CLIMATE CHANGE AND HEALTH
UNITED STATES – MEXICO BORDER

Organización Panamericana de la Salud
Oficina Regional de la Organización Mundial de la Salud

BECC
COCEF

El Colegio de la Frontera Norte

CLIMATE CHANGE AND HEALTH
UNITED STATES – MEXICO BORDER

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POSTHUMOUS TRIBUTE TO COMMISSIONERS CARLOS MARIN AND ARTURO HERRERA

Both the workshop and this volume are dedicated to the memory of engineers Carlos Marín and Arturo Herrera, commissioners of the International Boundary and Water Commission (IBWC) from the United States and Mexico, respectively, and who, along with Jake Brisbin, Executive Director of the Rio Grande Council of Governments, and pilot Matt Juneau, died in an aviation accident during an inspection flyover of the Presidio, Texas area which had been affected by severe flooding.

The IBWC is responsible for enforcing boundary and water treaties between the United States and Mexico and for resolving any disputes that might arise in this regard. Moreover, the IBWC operates and maintains control of water levels for dykes, reservoirs, dam diversions, waste water treatment plants, and border monuments in various localities along the US-Mexico border.

The tribute was delivered by Raymond McGrath (US Consul in Ciudad Juárez) and Roberto Rodríguez (Mexican Consul in El Paso). Their respective addresses are transcribed below.

WORDS OF MR. RAYMOND McGRATH,
CONSUL OF THE UNITED STATES IN CIUDAD JUÁREZ, MEXICO

Good morning and thank you for inviting me in the opening ceremony of this event.

It's very important for us to recognize a figure like Carlos Marín, Commissioner of the United States in the International Boundary and Water Commission. He was a trajectory of 28 years of service, and since 2006 was appointed as Commissioner by President George W. Bush.

His job was remarkable, as a diplomatic and a technician became capable to reach consensus in both sides of the frontier; an architect lobbyist, produced high level of binational cooperation; his compromise with coworkers and knowledge of the Region, made of this pretty challenging job, a transcendental legacy.

His commitment with the environment make of this event, the best tribute to his memoir and keep working cooperatively at binational level to assure water resources and quality sanitation.

Thank You.

WORDS OF MR. ROBERTO RODRÍGUEZ,
CONSUL OF MEXICO IN THE UNITED STATES, TX

It is a pleasure for us to be present in this workshop of climatic variability and to remember Mr. Arturo Herrera Solís, short time ago Commissioner of the Mexican Section in the International Boundary and Water Commission.

In few words I vividly remember Mr. Herrera in a meeting at the Ministry of Foreign Affairs in 2002, when the topic of discussion was the huge lag and debt the Mexican government had to the United States in water delivery (under the Treaty of Borders and Water of 1944).

His technical knowledge and lobbyist ability, allowed our representatives a good level of negotiation and the accomplishment of such treaty, in times when drought was a constant along the border.

I also remember Arturo talking about the La Amistad Dam in the Río Acuña zone and the necessity of a better infrastructure in order to avoid a disaster; talking about the coating of the channel "Todo Americano" in the Mexicali / Caléxico zone; or making reference to the "Dos Nogales" Area in the water treatment plant in Río Rico, Arizona, where he had to deal with problems generated by the Nogales tunnels.

It is important to emphasize that Arturo Herrera worked for more than 18 years (3 Administrations and 3 Presidents), in topics related to our border.

His death occurred precisely in a different scenario, when no drought existed, and he had to catch a plane with Commissioner Marin and fly over the zone where the Conchos River possibly overflowed last September 14th.

Thank you.

GLOSASRY

AAAS: American Association for the Advancement of Sciences
AHIMT: All Hazard Incident Management Team
AMA: American Medical Association
AVAD: Años de Vida Ajustados por Discapacidad
BDAN: Banco de Desarrollo de América del Norte
BECC: Border Environment Cooperation Commission
BEIF: Border Environment Infrastructure Fund
BID: Banco Interamericano de Desarrollo
BIDS: Border Infectious Disease Reporting System
BM: Banco Mundial
BVSF: Biblioteca Virtual de Salud Fronteriza
CAMS: Continuous Air Monitoring Station
CENAVECE: Centro Nacional de Vigilancia Epidemiológica y Control de Enfermedades (MEX)
CEPAL: Comisión Económica Para América Latina y el Caribe
CFE: Comisión Federal de Electricidad (MEX)
CH_4: Metano
CILA: Comisión Internacional de Límites y Aguas
CNA: Comisión Nacional del Agua (MEX)
CO_2: Dióxido de Carbono
COE: Centro de Operación de Emergencia.
COCEF: Comisión de Cooperación Ecológica Fronteriza (MEX)
COESPRIS: Comisión Estatal para la Protección contra Riesgos Sanitarios (MEX)
COFEPRIS: Comisión Federal para la Protección contra Riesgos Sanitarios (MEX)
COG: Council Of Governments (US)
COLEF: Colegio de la Frontera Norte (MEX)
CONAPO: Consejo Nacional de Población (MEX)
COP: Conference Of Parties (UN)
DACCG: Deployment Arrival Command and Control Groups (US)
DALY: Disability – Adjusted Life Years
DDS: Disaster District Chair (US)
DHS: Department of Homeland Security (US)
DHHS: Department of Health and Human Services (US)
DPS: Texas Department of Public Safety
ECLAC: Economic Commission for Latin America and the Caribbean
EDA: Enfermedad Diarreica Aguda
EMC: Emergency Management Coordinator
EMS: Emergency Medical Services
EMT Emergency Medical Technician
ENACC: Estrategia Nacional de Cambio Climático
ENOS: Fenómeno de El Niño Oscilación del Sur
EOC: Emergency Operation Center
EPA: Environmental Protection Agency (US)
GDEM: Governors Division of Emergency Management (US)
HCPS: Hantavirus Cardio Pulmonary Syndrome
HQ: Headquarters
IBWC: International Boundary and Water Commission

ID:	Identification
IDB:	Interamerican Development Bank
IMT:	Incident Management Team
INEGI:	Instituto Nacional de Estadística, Geografía e Informtica (MEX)
INIFAP:	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (MEX)
INSP:	Instituto Nacional de Salud Pública (MEX)
IPCC:	Intergovernmental Panel on Climate Change (UN)
IRA:	Infección Respiratoria Aguda
LVN:	Licensed Vocational Nurse (US)
MDG:	Millennium Development Goals
MMRS:	Metropolitan Medical Response System
MOC:	Medical Operation Center
MRE:	Meals Ready to Eat
MW:	Megawatt
NADB:	North American Development Bank
NAFTA:	North America Free Trade Agreement
NMSU:	New Mexico State University
NOAA:	National Oceanic and Atmospheric Administration (US)
OAS:	Organization of American States
ODM:	Objetivos de Desarrollo del Milenio
OEA:	Organización de Estados Americanos
OEM:	Office of Emergency Management
OMS:	Organización Mundial de la Salud
ONG:	Organización No Gubernamental
OPS:	Organización Panamericana de la Salud
ORSAN:	Observatorio Regional de Seguridad Alimentaria y Nutricional (Centroamérica)
PAHO:	Pan American Health Organization
PDAP:	Project Development Assistance Program
PECC:	Programa Especial de Cambio Climático (NASA)
PIB:	Producto Interno Bruto
PM10:	Particulate Matter of 10 micrometers or less
POD:	Point Of Distribution
RGCOG:	Rio Grande Council Of Governments
RN:	Registered Nurse
SDSM:	Statistical Down Scaling Model
SEDUR:	Secretaría de Desarrollo Urbano y Ecología (MEX)
SEMARNAT:	Secretaría de Medio Ambiente y Recursos Naturales (MEX)
SNV:	Sin Nombre Virus
SRES:	Special Report on Emissions Scenarios
TCEQ:	Texas Commission on Environment Quality
TLC:	Tratado de Libre Comercio
TLCAN:	Tratado de Libre Comercio de América del Norte
TXDOT:	Texas Department Of Transportation
UASI:	Urban Areas Security Initiative (US)
UN:	United Nations
UNDP:	Union Nations Development Program
UNFCCC:	United Nations Framework Convention on Climate Change
UTEP:	University of Texas at El Paso
VNO:	Virus del Nilo del Oeste
WHA:	World Health Assembly
WHO:	World Health Organization

THE IMPACT OF CLIMATE CHANGE ON HUMAN HEALTH

STATEMENT BY WORLD HEALTH ORGANIZATION DIRECTOR-GENERAL DR. MARGARET CHAN ON THE OCCASION OF WORLD HEALTH DAY

2007 marked a turning point in the debate on climate change. The scientific evidence continues to mount. The climate is changing, the effects are already being felt, and human activities are a principal cause.

In selecting climate change as the theme for 2008 World Health Day, the World Health Organization (WHO) aims to turn the attention of policy-makers to some compelling evidence from the health sector. While the reality of climate change can no longer be doubted, the magnitude of consequences—most especially for health—can still be reduced. Consideration of the health impact of climate change can help political leaders move with appropriate urgency.

The core concern is succinctly stated: climate change endangers health in fundamental ways.

The warming of the planet will be gradual, but the effects of extreme weather events – more storms, floods, droughts and heat waves – will be abrupt and acutely felt. Both trends can affect some of the most fundamental determinants of health: air, water, food, shelter, and freedom from disease.

Although climate change is a global phenomenon, its consequences will not be evenly distributed. Scientists agree that developing countries and small island nations will be the first and hardest hit.

WHO has identified five major health consequences of climate change.

First, the agricultural sector is extremely sensitive to climate variability. Rising temperatures and more frequent floods can compromise food security. Increases in malnutrition are expected to be especially severe in countries where large populations depend on rain-fed subsistence farming. Malnutrition, much of it caused by periodic droughts, is already responsible for an estimated 3.5 million deaths each year.

Second, more frequent extreme weather events mean more potential deaths and injuries caused by storms and floods. In addition, flooding can be followed by outbreaks of diseases, such as cholera, especially when water and sanitation services are damaged or destroyed. Storms and floods are already among the most frequent and deadly forms of natural disasters.

Third, both scarcities of water,
which is essential for hygiene, and excess water due to more frequent and torrential rainfall, will increase the burden of diarrheal disease, which is spread through contaminated food and water. Diarrheal disease is already the second leading infectious cause of childhood mortality and accounts for a total of approximately 1.8 million deaths each year.

Fourth, heat waves, especially in urban “heat islands”, can directly increase morbidity and mortality, mainly in elderly people with cardiovascular or respiratory disease. Apart from heat waves, higher temperatures can increase ground-level ozone and hasten the onset of the pollen season, contributing to asthma attacks.

Finally, changing temperatures and patterns of rainfall are expected to alter the geographical distribution of insect vectors that spread infectious diseases. Of these diseases, malaria and dengue are of the greatest public health concern.

In short, climate change can affect problems that are already huge, largely concentrated in the developing world, and are difficult to combat. WHO has increased its efforts to respond to these challenges. WHO and its partners have devised a research agenda to get better estimates of the scale and nature of health vulnerability and to identify strategies and tools for health protection. WHO recognizes the urgent need to support countries in devising ways to cope. Better systems for surveillance and forecasting, and stronger basic health services, can offer health protection.

Citizens, too, need to be fully informed of the health issues. In the end, it is their concerns that can spur policy-makers to take the right actions, urgently.

PROTECTING HEALTH FROM CLIMATE CHANGE

THE GREATEST IMPACTS FROM CLIMATE CHANGE WILL BE IN THE HEALTH AND WELL-BEING OF THE HUMAN SPECIES!

Mirta Roses-Periago
Director, Pan American Health Organization

CEvery year on 7 April, World Health Organization and Pan American Health Organization identify a topic of global public health interest as a theme for the celebration of thw World Health Day. For 2008 the theme was Protecting Health from Climate Change.

Climate change is an intrinsic element of the history of this planet. The scientific alliances allow us to better understand the phenomenon and our role of accelerating its stages and cycles. The evidence of this process has become stronger and clearer over time. In 2007, the UN Intergovernmental Panel on Climate Change submitted its fourth assessment report with more evidence than ever before on what is happening to the global climate. The report has been reviewed, and approved, by hundreds of scientific peer-reviewers and by national Governments.

People have been greatly concerned about the effect that climate change will have on the environment, but data point to one direction: The greatest impacts will be in the health and well-being of the human species.

Climate change impacts health both directly-for example, through heat waves, floods and storms, and other extreme weather events; and indirectly, through effects on infectious disease, on water availability, and on agricultural production.

These are not minor issues. Diseases that are sensitive to climate include some of our biggest killers, such as malaria and diarrhea, and climate change increases risk factors for other conditions such as malnutrition, the single largest contributor to the global burden of disease. Lack of safe food and water has resulted in diarrheal diseases in children and malnutrition in the long term. These are also diseases of children and of the poor. Indeed, when it comes to climate change, those whose health is most at risk are those who have contributed least to the problem. The poor, whether in rural or urban areas, have always suffered more from the consequences of a degraded environment. Climate change now threatens to perpetuate these problems. Our fight for equity is at stake.

Some diseases are highly sensitive to temperature and precipitation. Some years ago, a team of U.S. and Peruvian scientists working in Lima, took daily records both of temperature and of the number of children admitted to a pediatric clinic due to acute diarrheal disease. On hot summer days and during the El Niño phenomenon of 1997-1998, more and more patients were admitted. It suggests

that even small temperature increases may lead to an important increase in this disease in the poorest of populations. This pattern is seen throughout the developing world.

Dengue is another climate sensitive disease which greatly affects our Region. It is clear that its spread is closely correlated with warm, humid conditions. This known relationship has been used to study incidence of the disease with future climate changes. The conclusions are worrisome. The expected climate change is likely to increase the risks of dengue for millions of people over the coming decades.

PAHO, WHO, United Nations, Health Authorities

We have been working on understanding the health impacts of climate change for a long time. The first WHO assessment came out in 1990. In that report environmental contaminants which cause health problems, such as ozone depletion, were identified as gases which merit special attention. Thus, the process identified as the greatest contributor to climate change today, has already caused extensive damage to Public Health as an unlimited environmental contaminant.

