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Thank you Chairman Boxer, ranking member Inhofe and members of the Senate Committee on Environment and Public Works for the opportunity to present my views on human health impacts of global warming.

Opinions and perspectives of individuals who have long and credible histories of insect-borne disease research and operational experience have often been excluded from the debate on the role warming temperatures might have on future trends of malaria and other insect borne infections. For this reason alone, I appreciate the opportunity to be here today to describe the work and evidence compiled by people with hands-on-experience in the field of vector-borne disease control.

The topic of your hearing is important. The human health impact of global warming is being used as an argument for political actions to forestall theoretical harm. I am concerned about the scientific validity of this argument. I am also concerned about the consequences political actions will have for poor people in the United States and elsewhere. I will address these concerns in the course of my testimony.

A BBC report detailed a claim by WHO and researchers[1] that global warming would cause major increases in insect borne diseases. This claim is often repeated and similar claims have even suggested that global warming will worsen the problems of malaria in Africa and other endemic regions.[2]

No knowledgeable biologist would argue temperatures do not influence developmental rates of mosquitoes or developmental rates of malaria parasites in mosquitoes. Temperature does, in fact, have strong regulatory control over these developmental events. Likewise, combinations of factors, such as warming temperatures and increasing rainfall can produce favorable conditions for mosquito production. However, acquisition of insect-borne pathogens is complex and should never be reduced to considerations of warming temperatures alone. The one thing we have learned through the course of time

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[1] BBC News. Global warming disease warning. Friday, June 18, 1999. Website: http://news.bbc.co.uk/1/hi/sci/tech/372219.stm
"The World Health Organisation (WHO) says global warming could lead to a major increase in insect-borne diseases in Britain and Europe."
"This in turn could lead to an increase in disease-carrying pests such as ticks, mosquitoes and rats, which live in warmer climates and whose breeding-grounds are often in damp areas."
""There is an urgent need to consider how to improve research and monitoring and how to minimise adverse health impacts," they write in a report in the British Medical Journal."

[2] Warming trend may contribute to malaria's rise. Science Daily, March 22, 2006. Website: http://www.sciencedaily.com/releases/2006/03/060322142101.htm

and experience in control of insect-borne diseases is that presence of disease is largely a product of a few, very important, factors. One is human behavior as it relates to disease acquisition. Another factor is preventive measures to stop disease transmission. Another two factors are economic conditions and standards of living that work to prevent acquisition of disease. I want to illustrate the importance of the latter two factors with a study conducted by a large team of investigators led by Dr. Paul Reiter in the border area with Mexico.[3]

Each year Mexico reports outbreaks of dengue fever. For example, on Sunday, October 20, 2007, the Secretary of Health announced a dengue epidemic underway in Mexico, with almost 23,000 cases so far this year and 6 deaths.[4] Dengue outbreaks even occur along the border of Mexico with the United States. However such outbreaks generally do not extend into the United States.

The study I refer to was conducted in 1999 and encompassed two border towns, one in Mexico (Nuevo Laredo) and one in Texas (Laredo). The two towns are located close together and combined could be viewed as a single city with a river running through it. Temperature and climatic conditions in Laredo and Nuevo Laredo are practically the same. The population of Laredo was 200,000 and Nuevo Laredo was 289,000. The study involved collecting data on mosquito abundance and sero-prevalence of dengue infections (analyses of anti-bodies as evidence of previous dengue infection) in sample households in the two towns. Investigators found that *Aedes aegypti*, the urban vector of dengue virus, was more abundant in Laredo. Yet, sero-prevalence of dengue was greater in Nuevo Laredo. So, while the mosquito vector was "remarkably" abundant in the Texas town, risk of dengue infection was much less. The investigators used various sets of data to show that the major factor accounting for lower risk of dengue infections in Laredo was extensive use of air conditioners and evaporative coolers. In Laredo, houses and business were enclosed and people remained indoors where it was cool. As a result, mosquitoes could not enter houses or places of business and transmit disease. This was not true for most businesses and households in the Mexican city of Nuevo Laredo.

