education: Theory, Research, and Practice*, eds. Karen Glanz, Barbara K. Rimer and Frances Marcus Lewis, 462-484. San Francisco: Jossey-Bass.

^{ix} Alcala, R., and R.A. Bell. 2000. Promoting Nutrition and Physical Activity through Social Marketing: Current Practices and Recommendations. Davis: Center for Advanced Studies in Nutrition and Social Marketing, University of California, Davis. P. 22.

^x 2005. Great Valley Center. The State of the Great Central Valley: Assessing the Region Via Indicators - The Economy (2005)

^{xi} 2008 RC Luginbuhl , et al

^{xii} 2007. *Kristie L. Ebi and Gerald A. Meehl* Heatwaves & Global climate change: The Heat is On: Climate Change & Heatwaves in the Midwest. Pew Center on Global Climate Change.

References:

^{xiii} 2008. RC Luginbuhl, MS; LL Jackson, PhD; DN Castillo, MPH; KA Loring, ND Heat-Related Deaths Among Crop Workers -- United States, 1992-2006. *Morbidity & Mortality Weekly Report*. 2008;57(24):649-653. Centers for Disease Control and Prevention (CDC)

^{xiv} 2007. Bonauto D, Anderson R, Rauser E, Burke B. "Occupational Heat Illness in Washington State, 1995-2005," *American Journal of Industrial Medicine*.