Our work has evolved, from describing the risks to health due to climate change, the training of health practitioners, and guidance on how to do risk assessment and prevention planning, to proposing practical guidance on protecting health from specific climate risks

In recent years, ministers of health of our Region and from around the world have been raising the issue of climate change at their meetings. They are requesting PAHO and WHO to do more to support them in a more coordinated and strategic approach to protect human health from climate change. We are not only responding but we have anticipated their concerns. In 1995 PAHO raised the issue at the Conference on Human Health and Climate Change, at the National Academy of Sciences in Washington DC, alongside many experts and leaders concerned with public health, among them, the then U.S. Vice-President Albert Gore.

In Barbados, in 2002, we held the first International Conference on climate change and the impacts on health of the people in the Caribbean region. This was done in partnership with other UN and national agencies. In 2007 we held the first International Conference on Climate Change and the Effects on Health in the Central American Region, which was closed by Nobel Peace Prize recipient, President Oscar Arias of Costa Rica. We have held several other similar events globally, as in Brazil, with the First Regional Workshop to develop a Regional Plan of Action on Climate Change and Health, which was presented to the health ministers, during PAHO's Directing Council in September 2008.

The UN Framework Convention on Climate Change calls for "mitigation", that is, measures should be taken by countries to reduce the release of greenhouse gases. But because some aspects of climate change are irreversible, at least in the short to medium term, it also calls for "adaptation", by the different sectors. It is clear in the health sector that "Adapting to Climate Change" and "Protecting Public Health" are in fact the same agenda. The work of the health sector, in controlling infectious disease, in reducing environmental risk factors, and in providing health action in natural disasters, is already protecting populations from the health risks of climate change.

The health sector can and should also contribute to mitigation, by identifying ways to reduce their environmental impact, and in particular the emission of greenhouse gases, in its operations.

To properly address climate change and its impact on health, we need a **Comprehensive Framework of Action.** This framework should be focused on broad areas, addressing **Evidence** for action, implementing **Adaptation** mechanisms in the health sector, and providing **Leadership** to both protect people from climate change and promote healthier environments for all.

Under Evidence, we need to increase knowledge, information and awareness of the health consequences of climate change.

Although evidence accumulates with good research, we clearly understand that we already have enough evidence to know that we need to act. Lack of complete evidence is no justification for inaction. We need to carry out the applied research that tells us how best to intervene - not how much to worry, but how to respond. We must also disseminate information so that health professionals, in every corner of the Region, can help in protecting people from the threats of climate change. And we need to create the much needed awareness: that we can all fight climate change and we can take this unique opportunity to make a healthier planet.

Under Adaptation we must work harder to strengthen public health systems to address additional threats from climate change and we must improve our response to public health emergencies.

We need to be able to supply the basic health services, including during public health emergencies, such as floods, storms and heat-waves. They are the vanguard for the protection of the people from potential harm of climate change.

We need to consider health systems in the broad sense: doctors, nurses and hospitals, but also public health prevention. Our most effective responses to protect health from climate change are basic public health interventions.

Under Leadership we must promote and lead cross-disciplinary partnerships to ensure effective adaptation and mitigation actions.

Thirty years ago, the Alma Ata declaration provided a vision of primary health care, and PAHO has carried out this vision. Climate change reminds us of the importance of maintaining this vision.

Climate change threatens to increase the disease burdens of the poorest, and to undermine their progress towards the Millennium Development Goals. It is therefore yet another reason to expand our efforts to control high prevalence diseases, many of which are linked of poverty.

We are aware that in today's world, no single agency can solve health threats alone, and this is especially true for climate change. We must create the necessary partnerships to protect people, to enhance public health, to maintain the Primary Health Care spirit alive in front of a changing world.

PRESENTATION

María Teresa Cerqueira
Chief of PAHO/WHO United States – Mexico Border Office

Gustavo Córdova
Director General of the Northwest Regional Campus of the Colegio de la Frontera Norte (COLEF)

Daniel Chacón
General Manager of Border Environment Cooperation Commission (BECC)

There have long existed differing opinions and positions concerning the existence of climate change on our planet and whether it affects the sustainability of life. But although these differences persist, everyone agrees that the world's climate is no longer the same as it was decades ago.

Abundant scientific evidence now exists to show that the climate is changing, that the effects of this change are being felt and that human activity is the principal cause.

In the Paso del Norte Region these changes are already being perceived: extreme temperature changes; torrential rains, such as those that struck in August and September 2006; flooding in Ojinaga, Presidio, and Juárez in 2008; and the aftermath of hurricanes such as the one that hit Ruidoso in August 2008, to name only a few, are vivid reminders of their effects. Changes in the behavior of certain diseases that are appearing with greater frequency in our border region, reduced access to vital services such as drinking water, and rising levels of environmental disease focus our attention on the impact of climate change on public health and raise concerns about these phenomena.

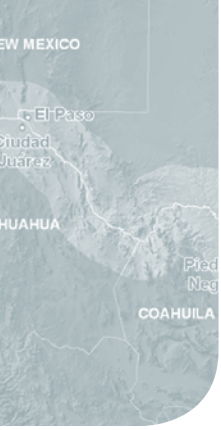
Human activity is one cause of the problem: maquiladoras on the Mexican side of the border, burning, use and treatment of chemicals in El Paso, urbanization of natural areas, indiscriminate use of water and deforestation are among the examples of mismanagement of natural elements for the supposed benefit of humankind.

For these reasons, and in order to encourage joint efforts to be undertaken in this area, the PAHO/WHO US-Mexico Border Office, together with the Colegio de la Frontera Norte (COLEF) and the Border Environment Cooperation Commission (BECC), in addition to academic, scientific and

governmental institutions on both sides of the border, embarked upon a series of meetings that culminated in the Workshop on Climate Change and Health, held on December 5, 2008 in the city of El Paso.

The numerous articles contained in this volume, prepared by professionals in their fields, show how climate change is manifested in our region, as well as its consequences for human behavior and specifically for health. We seek to ensure the active involvement of all health-related institutions (including health services and systems) and their vigilance in protecting the environment and reducing the harmful effects of climate change, empowering the citizenry in this regard, and seeking out new and better ways to live in harmony with nature.

We hope this event, planned jointly with BECC and COLEF and supported by a host of Mexico and US-based organizations, will serve as the starting point in a joint process that will bring about improved living conditions for the population without damaging their surroundings and better prepare people for potential adverse effects of climate change in the future.



IMPACT OF CLIMATIC VARIABILITY ON THE BORDER REGION

Daniel Chacón
General Manager of the Border Environment Cooperation Commission (BECC)

Climate change occurs when a climate is altered on a global or regional scale and produced by natural causes or by the actions of human beings which directly impact the concentration of gasses in the atmosphere.

The phenomenon manifests itself in the form of drastic climatic changes such as prolonged drought, torrential rains, and extreme temperatures.

The effects of climate change have not heretofore been fully manifested in all regions of the world, because temperatures have been slow to respond to concentrations of carbon dioxide (CO_2). Nevertheless, those concentrations do now exist in the atmosphere.

The rise of 0.6 degrees centigrade in the earth's temperature is closely linked to the pronounced accumulation of CO_2 and other gasses as a result of the greenhouse effect, and the possibility of a further temperature increase cannot be discounted.

Scientists warn that even a small variation in the earth's average temperature can have catastrophic consequences, and alternate sources of energy must be developed in the coming years in order to reduce greenhouse emissions.

According to the most recent records, CO_2 concentration is at 390 particles per million, whereas during the period prior to the Industrial Revolution, the figure was 200 particles. Projections suggest that, if emission rates remain constant, the level of particles could increase to 600 per million.

The worldwide goal in counteracting the effects of climate change must be to reduce gas emissions to pre-1990 levels. If this is not accomplished, negative effects of this trend will intensify markedly after 2020.

Even if greenhouse gas emissions do remain constant, that does not mean that climate change will stabilize. Additional solutions, such as clean, green, and renewable energy sources must be found to reduce the world's dependence on fossil fuels.

The effects of climate change vary in intensity and geographic location; consequently, climate variations in diverse parts of the world have differing characteristics.

DEFINING THE PROBLEM

To avoid climate change and its effects, people must modify some of their habits and activities in an effort to reduce carbon dioxide emissions; otherwise, projections indicate that the earth's temperature will rise by an additional two to six degrees centigrade, triggering even greater climate change.

The concentration of CO_2 in the atmosphere will not only exacerbate rises in temperature but also lead to lengthier periods of drought and more intense rains. A rise in sea level will threaten coastal areas.

Clues as to the nature of climate change and ways in which climate can be constructively controlled come from analysis of tree rings, precipitation models based on historic records of changes in sea temperature over time, and modeling of the effects of natural factors and human actions.

Variation in the earth's temperature has already exerted visible effects in some regions. One example is Canada, a country known for its cold winters, but whose temperatures in recent years have moderated. This lack of cold winters has facilitated the reproduction certain species of pests, thereby damaging the ecosystem. This regulating effect of the Canadian climate is no longer present. The country's rising temperatures may favor agricultural development but will unleash a growing number of pests on the nation's forests and alter the ecosystem.

DROUGHT

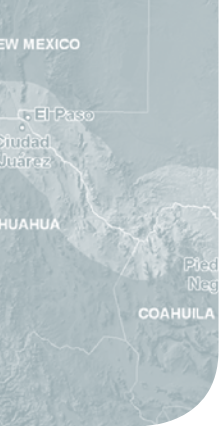
The megadrought of the sixteenth century is the severest recorded on the Palmer index and was occasioned by a persistent La Niña effect, requiring people to adapt to this climate event. That's the case for native populations of the southwest United States, who were forced to adjust to climate changes over the course of more than 10,000 years and who acquired an awareness of ecology by virtue of their continuing necessity to adapt and survive. Given the current context of climate change, it is possible that the very strategies which those native groups devised will be called into use again, fine tuned to fit the constraints of more modern needs.

CHALLENGES IN COUNTERACTING THE EFFECTS OF CLIMATE CHANGE

Preventive measures must be implemented to counteract the effects of climate change. If immediate action is not taken, in a few years the polar ice caps may melt, and rising temperatures may elevate sea level by an additional ten meters.

Human activity must be modified gradually to reduce gas emissions into the atmosphere, because what we do now will impact the quality of life of our children as well as people of all ages in future generations.

Climate change is a phenomenon that the general population should become familiar with. Armed with knowledge and information, people can be sensitized to the damage they cause to the environment and ways they can modify their behavior to avoid it.



Water conservation and waste water management are immediate priorities to ensure an adequate water supply for the future.

Activities which depend on extensive use of water – such as industry and agriculture – must also implement new procedures that will allow them to minimize their dependence on water. Private citizens must also adopt such measures.

In the future, large gardens and trees typical of some regions will no longer be sustainable in desert regions, given the quantities of water they require.

Fixtures that supply water to buildings and homes and the infrastructure of public utility systems must be checked and repaired to avoid leaks, one of the principal ways in which water is wasted.

Governments at various levels must cooperate in this effort to counteract the effects of climate change, because without public policies, appropriate programs, and the necessary investment to achieve resource-conserving infrastructure, many efforts will be in vain.

Governments must give priority attention to these areas: water conservation, development of alternative energy sources, and creation of an efficient, green system of public transportation.

DEVELOPING ALTERNATIVE ENERGY SOURCES

Modifying habits to reduce greenhouse gas emissions, along with water conservation and treatment, must be implemented jointly with development of alternative energies.

The goal for alternative energy development is to reduce emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride. All these gasses have the potential to contribute to warming in 100 years.

The use of renewable energies will permit more effective conservation of natural resources and favor long-term stability in fuel prices as compared to traditional sources of power. For example, in the United States, energy efficiency programs are racking up 400 billion dollars in annual savings, thereby encouraging reinvestment and price stabilization.

Worldwide dependence on traditional energy sources such as fossil fuels (petroleum, natural gas and coal) has increased concentrations of harmful gasses in the atmosphere, contributing to climate change.

Energy systems must be safe, feasible, and sustainable. Sustainability is perhaps the most uncertain factor, as there is no way to accurately predict supply levels in the future.

Solar energy is expected soon to become competitive in the marketplace. By 2015, more than one million homes in the U.S. alone are projected to be utilizing energy from the sun. Within this same time frame, more homes around the world are expected to be built by taking advantage of more efficient technologies.

Scientific data show that, if it were possible to place solar energy receptors in an area with a perimeter of 200 kilometers, enough energy could be generated to meet the world's needs in one day.

People must also change their mentality and begin to incorporate the use of solar heating and alternative energies in their homes, along with reduced use of automobiles, electricity, and water. These practices reduce emissions and save energy as well as money.

Alternative Energy in Mexico, the United States, and Canada

Mexico's high dependence on hydrocarbons and lack of a great diversity of energy sources make it necessary for the country to formulate policies and economic incentives to provide remedies.

Regulatory constraints, along with the monopolistic control exerted by Petróleos Mexicanos (PEMEX) and the Federal Electricity Commission (CFE), are among the obstacles that must be overcome in order to develop and incorporate alternative energies into the daily routines of Mexicans.

However, Mexico does rank third among nations in installed capacity for geothermal electrical power generation and shows great promise for harnessing wind energy in more than 100 specific sites.

In addition, sites have been identified with great potential for exploiting biomass in generating biogas. Most of theses sites are located in Mexico's northern border region, an area with potential also for photovoltaic and wind energy.

The United States accounts for 35% of the demand for energy worldwide, although in recent years alternative energy sources have been responsible for a reduction in dependence on fossil fuels.

Only 2% of U.S. energy needs are met by alternative sources such as solar and wind energy, but Americans have been choosing energy-efficient vehicles and opting to recycle. Some dwellings now utilize green energy.

Coal remains the fuel most used by Americans (45%), while petroleum satisfies 4% of demand, natural gas 17%, nuclear energy 19% and hydroelectric power 13%.

Wind energy in the United States has grown 26% in the past two years and has reached an installed capacity of 11,500 MW.