Essentially, the 1999 study illustrates the importance of a vigorous economy and high standards of living to prevent dengue and other important insect-borne diseases. The same is true of our protections against malaria. Many malaria-infected people are reported in the United States each year. For example, over 1,300 imported cases were documented in 2002[5] and this does not accurately account for many unreported cases that occur in illegal workers. In spite a continuous flow of malaria infections into the U.S., our country does not have endemic malaria. We have sustained this relative freedom from malaria for almost 60 years. Yet, we maintain almost no response capability to an imported case or exercise any specific preventive measures. Our freedom of malaria is

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[3] Reiter P, Lathrop S, et al. Texas lifestyle limits transmission of dengue virus. Emerg Infect Dis [serial online] 2003 Jan. Available from: URL:http://www.cdc.gov/ncidod/EID/vol9no1/o2-0220.htm

[4] Folha Online [20.10.2007] http://www1.folha.uol.com.br/folha/mundo/ult94u338268.shtml

[5] http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=Retrieve&db=PubMed&list_uids=12875252&dopt=AbstractPlus

not because of cold U.S. temperatures, use of insecticides or anti-malaria drugs, or any other specific malaria preventive measure. No, our freedom from malaria is a direct result of wealth and high standards of living. Indeed, a high standard of living is far and away the best malaria preventive measure yet discovered. However, absent a strong economy and high standards of living, malaria preventives will still eliminate or reduce malaria transmission, regardless of amount of rainfall or regardless of warming temperatures. To illustrate this point I will describe results of malaria control in southern Africa.

I take this example from the Lubombo Spatial Development Initiative (LSDI).[6],[7] This is a joint program between the governments of Mozambique, Swaziland, and South Africa to develop the general region into a competitive economic zone. The communities in this zone (Lubombo region) of high malaria risk are some of the poorest in the region. Malaria control was a priority undertaking of the LSDI because malaria control was recognized as a precursor to development. The tri-national program agreement was signed in 1999 and various stages of the program got underway in October 1999. Of the three countries, I will compare conditions in Swaziland with Mozambique.

Environmental conditions and native peoples of the adjoining strips of Mozambique and Swaziland are very similar. Patterns of temperature and rainfall are similar. There is considerable poverty in both and the only truly significant difference, in regard to malaria, is that Swaziland has maintained an indoor spray program for many years.[8] For this reason, when pre-spray (as far as the startup of the Lubombo initiative) surveys were conducted in 1999, malaria prevalence at the 4 sentinel sites in Swaziland was 2-8%. There were no significant differences in infection rates in children versus older age groups. In striking contrast, Mozambique had no routine spray program leading up to the pre-spray survey. Child and adult prevalence surveys were conducted at all sites in the first survey round in December 1999 in Mozambique. Average infection rate in children was 64% and 30% in adults. Infection rate differences in children and adults are attributed to protective immunity from frequent malaria infections. In other words, children in Mozambique were more susceptible to infection than were adults.

Data from these two countries show how preventive measures can truly provide high levels of malaria prevention in areas of high malaria risk. The level of protection is revealed in low infection rates in Swaziland (2-8%) versus 30 to 64% infection rates in adults versus children in Mozambique. The only explanation for low malaria infections in Swaziland and high infection rates just across the border in Mozambique was Swaziland sprayed houses. Mozambique did not. Additionally, once malaria infections were reduced in border areas of Mozambique, Swaziland infection rates dropped even lower. This drop was attributed to fewer imported malaria cases from across the border

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[6] Sharp BI, Kleinschmidt I, et al. Seven years of regional malaria control collaboration—Mozambique, South Africa, and Swaziland. Am J Trop Med Hyg 76(1), 2007 :42-47.

[7] Lubombo. Malaria control in the Lubombo spatial development area. A regional collaboration. Report produced on behalf of the Regional Malaria Control Commission by the MRC and UCT. August 2004:34 pp.

[8] Tren R. Africa Fighting Malaria. Washington D.C. personal communication October 18, 2007.

with Mozambique. By 2006, infection rates in Swaziland were only 0.25%. After spray operations were implemented in Mozambique, malaria rates on the Mozambique side of the border dropped from a pre-spray rate of 62% to 38% in 2001, 22% in 2002, and 8% in 2003. This example provides stark testimony to the fact that we can exert effective control over malaria regardless of warm temperatures or other natural ambient conditions. The bottom line is, we can control malaria. Our malaria problems stem from failure to do so.

I would like to end my testimony with a few comments about who might be harmed by political action on climate change based on the idea that insect borne diseases will spread. Luckily we can learn from history. In previous testimony before this committee I detailed the unfortunate political process that led to restrictions on the use of DDT and other insecticides in malaria control. These restrictions were not based on scientific evidence and we can trace the re-emergence of malaria and other insect borne diseases such as dengue to the rise in political pressure to ban the use of DDT and to dismantle the spraying programs. The people who paid for this unscientific political action were poor people in poor countries and, over many years, millions paid with their lives. It has taken many hard and difficult years to fight against this anti-insecticides agenda, but now the US government is once again supporting malaria control that uses insecticides including DDT. As a result, lives are being saved and malaria control is improving in many countries. But many lives were lost thanks to the unscientific and largely political anti-insecticides campaign. We have a responsibility not to repeat past mistakes. I would urge this committee to pay close and careful attention to the science and to disease control experts before taking political action on climate change on the basis of the spread of insect borne diseases.