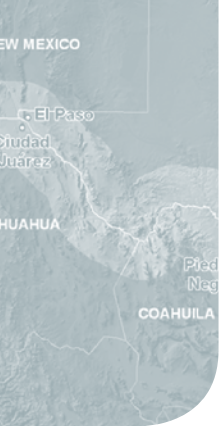
Meanwhile, Canada has been turning to renewable energy but is also endeavoring to utilize nuclear power, since it possesses significant uranium reserves.

Nuclear energy produces fewer emissions than traditional processes in generating electricity, medical diagnosis and treatment, desalinization of sea water, hydrogen production, agriculture, and other industrial purposes.

The Canadian government has announced its commitment to reducing greenhouse gasses 18% by the year 2010

Both the U.S. and Canada are developing so-called "Clean Coal" technologies, premised on the liquefaction and gasification of coal.

Although these new clean carbon technologies are expensive, their development is important to the future since they involve the capture and sequestration of gasses. In order to reduce emissions, it can be mixed with biomass.



Southwestern United States and Northern Mexico

The states of northern Mexico and the U.S. southwest now constitute the driest zone in the area.

Prolonged drought is one climate change that has occurred in this region, which receives only 25% of the rain. Consequently, the availability of water will be a problem in coming years, since bolsons are slow and uneven in replenishing themselves, so there are no reserves and life is lived day-to-day, with water on hand.

Water conservation measures must be implemented if we are to maintain an adequate supply for the public, for agriculture and for economic development.

Extreme climate is one of the realities of the border region, as illustrated by periods of prolonged drought, punctuated by very heavy rains such as those recorded in the Paso del Norte region in 2006.

Promoting proper waste water treatment is also recommended as a precaution for periods when water is in short supply and as a way to use treated water to encourage conservation.

Obstacles to Overcome in Developing Alternative Energies

Developing alternative energy sources has many benefits, since they not only reduce gas emissions but also are cost effective. Nevertheless, public policy and available funding are still not in place to spur the development and use of renewable energies.

Subsidies must be provided to companies that seek to modify their processes by incorporating renewable alternative energies, thus permitting them to keep their costs low and remain competitive in the world market.

BIOFUELS

Biofuels are another of the green alternatives being implemented throughout the world in order to reduce emissions and save money for consumers.

Moreover, experts say that going green is more profitable than to continue using traditional fuels.

In the U.S., production of biofuels has started to increase, reaching 5.6 billion gallons of ethanol per year. It is estimated that by the year 2030, 30% of fossil fuels will have been replaced by biofuels in the nation's transportation systems.

Development of biofuels has changed the face of industry. Ethanol refineries are already up and running and more will be operational in the future.

However, ethanol production using corn or soy has skewed the market worldwide, causing the price of these foodstuffs to rise worldwide. Moreover, its production has been shown to be unsustainable. But ethanol obtained from sugar cane has worked out very well in recent decades in Brazil.

Biodiesel can be produced using restaurant fats and particularly the seeds of the jatropha tree, native to the Caribbean and taken to India by the Portuguese in the seventeenth century. Because these seeds and algae have no practical applications as food, they are superior to corn or soy as raw materials from which to produce ethanol. In India, for example, it is expected that 20% of diesel usage will be of diesel manufactured using jatropha seeds.

ROLE OF THE BECC IN REDUCING THE EFFECTS OF CLIMATE CHANGE

The Border Environment Cooperation Commission (BECC) participates actively in certifying projects that encourage the development of alternative sources of energy, water sanitation and treatment, and the production of biofuels in the U.S.-Mexico border region. In this region, 25 water conservation projects, 2 clean energy projects and 14 clean air (paving) projects, among others, have recently been supported.

The BECC recently certified a project in the state of Sonora to reduce motor vehicle emissions, biodiesel production at a plant in El Paso, Texas, and generation of electric power through methane capture at a dairy in the state of Chihuahua.

There are now 21 projects in the pipeline targeted at reducing emissions and developing alternative energies and biofuels in the US-Mexico border region. Some of the more noteworthy of these projects are ethanol production, tire recycling, wind energy development projects, and the use of biogas to produce electricity.

CONCLUSIONS

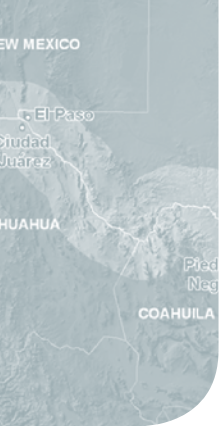
The topic of the environment must be presented to governments as a way to encourage green communities that will reduce harmful emissions. At the same time, people around the world will become better informed and will change their habits to curtail damaging effects of climate change.

Humans must modify their habits and behaviors now so that they will not be forced later by climate change to implement measures that are not preventive, but reparative. The worldwide goal in counteracting the effects of climate change must be to reduce gas emissions to pre-1990 levels. If this is not accomplished, negative effects of this trend will intensify markedly after 2020.

In an effort to cut emissions, some countries are already developing alternative energies to reduce dependence on fossil fuels and encourage the use of green vehicles.

Countries may intend to use alternative energy sources, but the fact is that only 2% of demand is currently being satisfied through these means.

Projections by specialists in the field have shown that extreme climatic phenomena in the last decade are a symptom of high levels of CO_2 and greenhouse gasses in the atmosphere, even though their full effect has not yet been felt. More prolonged droughts and intense rains will continue to occur as cold regions experience warming and climate tends to lose is regulating effect.



THE TOPIC OF CLIMATE VARIABILITY ON THE PUBLIC HEALTH AGENDA IN THE PASO DEL NORTE REGION

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INTRODUCTION

The topic of climatic variability has been under discussion for a long time and has always elicited controversy as to the degree to which it is present and the negative ways it impacts life on earth.

Scientists have taken different stands on the issue, but they all agree that the planet's climate has undergone change. Their agreement on this point is based on discoveries about the history and evolution of climate. It has been shown that temperatures have fluctuated over time and that, with each variation, living beings, including humans, adapt to change.

Some politicians and scientists believe that today's climate is different from that of decades ago, but that such variation is "normal" and that eventually there will be a return to normalcy without having caused great harm to life forms.

Others contend, however, that climate change is here and is significantly affecting the inhabitability of our planet. They see a compelling need to educate, to change attitudes and habits, since it is the actions of humankind that have accelerated the emission of greenhouse gasses, with increasingly pernicious effects.

The United Nations Convention on climate change[1] describes this phenomenon as "climate change attributable directly or indirectly to human activity that alters the composition of the global atmosphere and that is, in addition to natural climate variability, observable over comparable periods of time".

As we noted previously, humans are still using products that cause the greenhouse effect. But rather than being curtailed, this activity has continued, contributing to climatic variability and instability in

1 UNFCC: http://unfccc.int/portal_espanol/items/3093.php

our time. At the last meeting of the American Association for the Advancement of Science (AAAS)[2], one study showed that human activity is causing carbon emissions to enter the atmosphere at a faster rate than in the previous decade.

Carbon emissions have increased 3.5% annually since 2000, which compares to an annual rate of 0.9% during the 1990's. This is very different from what the International Climate Control Commission found in 2007[3].

It occurs because coal is still widely used as a source of energy, due mainly to its relatively low cost.

Another important point brought to light at this meeting is that satellite measurements indicate that seal level is rising faster than predicted, representing a serious threat to coastal regions such as Florida and New York.

EFFECTS ON HEALTH

These negative effects are manifested in different ways. The world's population is placed at greater risk, particularly those who are most vulnerable: the aged and the very young, pregnant and lactating women, marginalized populations in both urban and rural settings, and indigenous and displaced communities. This vulnerability can be exacerbated by associated factors, such as unsafe eating habits, conflicts, disease and poverty. These risks are directly related to a rise in the incidence and severity of natural disasters (droughts, floods, and other extreme weather phenomena), and vectors such as dengue, malaria, and West Nile virus create mounting health problems.

Delving a bit deeper into our topic, we can differentiate between the effects of climate variability which impact health directly and those which impact it indirectly. Direct effects are those related to extreme climatic conditions and include heat stress brought on by bad weather and disasters.

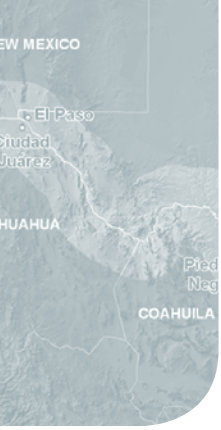
Indirect effects are ways in which climate influences the behavior of vector-borne and waterborne diseases and diseases spread by food, and the safety of food and water supplies. We must also consider socioeconomic problems and displaced populations.

In the Region of the Americas, the most worrisome issues are: increased incidence of extreme climate, changes in food supplies and nutritional safety, the availability of water, the variety and distribution of vector-borne diseases, and rising sea levels[4].

Other effects include socioeconomic repercussions that influence the development of countries and the health and wellbeing of populations, repercussions caused principally by a reduction in the productive capacity of the population (greater numbers of persons suffering from new or more virulent diseases), damage to and even destruction of marine and terrestrial ecosystems (loss of biodiversity), and impairment of infrastructure.

More and more important professional organizations are becoming involved in the issue. At the latest meeting of the American Medical Association (AMA), in November 2008[5], the consensus was

2 American Association for the Advancement of Sciences – Annual Meeting http://www.aaas.org
3 Intergovernmental Panel on Climate Change: http://www.ipcc.ch
4 Panamerican Health Organization: 2008 World Health Day. http://www.paho.org/english/dd/pin/whd2008_technical.htm
5 American Medical Association – American Medical News http://www.ama-assn.org/amednews/2008/12/01/prsh1201.htm



that global warming is a real phenomenon and that human activity is accelerating the process.

The AMA reached an agreement to support the report of the United Nations Intergovernmental Panel on Climate Change (UNIPCC), which warns of serious consequences to human health produced by heat waves, droughts, floods, lack of a safe water supply, displacement of populations, and the spread of infectious disease.

At present, the United States is seeing an increase in vector-borne diseases like dengue and even malaria.

The AMA urges medical societies to work with health departments in fighting against the effects of global warming.

Moreover, it recommends ramping up efforts to reduce medical supply waste, to recycle, to develop and use environmentally friendly products, and to build more energy-efficient health care facilities. According to the AMA report, between 30% and 50% of discarded medical supplies can be recycled.

STATUS OF HEALTH IN THE PASO DEL NORTE REGION

As noted earlier, the negative effects of climate change extend to all corners of the globe, and the Paso del Norte region is no exception.

The health of our people is at grave risk of an unprecedented and rapid decline if necessary precautionary measures are not taken immediately.

Let us first mention the effects of weather phenomena which are becoming more and more frequent and severe. Periods of flooding and drought have wreaked havoc: the floods affecting El Paso, Texas, Ciudad Juárez, Chihuahua, and Doña Ana County, New Mexico in 2006 caused displacement of population, damage to infrastructure, loss of dwellings, suspension of basic services, loss of jobs and – worst of all – loss of human life6. It is important to remember that the consequences of such a disaster also include issues of mental health, disruption of access to health services, increase in conjunctival, dermal, diarrheal, and respiratory diseases, and even rise of vector-borne diseases7.

Other floods, although less severe, occurred in July 2008, inundating some areas of El Paso and the El Barreal sector of Ciudad Juárez. Lincoln County, New Mexico was also hit in the aftermath of Hurricane Dolly, and that storm toll included 1 death, 200 homes damaged, downed power lines, and millions of dollars in damage8.

Finally, in September 2008, the “La Vencida” dike burst, causing flooding in the city of Presidio, Texas and surrounding areas. An indirect result of this calamity was that IBWC Commissioners Carlos Marín and Arturo Herrera were killed when the plane in which they were traveling to tour the area crashed.

6 2 deaths according to registers of Ciudad Juárez.

7 A more detailed explanation of this point may be found in the article by Dr. Héctor Puertas: “Epidemiological surveillance on climate change in the Paso del Norte Region,” which appears later in this volume.

8 Jenkins, J. and Iturralde, G. Editors, Lessons Learned from 2006 Floods in the Paso del Norte Region. Page 12.

The region has also seen recurrent droughts, particularly on the Mexican side, triggering an exodus of farm workers into urban areas and a consequent deterioration of the food supply, producing overcrowding, raising unemployment and marginalization, leading to breaches of public safety and a general worsening of health among the affected population.

We must also place the focus on water: a crisis has existed on the US-Mexico border since the signing of a treaty in 1906 allotting fixed quantities of water based on the surface area of land with no regard to population density, which resulted in harm to the Mexican side[9].

The effects of climate change also extend to diseases which normally occur in the border region but which now behave differently. The case of vector-borne diseases transmitted by mosquitoes is remarkable, since these insects have developed new and more effective survival mechanisms in reacting to climate change. Chief among the mosquito-borne diseases are dengue and West Nile virus, and in the very near future the number of malaria cases is expected to rise[10].

THE ROLE OF PAHO/WHO

The Pan American Health Organization is an international public health entity with 100 years' experience dedicated to improving health and living conditions among the peoples of the Americas. It is part of the United Nations System and serves as the World Health Organization's Regional Office for the Americas. Within the Interamerican System (OAS), it is the organization that specializes in health.

Its mission is to oversee collaborative strategic efforts among member states and other allies, to promote health equity, combat disease, and improve the quality and length of life for the people of the Americas.

PAHO's role in this regard is to articulate positions, interventions, and action strategies for the various states and entities it serves, assist and advise in the implementation of health programs, and participate in any initiatives that promote the health and wellbeing of the population.

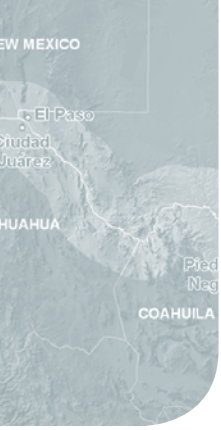
PAHO's US-Mexico Field Office, founded in 1942, is located in the city of El Paso, Texas. Its mission is to provide ongoing and dynamic monitoring of the status of health in the US-Mexico border region, to disseminate this information to governmental and nongovernmental agencies (involved in border health), and to mobilize resources to provide high quality, collaborative technical cooperation with those agencies in order to maintain and improve the health and environment of the border region.

The technical cooperation thus provided includes several programs involving joint efforts on the topic of climate change. But it is in the sphere of environmental health where there is a specific mandate to provide expertise relevant to climate change, embracing the following programs: water, air, Border 2012, pesticides, disasters, and climatic variability.

PAHO and WHO are working together on global climate change through the Region of the Americas, evaluating risks in each country, raising the level of knowledge and consciousness about the health consequences of climate change, and improving health systems in response to variations in climate,

9 Additional information about this topic can be found in the article by Karl Woods: "Climatic variability and its impact on available water supplies".

10 This issue is thoroughly discussed by Héctor Puertas in his article "Epidemiological surveillance on climate change in the Paso del Norte region," appearing in this volume.



thus strengthening public health by making climate-change-related health decisions and establishing interdisciplinary relationships for the purpose of implementing science-based priorities for change.

At the local level, PAHO encourages the acquisition of knowledge and the implementation of lines of action to:

- Understand the characteristics of climate variability and its consequences in the region.
- Involve and commit the principal institutions that deal in health issues and that generate knowledge about climate variability and its consequences.
- Provide follow-up on initiatives and commitments stemming from the recent World Health Day (April 7, 2008) on Climate Change and Health.
- Strengthen and provide expertise to epidemiological and meteorological surveillance systems in the region.

RECOMMENDATIONS

Our region is in danger of suffering harm from events occurring in a natural order altered by the hand of man.

Therefore, humans must take immediate action to lessen the negative impact and avoid irreversible harm. There are two response options which nations may elect to implement: mitigation and adaptation[11].

Mitigation is understood to mean the set of interventions designed to reduce greenhouse gas emissions and corresponds to primary prevention, which helps to prevent injury and disease. Mitigation can diminish, postpone, or avoid impacts.

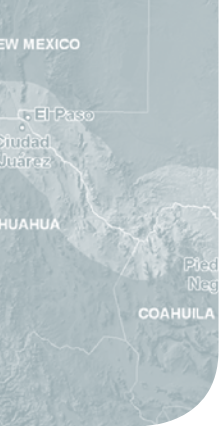
Adaptation is defined as adjusting the natural or human system to a new and changeable system that responds to stimuli in the climate and their effects. This response must come from civil society, industry, government, and other sectors. It must be carried out in an intercultural context, raising the consciousness of the public.

These actions will affect human beings and their environment in additional ways. For example, the use of fewer motor vehicles and promotion of transportation based on expenditure of energy by the human body will lead to a reduction in greenhouse gas emissions and will lower the incidence of chronic-degenerative diseases.

At the local level, people must take charge of the issue, recognizing the dangers of climate variability and taking steps to minimize its impact.

Health services in the region must be closely linked and interconnected, both for sharing of information and for planning, implementing, and evaluating joint actions taken to avoid the spread of disease and the negative processes that fuel climate change.

11 Pan American Health Organization: World Health Day 2008. http://www.paho.org/english/dd/pin/whd2008_technical.htm



ATMOSPHERE-LITHOSPHERE INTERACTION VARIABILITY AND ITS POSSIBLE HEALTH EFFECTS FOR THE RESIDENTS OF THE PASO DEL NORTE REGION

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I. SUMMARY

The thin skin contacting the earth's atmosphere and lithosphere contains our ecosystems and our civilization. The Paso del Norte region of southwestern North America, an isolated, arid, mountainous urban area, is vulnerable to extremes in atmosphere-lithosphere interaction which have implications to the public health of its residents. These hazards typically come from too much or too little rain or wind. Too much rain causes flash flooding, river flooding and landslides, while too little rain presents hazards from drought. Too little wind causes air stagnation and air pollution, while too much wind causes dust storms. These various extremes have differing (potential) public health impacts. The local effects of global climate change are unclear, but will certainly include warmer temperatures in the Paso del Norte, and more dynamic natural hazards. Improved preparedness and planning is needed to face and cope with these extreme natural events.

II. INTRODUCTION

A. THE ATMOSPHERE AND THE LITHOSPHERE

Essentially all life on Earth is found in a very thin skin around its surface, less than 1% of the overall thickness of the Earth system. Human civilization and almost all biota and ecosystems are confined to the atmosphere (about 99% of which is contained within 50 km above the surface of the solid earth) and the lithosphere – the outer skin of the solid Earth – which is also only tens of kilometers thick. The very thin skin of the Earth in which we live including the atmosphere and lithosphere is very dynamic, constantly interacting in ways to present hazards to our civilization. In the Paso del Norte region, these natural hazards generally are manifested by wind and water, too much or too little of either.

B. PHYSICAL AND CLIMATIC SETTING OF THE PASO DEL NORTE REGION

The Paso del Norte metropolitan areas are comprised of the major cities of El Paso, Texas, USA and Ciudad Juarez, Chihuahua, Mexico, along with various suburbs. The region is located at the extreme westernmost edge of Texas, south-central New Mexico and north-central Chihuahua. The metropolitan area is split by the international boundary, the river Rio Grande (Rio Bravo del Norte). Its population of approximately 2.5 million makes it one of the largest binational metropolitan areas on the USA-Mexico border or on any international border, and one of the 50 largest metropolitan areas in the Western Hemisphere. It is a geographically isolated conurbation, more than 550 km east-southeast of its nearest large (pop. > 1 million) neighbor (Phoenix, Arizona).

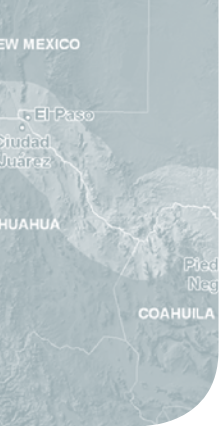
The Paso del Norte lies in southwestern North America, in the Chihuahuan Desert of the Basin and Range geomorphic province. The metropolitan area has strong variations in topography, with the Sierra de Juarez providing a southwestern backdrop to Ciudad Juarez, the Franklin Mountains nearly bisecting the city of El Paso, and Mount Cristo Rey and the Rio Grande Rift fringing the metropolitan area in New Mexico. Surface elevations range from approximately 1,143 meters (3,750 feet) above sea level along the river to 2,193 meters (7192 feet) at North Franklin Mountains. The Franklin Mountains rise high enough into the atmosphere to produce clouds and enhance precipitation through orographic uplift. El Paso's nickname is the "Sun City," and rightly so. The area receives 88.2% of the possible sunshine, and experiences over 300 sunny days per year. The Paso del Norte receives an average annual horizontal ground-level solar energy of ~200 kilolangleys per year, near the maximum for the Western Hemisphere. It has an arid, warm climate: according to the USA's National Weather Service, El Paso has an average annual maximum temperature of 25.1°C and an average annual minimum of 11.2°C. Temperature averages range from a high of 35.2°C in June to a low of 0.5°C in January. Average annual precipitation is 21.8 centimeters, with infrequent winter snowfalls. Hot (maximum temperature > 40°C), dry days are most common in late spring, while freezing weather is most common in December and January. Continental tropical (dry desert) air masses dominate El Paso's weather, although variations in weather are often caused by air masses intruding from surrounding regions. The predominant rainy season is produced by the North American southwest monsoon, with more than half the average annual precipitation (12.3 cm) falling in July, August, and September. The mountainous topography in which the Paso del Norte is built into causes localized variations in the wind speed and direction.

The vicissitudes and the interactions of the atmosphere and the lithosphere in the Paso del Norte cause physical hazards to its millions of residents, as well as potential public health impacts. These are generally in the form of water (precipitation), or air movement (wind). Either too much, too little, or the wrong type of these manifestations in the wrong place impacts the well being and health of the Paso del Norte's inhabitants. What is more, projected future global climate changes will certainly have local effects on the Paso del Norte. The rest of this paper will explore these extremes and potential changes.

III. PRECIPITATION

A. TOO MUCH

The Paso del Norte's 22 cm of precipitation per year falls almost all as rain. Thunderstorms, especially during the summer monsoon, provide a significant amount of the area's surface water supply, but



raise the risk of catastrophic flooding, such as those that happened in August 2006. From 1972 to 2002 flash floods (producing at least 5 cm of rainfall in less than 6 hours, with significant flooding) happened approximately 1.5 times per year in the region including the Paso del Norte: almost half of these floods happened between 16 July and 15 August.

Thunderstorms in the desert may be sudden, intense, and dynamic, and provide great hazards to life and property. Lightning and flash floods are the deadliest natural hazards in North America, killing more people than earthquakes, tornadoes, hurricanes, and other natural phenomena. The effects of thunderstorms may be much localized: due to their small scale, some parts of the metropolitan area may be receiving copious, flood-producing rains, while the "official" rain gauges less than 10 kilometers away may be reporting sunny skies. Such an effect happened on 8 July 2008, when flood waters more than 1.3 m deep from an isolated, high-precipitation thunderstorm caused evacuations and damage, even though the El Paso International Airport reported no rain. Due to the mountainous topography, flowing water from heavy storms over steep slopes may converge and run off in deep torrents tens of kilometers away in the surrounding lowlands, flooding areas which are not receiving rain at the time. On 22 June 2006, the city of Alamogordo, New Mexico (120 km north of El Paso) was seriously damaged by flash floods originating from a heavy, stationary thunderstorm over the mountains to its east, even though the city itself received no rain. A similar scenario could happen in the Paso del Norte. River flooding can also be caused by extreme atmospheric events in other parts of a drainage basin: the Rio Bravo del Norte/ Rio Grande may reach flood stage and inundate low-lying lands in the Paso del Norte, due to rains far upstream. In August 2006, the river reached flood stage in El Paso/ Ciudad Juarez due to extremely heavy storms near Hatch, New Mexico, approximately 130 km to the north.

The public health effects of flooding include the spread of toxic compounds in the flood waters, the spread of bacteria and infectious agents in the water and mud, mold and fungi which grow in damp environments, and other hazards such as promoting the breeding of disease vectors. For example, after the heavy rains of the 2006 summer monsoon which provoked repeated flash flooding in the Paso del Norte, the population of mosquitoes dramatically increased. Swarms of mosquitoes in the Upper Valley of El Paso County, TX/ Doña Ana County, NM were so dense that they could be regularly seen on the National Weather Service's Doppler radar normally used for tracking of storms. These mosquitoes are vectors for West Nile virus and may in the future be vectors of other infectious diseases as the climate warms.

Most of the rest of Texas and eastern New Mexico and Chihuahua experiences its most severe weather not in the late summer (as does the Paso del Norte), but during the late springtime (from mid-April through June). At this time the dryline, an atmospheric phenomenon comprising a sharp boundary zone between dry, hot desert air of the Southwest and humid, warm air of Southeast North America, moves across the south-central portion of the continent. Along this line, severe thunderstorms including hail, tornadoes, and damaging straight-line winds are prone to occur. At present, the dryline almost always stays ~100 km or more to the east of the Paso del Norte. However, if global climate changes cause the dryline to shift westward (as predicted by some models), the Paso del Norte region would become subject to severe springtime storms. On 28 May 2008 the dryline moved unusually far westward, destroying parts of the city of Tularosa, New Mexico with high winds and large hail.

The Paso del Norte is so far inland that tropical cyclones (hurricanes) are generally not able to strike the metropolitan area with severe winds while they are active (landfalling). However, dissipating tropical cyclones strike the Paso Del Norte on almost an annual basis; they may arrive from the

Pacific Ocean basin (from the southwest) or from the Atlantic / Gulf of Mexico (from the southeast). Depending on their intensity, they may provide anything from cloudy skies and light rains, to heavy rain and flash floods. The remnants of Hurricane John (a Pacific storm) struck the Paso del Norte area on 4 September 2006, causing flash flooding, inundating more than 20 neighborhoods in Ciudad Juarez and El Paso, and leaving thousands of persons homeless. Hurricane Dolly (an Atlantic storm) began to dissipate after making landfall at the USA-Mexico border on the Gulf of Mexico, but as a weakened cyclone, it crossed directly over the Paso del Norte on 26 July 2008, causing flash floods, funnel clouds, landslides, the collapse of a historic church in Ciudad Juarez and the evacuation of numerous colonias. The exact potential impacts of expected global climate change on tropical cyclones are uncertain, but most projections expect an increase in the frequency and/or intensity of these storms. Therefore, they may become an even more recurrent hazard in the Paso del Norte.

Heavy rains combined with steep slopes and unstable geological materials are the recipe for landslides. Since hundreds of thousands of residents of the Paso del Norte region live on steep slopes or directly beneath them, they are at risk of damage to body and/or property from this particular atmosphere/lithosphere interaction. Geologists have mapped many landslide-prone areas and active and inactive landslides in the Paso del Norte. A number of urban parks in the metropolitan area (such as Franklin Mountains State Park and McKelligon Canyon Park) attract recreation-seeking residents: heavy rains in late July 2006 culminated in approximately 435 landslides in the Santa Catalina mountains surrounding Tucson, Arizona, and a similar event could not be ruled out in the Paso del Norte.

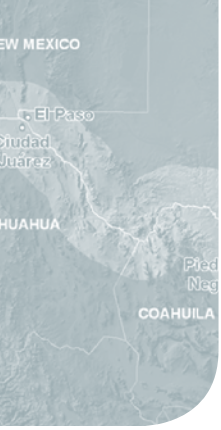
B. TOO LITTLE

The Paso del Norte region is in the center of the Chihuahuan Desert, with more than a magnitude more evaporation than precipitation: in most years it receives relatively little rainfall. But in periods of prolonged drought, the effects of lack of rain become extreme. From 1994 to 2003, the region experienced a protracted drought and “lost” approximately 2.5 years’ worth of rainfall in less than a decade. In such periods of prolonged drought, what little vegetation cover there is in the Chihuahuan Desert decreases, the land dries out, and the frequency of dust storms increases. Although the majority of the water supply for industrial and residential use in the Paso del Norte comes from groundwater, the reduced surface water supply in periods of too little rain provokes stresses and economic hardships on the residents. Being growing, large cities in an arid climate, Ciudad Juarez and El Paso have uncertain water resources requiring innovative methods to meet the water needs of their citizens and businesses.

IV. WIND

A. TOO LITTLE

The region’s mountains and river valleys make the Paso del Norte metropolitan area act like a bowl in the atmosphere. When skies are clear and the air is still (too little wind), the air becomes stagnant. Without wind to provide ventilation, especially in winter when radiational cooling of the earth’s surface promotes the formation of an inversion (increase of temperature with height) in the lowest atmosphere, air pollutants can build up in the lowlands where most of the Paso del Norte’s population lives. Degraded air quality in the region comes from increased atmospheric concentrations of ozone, nitrogen oxides, sulfur oxides, soot, industrial emissions, and other sources of pollutant gases and particulate matter. Hundreds of brick works (ladrilleras) in Ciudad Juarez



and many other large and small point sources of pollutants can cause degraded air quality that can occasionally exceed State and Federal pollutant limits. Vehicles traveling on unpaved roads, especially in Ciudad Juarez, suspend clouds of airborne soil (fugitive dust) that causes "spikes" in particulate matter concentrations. The result is a low-lying haze when the air moves too little.

The public health effects of air pollution are very clear and potentially serious for the Paso del Norte's residents. Increased air pollution is known to be associated with everything from simple eye and skin irritations to acute respiratory and cardiovascular diseases. The Paso del Norte area has a very high incidence of asthma, especially pediatric asthma, which is widely considered to be exacerbated if not caused by air pollution episodes.

B. TOO MUCH

At any time of the year, but especially during the dry, windy period from late autumn through the middle of spring, high winds and dry conditions in the Paso del Norte region cause the atmosphere to entrain small pieces of the lithosphere and move them downwind as blowing dust and sand. During the summer monsoon season, strong winds spreading out from the base of thunderstorms cause haboobs (airborne walls of dust and sand) that quickly envelop the city in a harsh, gritty cloud.

Dust and sand storms are probably more frequent in the Paso del Norte than any other major metropolitan area in the Western Hemisphere. Blowing dust or sandstorms are recorded approximately 30 days per year in the Paso del Norte (excluding haboobs): on approximately 15 days per year, dust is thick enough to obscure visibility for at least two hours. The Chihuahuan Desert region has been determined from long-term analysis of space satellite data to be one of the dust "hotspots" of North America. 64% of serious (lasting $>$ 2 hours and reducing visibility to $<$ 10 km) dust events happen between February and May. Dust storms are most frequent in the Paso del Norte during March and April (25% of all dust storms occur in April), when aeolian plumes generated in the Chihuahuan Desert may be detectable from space and send airborne particles thousands of miles downwind. In the Paso del Norte region near the dust source area, the dust creates extremely high concentrations of particulate matter, a regulated air pollutant. For example, the University of Texas at El Paso (UTEP) Continuous Air Monitoring Station (CAMS) run by the Texas Commission on Environmental Quality (TCEQ) recorded a peak 1-hour PM10 particulate matter concentration on 15 April 2003 of 4724 micrograms per cubic meter (μg/m3) for the hour from 1:00 to 2:00 p.m. local time, the highest hourly PM10 reading anywhere in Texas during 2002–2004. According to comments provided to the U.S. Environmental Protection Agency regarding proposed monitoring requirements for coarse particles, the only urban area to be included in the USA's top twenty 24-hour PM10 concentrations between 2000 and 2004 was El Paso.

Airborne dust constitutes a serious safety hazard in the Paso del Norte metropolitan area as well as many other desert cities worldwide. Airborne soil particles can reduce visibility and have an abrasive effect on machinery. Dust storms, even if brief and spatially localized, must be taken especially seriously because of blinding conditions on local roads. Dust storms have been attributed to many motor vehicle collisions resulting in loss of property, injury and death: since the 1990s, the El Paso area has averaged between 1 and 2 traffic fatalities annually directly attributed to dust storms. Several local highways are occasionally closed due to dust storms, and numerous signs along these roads advise of the dust hazard. The USA National Weather Service has compiled a list of driving safety procedures to employ during a dust storm. For example, drivers are advised to never stop on the pavement. Motorists are warned to ensure that they turn off their headlights when pulling off

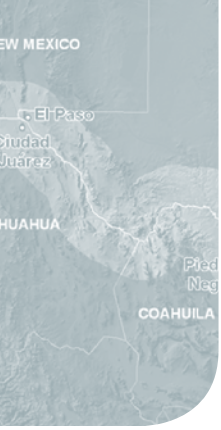
a roadway during a dust event. In the past, drivers have pulled off the roadway with their lights on: vehicles approaching from the rear and using the advance car's lights as a guide have inadvertently left the roadway and in some instances collided with the parked vehicle. When stopped in a dust storm, drivers are warned to turn off all lights including brake lights and set the emergency brake, reducing the possibility of a rear-end collision. If conditions prevent pulling off the road, motorists are advised to proceed at an appropriately reduced speed with lights on, using the center line as a guide.

The health effects of dust and sand storms, in addition to the risk of injury caused by the safety hazard, are likely although unclear. A potential relationship between inhaled mineral (soil) dust aerosols and asthma has been suspected since the Dust Bowl of the 1930s. Dust storms have long had a suspected association with asthma; studies in Asia, the Caribbean, and Alaska correlated increasing asthma symptoms with increasing dust loadings. However, the nature of El Paso's dust differs from that of those sites. Although it has not yet been correlated with asthma and respiratory health per se, university researchers in El Paso and Ciudad Juarez are now actively investigating the connection between dust storms and respiratory health. High particulate matter concentrations have also been reported to increase the incidence of cardiovascular disease. The Sin Nombre virus (SNV), the etiologic agent of Hantavirus cardiopulmonary syndrome (HCPS), is often contracted through the inhalation of virus-contaminated excreta spread through the air from infected rodent droppings, and risk of its transmission may be increased during wind storms. Similarly, dust storms increase the risk of coccidioidomycosis (valley fever or desert fever), a disease caused by Coccidioides immitis, a fungus which resides in the soil. The C. immitis spores are entrained into the air by disruption of the soil, such as during a dust storm. Both Hantavirus and C. immitis occur in the Paso del Norte, and residents breathing dust during high winds may be at increased of contracting HCPS or coccidioidomycosis.

V. POTENTIAL IMPACTS OF GLOBAL CLIMATE CHANGE ON ATMOSPHERE-LITHOSPHERE INTERACTION IN THE PASO DEL NORTE

Large-scale (global) climate has been changing throughout geological history, and will certainly keep changing in the future. The general consensus of the scientific community at present is that global climate is warming rapidly due to the anthropogenically-enhanced greenhouse effect (increase in greenhouse gases such as carbon dioxide and methane). How will these global climate changes specifically impact the atmosphere-lithosphere interactions in the Paso del Norte region?

We can assume that the climate in the Paso del Norte will get warmer. The urban heat island effect (increased temperature in cities due to urban energy usage and increased absorption of sunlight by the urban surface) is already in effect in the Paso del Norte: increased temperatures caused by global warming will exacerbate the heat island effect and increase heat-related mortality and morbidity. These temperature increases will be most evident as higher nighttime (minimum) temperatures than afternoon (maximum) temperatures. Some experts have recently stated that increased temperature – due to heat island effects and a warming climate – pose a potentially greater limit to growth and development of cities in the desert Southwest of North America than lack of water does. Climate model simulations for the state of Texas suggest that average daily summertime temperatures will rise by several degrees Fahrenheit in the near future (2010- 2039), by three to six degrees in the medium term (2040-2069), and by as many as ten degrees in the long-term future (2070-2099), depending on the potential amount of continuing greenhouse gas emissions. Warming temperatures



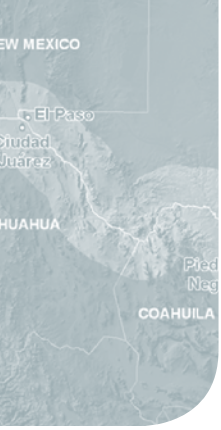
are already causing range expansions and contractions of various organisms: the range of known disease vector species (such as various species of mosquitoes) will certainly expand from the south into the Paso del Norte, increasing the area's exposure to new public health hazards.

The potential impact of global-scale climate changes (such as greenhouse warming) on individual localities or local-scale phenomena (known as downscaling) is less certain. The exact changes are uncertain, and different climate models run for the Southwest (including the Paso del Norte) give different results under different scenarios. Will the future climate of El Paso and Ciudad Juarez be warmer and wetter, or warmer and drier? Will the dryline shift to the west (bringing more severe weather in the springtime to the Paso del Norte), or not? What will be the effects of global climate change on the summertime monsoon that currently brings most of the region's rain? Will higher temperatures, which cause an increased moisture-holding capacity of the atmosphere, mean more intense storms, flash floods, and landslides? What will the effect of future climate changes be on wind- will there be an increase of periods of too much wind (more dust storms and coccidioidomycosis), and/or an increase of periods of too little wind (more stagnation and air pollution)? It is too early to answer any of these questions with any confidence, but the Paso del Norte region must be prepared for any number of changes in its local climate, leading to changing dynamics of atmosphere-lithosphere interactions, caused by global climate change.

VI. FINAL COMMENTS

The Paso del Norte metropolitan area will continue to be at risk from extremes in atmosphere-lithosphere interactions in its arid, mountainous terrain. Global climate changes and increasing population will certainly impart increasing local risks to these interactions, whether they are caused by too much or too little wind or water.

The best solution for residents, emergency managers, health professionals and public officials is to be prepared. Better civic and emergency planning for natural hazards, especially on a binational level, will improve preparedness for the inevitable extremes that will continue to occur no matter in what manner climate changes on a local and global level.



CLIMATIC VARIABILITY AND ITS IMPACT ON THE ECONOMY
A CASE STUDY: CENTRAL AMERICA

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INTRODUCTION

The topic of climatic variability and its possible impact on the global economy has been widely analyzed in recent years, with studies being conducted typically from the perspective of agricultural output and processes of desertification. An equally vital aspect is the economic impact of cyclonic phenomena, which are occurring with greater frequency and severity in the countries of the Caribbean Basin. The Economic Commission for Latin America and the Caribbean (ECLAC) has developed a methodology for evaluating damage caused by this type of disasters. This paper will summarize that methodology and focus on one additional aspect: the economic toll exacted by cyclonic phenomena in the long term.

The international community has begun to explore possible ways for countries that emit greenhouse gasses to compensate countries that suffer the effects of climate change, and it is therefore imperative to devise a methodology that includes, in addition to consideration of immediate damage and losses, assessments of long term economic cost.

BACKGROUND

The economic implications of climatic variation have been thoroughly studied during the last decade. The topic has become increasingly important in recent years. Among the numerous publications dealing with the issue, the most visible and controversial is probably the report by Lord Nicholas Stern of Brentford, known as the Stern Report (October 2006), commissioned by the British Ministry of Labor. Lord Stern, a prominent English economist who succeeded Joseph Stiglitz as chief

economist and vice president of the World Bank, concluded that governments should take steps to mitigate the problem, since it is a situation which cannot be resolved by market forces alone[1].

In March 2008, the High Commissioner and the European Commission presented testimony to the European Council concerning climate change and international security, in which the following reference is made to Latin America:

"In the driest areas of Latin America, climate change will lead to salinization and desertification of agricultural lands and diminished productivity of important crops and livestock, with adverse consequences for food safety. The projected rise in sea level will increase the risk of flooding in low-lying areas. Elevated surface temperatures on the oceans will adversely affect coral reefs and displace schools of fish. Latin America and the Caribbean are already suffering harmful effects, including extreme weather associated with the El Niño cycle. Changes in rain patterns and the disappearance of glaciers will significantly impact the availability of water for human consumption, for agriculture, and for generating power in the Andean region, for example. Countries of the Caribbean and Gulf of Mexico are already being affected by strong hurricanes, and this will be exacerbated by climate change and result in social and political tensions in a region with weak governance structures in many nations".[2]

In November 2008, the Global Trends 2025 report prepared by the National Intelligence Council of the United States also dealt with the implications of climate variability, with particular reference to the movement of migrants, citing the Stern Report regarding the possibility that the number of migrants could increase tenfold in the coming four decades.

Other recent studies, such as the Global Climate Risk Index (2008), have concluded that extreme weather phenomena will continue with greater frequency and intensity due to global warming, noting that such events have the potential to markedly erode progress made toward the Millennium Development Goals (MDGs). Based on analyses of the NatCatSERVICE data base of Munich Re, this report asserts that populations in lesser developed nations are being affected to a greater degree than those in industrialized countries.

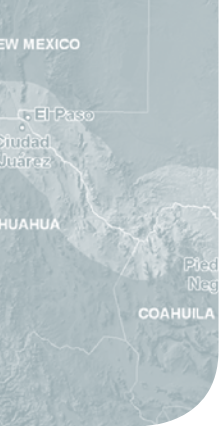
The topic of shared risks and possible compensatory measures has been explored in greater depth in recent years and is one of the key points on the agenda of the United Nations Framework Convention on Climate Change (UNFCCC) in Poznan, Poland, in December 2008.

The Swiss government has proposed that developed nations impose a tax of 2.00 US dollars per ton on carbon dioxide emitted to create a climate risk insurance fund, of which 60% would be retained by the countries that charge the tax and 40% would be earmarked for a multilateral relief and rehabilitation fund for communities affected by climate disasters.

The tax would serve as both an incentive and a disincentive for developed countries. As an incentive, it would encourage the use of alternative sources of energy, and as a disincentive it would reduce the consumption of fuels that release carbon dioxide.

1 The Stern Report contradicted previous major studies, such as that by Tobey, Reilly and Kane (1992), which concluded that global warming has no appreciable impact on global food production. Its methodological approach was criticized by prominent economists such as Partha Dasgupta and William Nordhaus, but it was supported by five Nobel Prize winners in Economics: Kenneth Arrow, James A. Mirrlees, Amartya Sen, Joseph Stiglitz and Robert Solow. Some subsequent studies, like Parry (2007), have confirmed that global warming is reducing potential agricultural production and increasing the risk of starvation.

2 "Climate Change and International Security", European Commission S113/08, 14 March 2008.



It is expected that in June 2009, at the meeting in Bonn of the United Nations Framework Convention for Climate Change, more detailed proposals will be presented regarding possible ways to provide insurance and compensation. The proposals so negotiated would be voted upon by the Conference of Parties (COP-15) in December 2009 in Copenhagen, Denmark.

According to the Global Climate Risk Index 2009 presented in Poznan, more than 15,000 people died in 2007 and $80 billion in damage was caused as a result of extreme climate phenomena[3].

CYCLONIC PHENOMENA IN CENTRAL AMERICA: THE EXTENT OF DAMAGE

The isthmus of Central America lies in the path of Caribbean hurricanes. Historically, their seasonal occurrence has caused material damage in the form of floods, loss of life and dwellings, destruction of crops and occasional loss of infrastructure.

In recent decades, the greater frequency and severity of cyclonic phenomena and other manifestations of climatic variability (droughts and irregular rainy seasons) have led governments in the region to establish a Regional Observatory for Food and Nutrition Security and a permanent forum for monitoring climate trends and conducting ongoing evaluations of the impact of seasonal forecasts for agriculture, fishing, water, nutrition, and health, and apply these to risk management strategies[4].

The structural vulnerability of Central American societies to disasters resides in their high poverty rates. Their exposure to these risks and, consequently, the magnitude of damage that could result, has been on the rise due to population growth and the grown of urban areas.

To measure this damage, the Economic Commission for Latin American and the Caribbean (ECLAC) has developed a methodology which, since the 1990s, has been regularly applied in the case of occurrence of such disasters[5].

The ECLAC assessment procedure with regard to socioeconomic aspects can be outlined as consisting of four main areas:

1. **Social sectors, especially**
   - a. Health
   - b. Housing
   - c. Education

2. **Production sectors, including**
   - a. Agricultural production
   - b. Livestock production
   - c. Industrial production
   - d. Forestry, services and others

3 The report indicated that Nicaragua climbed to third place in climate risk as a result of damage produced by Hurricane Felix (September 2007).

4 For institutions participating in the Regional Advisory Committee for Food and Nutritional Security, and the application of climate forecasts, see for example "VII foro especializado sobre la aplicación de los pronósticos climáticos para la gestión de riesgos en la seguridad alimentaria y nutricional", November 28, 2008.

5 See ECLAC (1990): "Manual for Estimating the Socioeconomic and Environmental Effects of Natural Disasters." The revised version of 2003 includes environmental damage and incorporates several of Bloomenstein's (2002) suggestions.

3. **Infrastructure, embracing mainly**
   a. Roads
   b. Electric power
   c. Telecommunications
   d. Aqueducts and sewage

4. **Environment**
   a. Water
   b. Forests
   c. Biodiversity

To assess damage occasioned by this type of disasters, ECLAC has established measurement criteria and a methodology to consistently determine the extent of damage to reserves and to production or income.

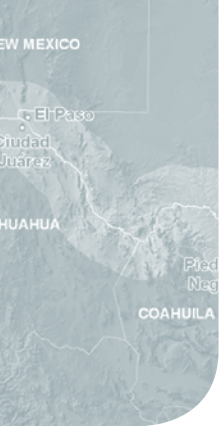
Table 1 shows ECLAC estimates for the impact of Hurricane Mitch, which hit in October 1998, on each of the Central American nations.

Both immediate and long-term damage are estimated. In the case of Honduras, the magnitude of destruction was so great that losses in the productive sector occurred almost instantaneously, while long-term economic effects and losses were predicted to be slight.

However, for Nicaragua, although losses were also enormous, particularly in terms of infrastructure, long-term economic effects were also judged to be substantial.

Table 1: Hurricane Mitch: Economic Impact

	Costa Rica	El Salvador	Guatemala	Nicaragua	Honduras	América Central
Población afectada	16,500	346,910	750,000	867,752	5,370,000	7,351,162
US$ miles						
Sectores sociales						
Daños	3,569	37,600	48,000	269000	439000	797,169
Costo de reconstrucción	29,755	67,400	52,200	233100	592600	975,055
Infraestructura						
Daños	25,096	74,300	115,800	340200	665400	1,220,796
Costo de reconstrucción	41,623	37,700	82,200	867300	687800	1,716,623
Sectores productivos						
Daños	62,424	269,200	579,000	369000	2640000	3,919,624
Costo de reconstrucción	27,000	42,500	217,200	196500	1151700	1,634,900
Medio ambiente						
Daños		7,000	5,100	8600	46700	67,400
Costo de reconstrucción			63,900	39600		103,500
DAÑOS	91,089	388,100	747,900	986,800	3,791,100	6,004,989
COSTO DE RECONSTRUCCIÓN	98,378	147,600	415,500	1,336,500	2,432,100	4,430,078
Como % del PIB	1.3%	4.3%	7.3%	65.7%	89.8%	19.6%
EFECTOS ECONÓMICOS	-	149,148	207,766	1,034,000	88,350	1,479,264
Como % del PIB	0.0%	1.2%	1.3%	14.9%	2.5%	2.8%



The extent of damage varied significantly from country to country. In some instances, losses involved irreparable harm, as in the case of Honduras, where plantations were obliterated by the hurricane.

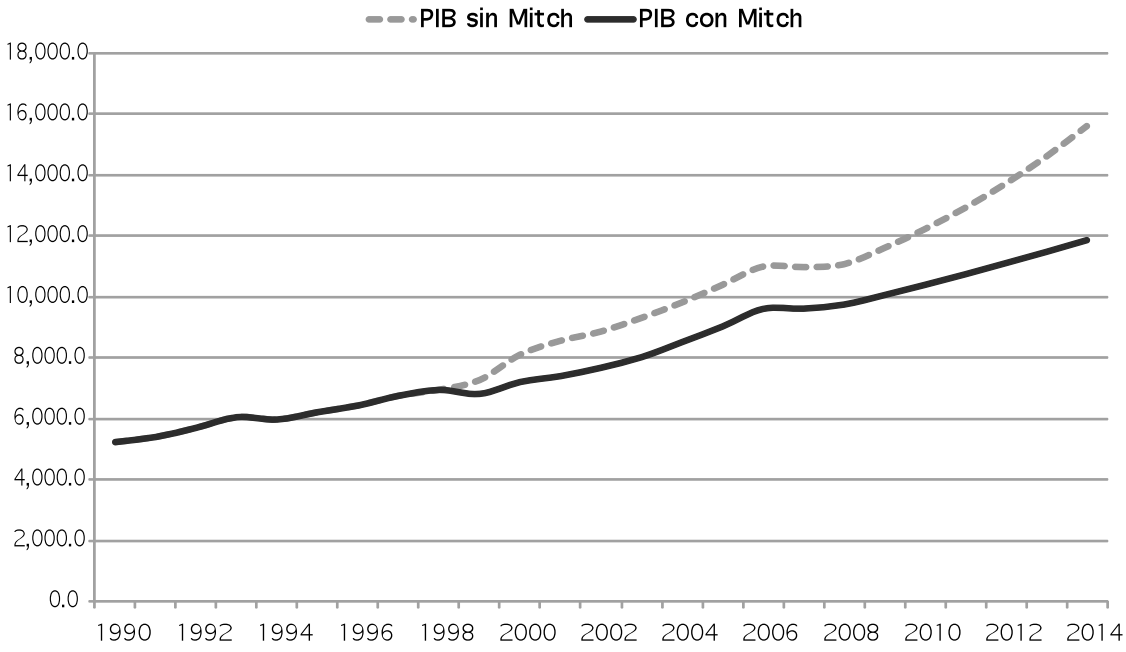
This methodology is also appropriate for calculating reconstruction costs necessary for renewing or restoring lost infrastructure[6].

LONG-TERM ECONOMIC COSTS

There is one additional socioeconomic toll which has not been included in the ECLAC model and which must be considered, particularly in regard to compensatory mechanisms being planned for the future. This factor involves the realization that loss of a portion of capital reserves, added to unrecoverable losses in production, causes production capacity to decrease.

The graph below illustrates the implications of Hurricane Mitch on the Honduran economy. The gross domestic product (GDP) is shown by the solid line, and the dotted line traces the direction the GDP would have taken in the absence of Mitch.

Graph 1: Honduras 1999-2014: GDP with and without Mitch



The underlying calculations for plotting each path are quite simple. Each year the GDP is the product of capital reserves and average capital productivity. Capital reserves are the result of a process in which annual investment accumulates. Naturally, depreciation of capital reserves is taken into account every year.

6 Bloomenstein (2002) stresses that the use of market prices to estimate replacement costs can be inadequate when markets have been disrupted and prices altered in the wake of a disaster.

In the years after Hurricane Mitch, capital reserves plummeted, and in 1998 the drop in value was equivalent to nearly 90% of the GDP. The GDP trend suffers a huge setback, since not only production is curtailed, but growth rates are also slowed by loss of capital reserves.

To assess the manner in which Honduras's GDP would have behaved, we need only to assume that the destruction of capital reserves did not occur and apply average productivity for the following years to the "without Mitch" levels.

The period 2009-2014 is a simple simulation of what the Honduran GDP will do as a result of the formation of capital that currently governs it and the alternative course, which could have continued had the destruction not occurred.

Using this type of calculation it is possible to estimate the true impact of the damage, not only as regards replacement of infrastructure, but also in terms of setbacks to expected economic growth.

These costs have implications for taxation, because a reduced GDP translates into lower tax revenues and, therefore, reduced availability of funds to invest in social services such as health and education.

It becomes obvious, then that the shock which a natural disaster can cause to a community, country, or region is an economic toll which goes beyond simple material losses. It lowers people's incomes as well as the availability of funding for health and education, both of which are permanent effects.

For this reason, discussion of compensation mechanisms in Bonn in July, which will be voted upon in Copenhagen in December 2009, must take into account that, over and above material damage actually incurred, prospects for prosperity in countries that have suffered the effects of climate change have been significantly impaired, to the extent that such damage stems from greenhouse gas emissions.

That is, material prosperity that the developed nations have attained is at the expense of economic setbacks in the most vulnerable countries. The cost involves not only loss of infrastructure, but also a human cost in the form of poverty, a factor which directly impacts health.

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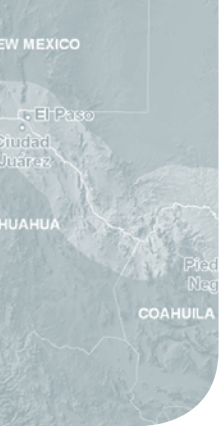

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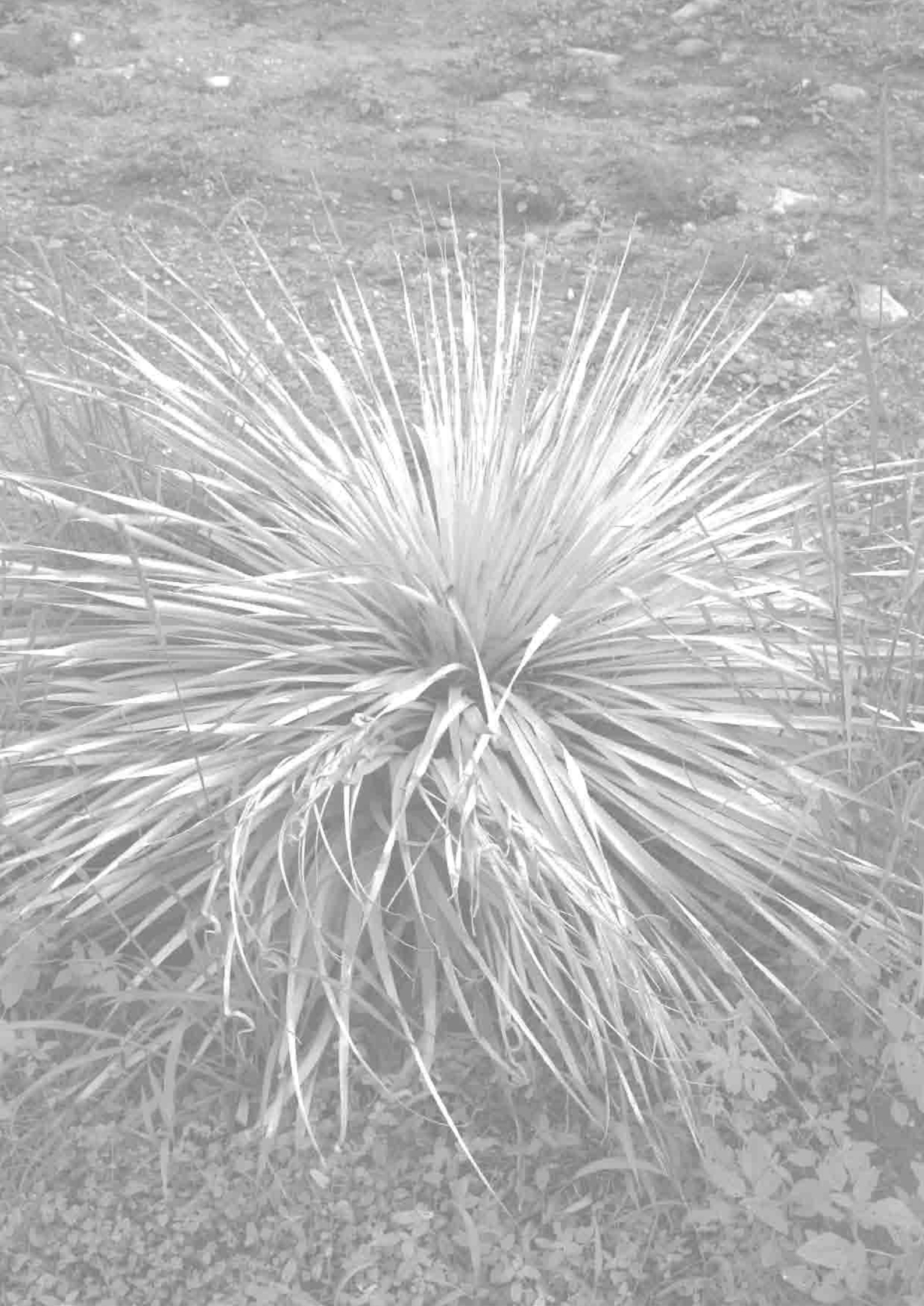

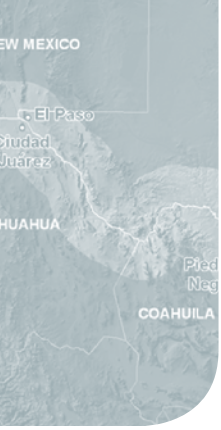

PREPAREDNESS AND RESPONSE TO EMERGENCIES AND DISASTERS IN EL PASO CITY/COUNTY AND SURROUNDING AREAS

Office of Emergency Management (OEM) for the city and county of El Paso, Texas

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INTRODUCTION

By Executive Order of the Governor of Texas GWB 95-1b Relating to Emergency management and The Texas Disaster Act of 1975, Chapter 418 et seq. of Texas Government Code, the Governor shall "… designate the Mayor of the municipal corporation and the County Judge of each county in the state as the Emergency Management Director for each such political subdivision". In the City and County of El Paso, the emergency management directors are: the mayor, city Manager and county judge who oversee and delegate the day-to-day emergency management program and mission to the emergency management coordinator (EMC).

Emergency Management is the process of coordinating available resources to deal with emergencies effectively, thereby saving lives, avoiding injury and minimizing economic loss. This is accomplished through organized analysis, planning, decision making, and assignment of available resources to prevent, protect from, respond to, and recover from the effects of all hazards.

The Mission of Emergency Management is to administer a program for the citizens of El Paso City and County to **Prevent**, **Protect** from, **Respond** to and **Recover** from, natural or man-made disasters. The El Paso City/County Office of Emergency Management (OEM) provides an all hazards approach to all major incidents. OEM serves the City and County of El Paso and will assist other areas whenever possible.

OEM is responsible for development and implementation of plans for the protection of the community and for minimizing the effects of a disaster. OEM is further responsible for designing and directing local emergency exercises, coordinating the activities of local agencies and resources during disaster, coordinating requests for assistance and providing information to the state and federal agencies during disaster operations.

When a major incident occurs, the City and County department heads, and state and federal officials, convene and operate in the Emergency Operation Center (EOC). The EMC assists the officials with their responsibilities during a disaster.

The EOC is where emergency operations are conducted:

- EOCs provide a means of centralizing and managing communications and information between the emergency management director's staff at the EOC and the Incident Commander in the field, and between the EOC and the public.

- EOCs manage a community's disaster efforts through the centralized, coordinated efforts of government officials, response agencies, and community volunteers.

During this season of a large number of hurricanes on the warm waters the Gulf Coast of Texas, the community of El Paso assisted the State of Texas and the County of Presidio by deploying All Hazard Incident Management Teams (AHIMT or IMT) and preparing sheltering operations for the care of evacuees.

A REGIONAL APPROACH

The Regional approach is a concept and a system that our area is attempting to bring to fruition. That is not as easy as it appears on paper. There is much planning that we, as a region, must perform. To bring all the various agencies, jurisdictions, responders, private entities, etc. to the table and get all to agree is not an easy task; and it is not because of ego's or agendas but rather the diversity of our region. The needs of the large El Paso urban and suburban areas differ greatly from one part of one area to another.

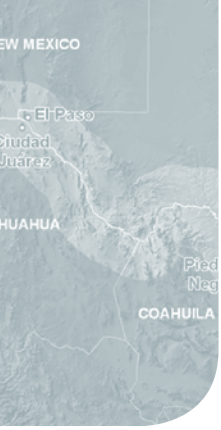
Our area/region is working through the issues and is working towards a truly regional approach. This is accomplished by the planning discussed above, coming together and agreeing in concepts and response issues and then finally putting them down in writing and gaining signatures on those documents and calling them "Mutual Aid Agreements" or "Memorandums of Agreement". The following are samples of such agreements in the El Paso region:

A. Bi-National Hazardous Materials Emergency Plan

This is a notification and training agreement between the City of El Paso, Texas; Sunland Park, New Mexico and the Municipality of Juarez, Chihuahua, Mexico.

B. Mutual Aid Agreement Between the City Of El Paso, Texas and US Army Installation Management Command Headquarters, US Army Garrison Fort Bliss Texas.

This is an agreement to secure for each, the benefits of mutual aid in fire prevention, training



activities, response to incidents involving weapons of mass destruction, hazardous materials, medical emergencies and fire.

C. Agreement for Mutual Aid Regional Interstate MMRS Response Capability.

This agreement is between the City Of El Paso and the County of Dona Ana, New Mexico.

D. Rio Grande Council of Governments Region Mutual Agreement. (Texas State Planning Region 8).

This mutual aid agreement is made by and between the cities and counties (which include: City of El Paso, County of El Paso, Village of Vinton, Town of Anthony, Town of Horizon, City of Socorro, Town of Clint, Hudspeth County, Dell City, Culberson County, Town of Van Horn, Jeff Davis County, City of Valentine, Presidio County, City of Presidio, City of Marfa, Brewster County, and City of Alpine) of the Texas State Planning Region 8 (as designated by the Governor's Office) but not exclude the Ysleta del Sur Pueblo and for the purpose of this document referred to as the "RGCOG" or "COG").

LOCAL ASSISTANCE TO THE STATE

The City Of El Paso has shown it's commitment to both the region and the State of Texas in it's willingness to respond in times of need. Examples of this are as follows:

A. Hurricane Dolly: The City Of El Paso deployed five members of an AHIMT. The team was trained earlier in the year by the Texas Forestry Service in Incident Management. They were tasked with responding to the region and falling under the incident command structure that was put in place by the Texas Forestry Service. The AHIMT traveled in two SUV vehicles to South Texas to assist with the effects and destruction of Hurricane Dolly. The five individuals where Battalion Chief Mike Moss, Battalion Chief John Davis, Division Chief Calvin Shanks, Lieutenant Daniel Medrano and Battalion Chief Ralph B. Johnson.

Arriving the day after the hurricane actually struck was quite an adventure for the team. They weathered the night of the hurricane in a local hotel in Weslaco, TX. The area lost all power and water; once it was safe to venture out of the hotel the team members were deployed to the area's "Regional Command Post". A plan was put into place to provide the command structure that would be needed at the various Points of Distribution (POD's) that were to be set up throughout the devastated area.

The Team oversaw the location set up from the beginning, devising traffic flow patterns for both vehicle and walk up traffic and all logistical support for the workers of the site; to include sanitary needs for workers, medical standby, and food and hydration needs as well. The teams members anticipated re-stocking needs (using forward planning techniques) and insured the sites were never without stock for the citizens for very long.

The task was daunting, however, there were distinct issues in the teams favor that made for a successful mission; some of them are listed below:

- The brunt of the work was performed by the Texas Military Forces. These individuals were nothing short of amazing with what they could, and did, accomplish. They arrived at

day break and worked through night fall in conditions that were not very comforting. The temperature was high as was the humidity.

- The local governmental agencies were extremely helpful. Even though their communities had been devastated, they were willing to sit down and work with the AHIMT's and devise a plan that would work. Great relationships were built through a solid foundation of trust and hard work.

- The citizens of the affected areas came out and volunteered their time to assist their neighbors and fellow citizens. These are the same individuals whose homes and businesses were ravaged by the storm that were coming out to assist those that were in even worse shape than themselves. This truly showed the spirit of not only Texans, but of all Americans.

- There were numerous companies that came out in support of their communities. But one in particular, HEB grocers, had a presence in almost every community and were very instrumental in our ability to distribute the food and water that was necessary to sustain life during the initial few days after the hurricane struck. We utilized their distribution center as our "Regional Command Center" and it doubled as the brain center for all supplies being received and distributed to our POD's.

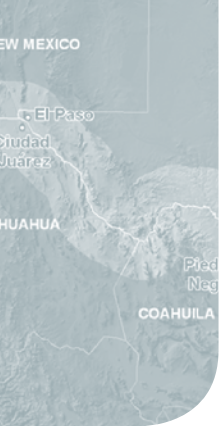
- The team stayed in South Texas for approximately seven days and experienced the positive effects the response and recovery efforts had on the community. The communities transformed on those seven days, from extreme devastated communities to communities coming back to life due to highly effective hard work and cooperation. The regional cooperation was at its best.

B. **Hurricane Ike:** The City of El Paso supported the State during one of its worst hurricane storms in decades; Four members of the area's All Hazards Incident Management Team deployed to assist; Battalion Chief John Davis, Battalion Chief Mike Moss, Lieutenant Daniel Medrano and Battalion Chief Ralph B. Johnson. They were sent into Houston the morning after Ike had delivered its destructive winds and torrential rains through the city. Again, the team utilized two SUV's and equipment purchased for just this type of deployment.

- The team met up with the command post at Reliant Stadium; Reliant Stadium is where the Houston Texans professional football team plays. The stadium was loaded full with response vehicles; ambulances were the majority. It was quite evident from the beginning that this would be different from Hurricane Dolly.

- The team was given their orders; two would go to Galveston Island and two would go into the Beaumont area. Both areas had suffered the devastating effects of the storm and the primary goal was to move the people that had not previously evacuated.

- The team that went to Galveston Island saw a community that had been completely destroyed; buildings that had stood for over a century washed or blown away; roadways that were completely impassable. Citizens had evacuated to a high school gymnasium that had no electricity or running water. The IMT team's task was to oversee the ambulance strike teams that had deployed to the island to assist in the evacuation of those citizens that wanted to leave.



- The two team members on Galveston Island worked 14-18 hour/day until the evacuation efforts were concluded. They also were tasked with overseeing other ambulance strike teams that had been deployed to the mainland area close to Galveston Island.

C. **Hurricane Gustav Local Efforts:** The City of El Paso assisted in preparing our community to receive hundreds of general population evacuees as well as special needs evacuees from the affected areas of the coast of Texas due to Hurricane Gustav. The community of El Paso banded together and performed sheltering operations in very short notice.

- The El Paso Convention Center was set up to house up to seven hundred general population evacuees. The hundreds of cots were cordoned off to facilitate the separation of males from females and areas that would keep families together as well. Feeding areas and personal hygiene needs were also put in place.

- The Deployment Arrival Command and Control Group (DACCG) facility on Biggs Army Air Field was set up to accept, both litter bound patients as well as those that were ambulatory. A triage, treatment and transport area was designated and stocked with necessary supplies and equipment.

- The Sun Metro System had buses standing by to facilitate the fast transport of the evacuees to either the convention center or to medical treatment facilities.

- Regional Ambulance services sent ambulances when we called and asked for their help. They were staged at the DACCG and readied to transport litter bound patients to waiting facilities.

- Numerous other agencies were on standby and ready to assist with all levels of patients.

Though El Paso never did receive any evacuees during Hurricane Ike or Gustav, the preparation that was undertaken to be ready, if and when we did receive evacuees, proved one thing: A Regional Approach is a must for any community that truly expects to get through a disaster; whether it is the affected community or the community providing assistance.

El Paso is very lucky to have been in the "Planning" phase for the past decade with the region. Are we where we need to be? We do not believe any community is ever to that point; but if we all continue to plan as a region we will fare much better in the time of a disaster than if we don't. So, for our community, we decided along time ago to do it as a region.

EL PASO ASSISTANCE TO PRESIDIO

This is an account of the actions taken by the City of El Paso's IMT members, starting with their deployment to their demobilization.

Chronological Description of Events:

The highest elected official of the affected area must declare an emergency status with the state of Texas. Judge Agan makes this request to the state.

September 14, 2008 – 10:00 pm:

Status:

Emergency evacuations ordered by Presidio County Judge Agan. The threat of breach could flood many low lying residences and businesses. The concern is that the levies will not hold much longer. Threat of flooding is imminent. Many area residents observed parked around the city on hills in anticipation of the rush of water. They do not want to go to the shelters.

Mexican authorities are releasing water from the dam on the Mexican side so that the dam does not break. They are expected to continue releasing water for the next couple of days. Populations have been advised that when the emergency sirens go on, the city will notify local citizens that they have only minutes until potentially dangerous flood waters will affect the low lying areas. Residents have been advised to move to higher ground.

Request has been made to Midland County EMC for additional emergency management support. The status of assistance is unknown at this time. The command center is being operated out of Border Patrol HQ in Presidio.

Actions Taken by the Presidio Officials:

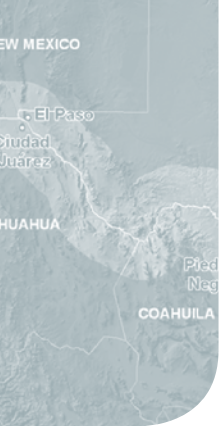
The State of Texas Department of State Health Services (DSHS) was notified and a contingency from El Paso deployed and ensured health and safety issues were addressed.

Shelters - 2 shelters operating

- Elementary School – population of 80; local residents were managed by the Independent School District – 3 Medical Special Needs patients on O2 under the care of schools nurses.
- Activity Center – population of 70, managed by the local private clinic staff (Dr. Sumerlin practice).
- Other facilities will be opened if needed.
- Both shelters received cots from the Red Cross and are expecting more to support up to 500 residents if needed.
    - Preliminary walk-through determined food operations should be adequate to support operations. Restroom facilities should also be adequate.
    - Elementary School has showers, although they were not operating while El Paso IMT members were there. Activity Center does not have showers.
    - No assessment of population health status.

Medical Support

- Dr. Linda Sumerlin will be available for the next few days. She is the only physician in the community. There are two RN's and two LVN's.



- Dr. Sumerlin may be contacted.
- No Pharmacy, limited supplies on hand.

EMS

- 2 ambulances in Presidio, only one is operational.
- Mutual agreement in effect with Marfa for ambulance back-up.
- El Paso had placed two ambulances and two EMT paramedics and two EMT basics standing by and ready to deploy.

September 15, 2008:

- Provided regional Director with update.
- Obtaining general supplies to take to Presidio to support DSHS staff at clinic.
- Establish command center at Presidio Field Office.
- Coordinate medical conference call once in Presidio.
- Provide hand sanitizer to shelters.
- Obtain general health status of populations through interviews of residents.
- Conduct foodservice inspections and Environmental Survey of Shelters.

Unmet Needs: (in the event of levy failure)

- Emergency medical physicians and nurses
- Additional EMS support
- Vector Control

The Texas Department of Public Safety (DPS) coordinated and requested the Texas Department of Transportation (TXDOT) for heavy equipment and the International Water and Boundary Commission for river and levee experts. These agencies also were deployed from El Paso.

September 16, 2008:

The rains in Mexico continued, the Dams were at peak levels and they were estimated to fail unless the incoming water was released. The water released ultimately caused a breach of the Rio Grande banks on the Mexican side of the river which flooded the City of Ojinaga in Mexico. This breach was north of the City of Presidio, the banks failed again but this time, on the United States side along the south end of the city of Presidio.

September 17, 2008:

The Governors Division of Emergency Management (GDEM) tasked the Texas State Forestry Service to proceed to Presidio to mitigate the situation and prevent the loss of life.

September 18, 2008:

The El Paso Office of Emergency Management was notified. At the close of business, arrangements were made and a contingency from El Paso deployed the next day.

September 19, 2008:

El Paso IMT members arrive at Presidio and provide a report of the situation, response, accomplishments, and goals.

Situation:

Due to large amounts of rain in Mexico, especially in Northern Mexico, the banks of the Rio Grande near Presidio, Texas are about to break. The judge of Presidio declared a state of emergency. The levee in the southern part of town did have a minor collapse causing flooding and evacuation of the immediate low lying area. Sheltering is occurring in the elementary school. The Texas Forestry Service arrived and commenced to mitigate the situation. El Paso assistance was also requested.

Response:

The IMT members deployed from El Paso were a logistics officer, a safety officer, and one technical specialist and two licensed vector control technicians.

Accomplishment:

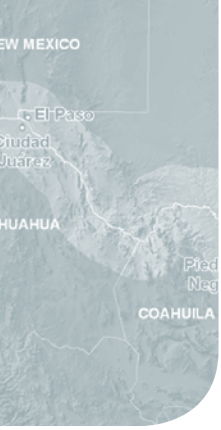
Immediately the IMT members were briefed of the situation and vector control went out to survey the flooding and developed a plan of attack on the mosquito infestation. The safety officer reviewed the Incident Action Plan and went to the field to observe the lay out of the secondary levee that needed to be built. The logistics officer assessed the necessary Incident Command System forms and worked with the planning chief for the purpose of ordering resources from the state.

Goal:

Preventing the flooding of the city of Presidio, Texas was the primary goal. This will be accomplished by creating a secondary levee on the North side of town. Along a railroad trestle 600 super size sand bag sacks will be lifted and dropped by five Chinook CH-47 helicopters thus creating a second levee which will block the water from entering the city. Thousands of regular size sand bags were made by 200 prisoners to be placed along this second levee. This plan will go into full force the following day.

A small example of some of the items requested through the Disaster District Chair (DDC) and the Medical Operation Center (MOC):

- Received plastic sheeting: 11 of the 20' x 50' and 10 of the 20' x 100'. This was laid out along the levee banks and reinforced with sand bags on top to keep the plastic in place.
- Received 27,648 individual military style Meals Ready to Eat (MRE) for emergency responders and the community.
- One truck of ice (4000 bags per truck). This was the fourth truck for the workers and the community.



- Received an additional truck of bottled water, total of two, 10,000 bottles of water.
- Received a 400 kilowatt generator to provide power to the Shelter and Command Post.

September 20, 2008:

Gov. Rick Perry has issued a disaster declaration and requested a presidential disaster declaration for Presidio County in response to floods threatening lives and homes in the area. An excess release of water from reservoirs in northern Mexico and the continuing heavy rain has caused a levee breach along the Rio Grande River.

Yvonne Vásquez from the El Paso Public Health Department, Chief Victor Acosta, Chief John Davis and Chief Michael Moss from the El Paso Fire Department, Lt. Steve Córdova and Lt. Danny Medrano from OEM, responded as All Hazards Incident Management Team members assisted with the command and control effort.

The El Paso Health Department Vector control team also responded and was successful in spraying the City of Presidio and the surrounding areas. They continued to maintain vector control and collected vector samples that were sent to Austin for disease testing. When they were released, vector control was continued by the Presidio Municipal Services.

Prior to the arrival of any assistance, the Presidio community came together in time of crisis. Women and men of all ages and school children were filling sandbags around the clock. One account of the community response was “little old ladies are out there filling sandbags”. Filling sandbags was crucial to averting major flooding. Fort Stockton Correctional Facility eventually sent 48 prisoners. By the end of the emergency operation, over 6,500 feet of levee was reinforced with over 25,000 regular size sandbags and air operations dropped giant sandbags weighing between 3,000 and 3,500 pounds.

After the response phase and return of the El Paso teams, the brave and dedicated officials and people of the Presidio community continued sheltering operations and monitoring the dam. The successful response from the start would not have been possible without the help of the entire Presidio community.

BE PREPARED

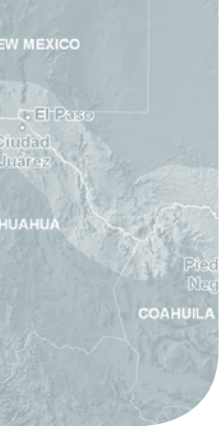
When a disaster strikes, it is not only the responsibility of the government to be prepared, but also the entire community. The community plays a major role in preparedness. There are certain actions that can be taken by individuals and families to lessen the impact when a disaster occurs. The people of a community will be better able to survive a major incident if they prepare for the unexpected and get informed, develop a family communications plan, and prepare an emergency supply kit.

Every member of the community can make a difference during an emergency by the actions they take, especially if they are prepared for emergencies most likely to occur in their area. The people of the community must be knowledgeable of the potential emergencies that can occur in their area. For example, there are certain potential emergencies that are prone to happen depending on the region. There is an obvious need to be prepared for earthquakes in California. Other hazards range from frequent flooding to extreme weather temperatures; both extreme droughts and severe winter storms can paralyze even the major communities. Armed with knowledge of what emergencies

are more probable in their area, the better people will be prepared to take the necessary actions. Emergency plans have been established by state and local governments for the macro perspective of community wide response. Certain facilities and buildings also have specific emergency response plans such as the workplace, schools, and daycares.

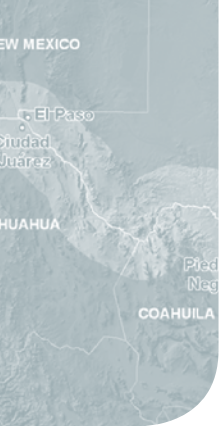
The following are some key examples of what a personal or family emergency plan should contain:

- How to contact each other; long-distance phone number of friends or relatives should be listed, predetermined out-of-town contact where family members can call and check-in and relay messages stating the location and condition of the family member. When you have selected an out-of-town contact, make sure everybody involved in the family emergency plan knows the phone number and has a method to communicate to that number like a prepaid phone card.
- View and listen when possible to emergency radio or television broadcast for information of the proper actions to take.
- Basic necessities such as fresh water, food, clean air and warmth. A supply of blankets and/or sleeping bags and a complete change of clothing appropriate to climate.
- When clean air is a necessity: heavyweight plastic bags or plastic sheeting, some duct tape and scissors to create a barrier.
- Flashlights and extra batteries, a cell phone or whistle to signal for help, a can opener for canned food items, wrench or pliers to turn off utilities, moist towelettes and garbage bags for personal use.
- Prescription medication or glasses, infant formula and diapers, pet food and extra water for your pet.
- Aspirin or non-aspirin pain reliever, anti-diarrhea medication, antacid, and laxative.
- Important family documents such as insurance papers, photo IDs, bank account records, and proof of ownership for residence and vehicles in a safe place that is waterproof.
- Cash and travel's checks and change are recommended.
- Matches in a waterproof container, paper and pencil, books, games, puzzles or other activities that can be used by children and adults to pass time.
- Fire extinguisher.
- Personal hygiene items to include feminine supplies.
- Emergency supply kit that includes a first-aid kit; mess kits, paper cups and plates, plastic utensils and paper towels.
- Consider taking a first aid class. A handful of medical supplies are recommended like glucose and blood pressure monitoring equipment and supplies. Some items that are often overlooked are scissors, tweezers and petroleum jelly or other lubricant. Having the mentioned items can help you stop bleeding and/or prevent infection when medical services are held up handling emergencies in a widespread disaster.



The above is a brief description of what is needed. There is a plethora of information available for anyone who wishes to be prepared. Most communities have public safety response agencies which have emergency plans that address the emergencies that might befall the region. More information is available from many local, state and federal agencies such as: emergency response agencies, public health departments and emergency management offices. For more thorough information and guidance on how to prepare a personal and family emergency plan and what supplies are needed, the El Paso Office of Emergency Management recommends the following websites: the United States Department of Homeland Security at www.ready.org and the American Red Cross at www.redcross.org/BeRedCrossReady/.

It takes the entire community to Prevent, Protect from, Respond to and Recover from disasters. Volunteering in your community is essential for successful emergency response and recovery. Volunteerism is a self rewarding and vital aspect of disaster response. Contact local nonprofit agencies or call local government officials for information.



CLIMATE CHANGE: VULNERABILITY IN PRIORITY SECTORS, SPECIFICALLY IN HEALTH

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Risk Management Committee, Ministry of Health, Federal Commission for Protection against Sanitary Risk (COFEPRIS)

BACKGROUND

The dangers of climate change on health worldwide are diverse, ranging from increased risk of extreme weather events to modifications in the dynamics of infectious diseases.

Some of the repercussions on health are already being observed: rising death toll from heat waves, variation in the incidence of vector-borne diseases such as malaria and dengue, and increasing malnutrition and diahrreal diseases.

The World Health Organization (WHO) stated in 2008 that the global repercussions of climate change will have a disproportionate effect on vulnerable populations, such as young children, the aged, the sick, the poor, and isolated populations.

In 2005, climate change was contributing to the death of 150,000 people and sickening five million each year (WHO, 2007). Rising temperatures kill people in the form of heat waves or by triggering increasing numbers of natural catastrophes such as floods, typhoons, cyclones and droughts. These phenomena reduce water quality, spreading illness such as diarrheal diseases. Increases in rainfall and temperature also impact the behavior of tropical diseases like dengue and malaria.

Recent climate changes have had various health consequences, such as the death of 44,000 people during a heat wave in Europe in the summer of 2003.

THE SITUATION IN MEXICO

Because of its geographic location and its population distribution throughout the length and breadth of its national territory, Mexico will see direct and immediate change wrought by climate change upon elements that are key to human health (air, water, soils, food, and ecosystem equilibrium, among others). The National Institute of Statistics, Geography, and Informatics (INEGI) reported in 2004 that in Mexico there has been a significant rise in population in urban areas facing sanitary risks.

At present, there are some 18 million Mexicans living in areas at high risk for flooding. The result is that one fifth of the country's population is highly vulnerable to climate change in the form of El Niño/La Niña events or the rising incidence of extreme rainfall and storms such as devastating hurricanes.

One of Mexico's top short-term priorities is to strengthen public health systems in response to the threat of climate change. More investment must be made in public health systems in order to meet the Millennium Development goals relating to health. To this end, at the national level the health sector must:

1. Assess possible repercussions of climate change on health and determine to what extent health systems currently in place can cope with the added threats of extreme weather, and

2. Formulate and implement adaptation strategies to improve operations and offer protection against climate risks. This approach will involve internal interventions within the health sector itself, such as control of tropical diseases and providing primary care, as well as ensuring an adequate water supply for human consumption and sanitation. An ongoing concern should be to guarantee equity in sanitation and give priority to protecting the sanitary safety of especially vulnerable groups.

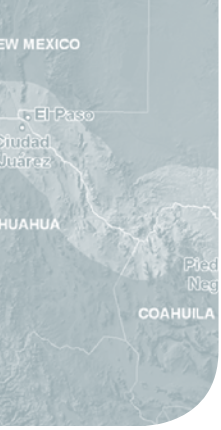
In order to build capacity in facing public health emergencies, it is particularly urgent to strengthen the ability of health systems to respond to acute crises associated with climatic variability, in particular the impact of increasingly common and severe natural disasters and epidemics exert upon sanitation.

Another course of action is to promote sanitary development. Health organizations at the national and regional levels must promote health by assessing the impact on sanitation of decisions made in other sectors, such as urban planning, transportation, and generation of energy, food production, land use, and water resources. In this way, health organizations can support those decisions that offer opportunities to improve health and at the same time reduce greenhouse gas emissions that contribute to climate change: for example, new investments in sustainable transportation and development of clean energy sources.

Effective research into aspects of safeguarding health against climate change will depend on obtaining better data and evidence of the efficiency and effectiveness of public health measures to be taken in this regard. This research must be systematic and interdisciplinary and have short-term applicability.

Particular attention should be paid to sanitation as it applies to vulnerable groups, and evaluation of interventions targeting these populations should be given high priority.

Moreover, it is vitally important to encourage interdisciplinary partnerships in seeking effective, wide-ranging solutions in the form of mitigation and adaptation. Mexico should establish these types



of alliances in three hierarchies (federal, state, and municipal) and regionally, taking advantage of technical knowledge possessed by governmental, intergovernmental, and nongovernmental organizations, communities, industry, and professional groups.

Failure to respond will mean paying a price in terms of disease, expenditures on sanitation, and loss of productivity. It is estimated that the direct and indirect cost to sanitation and lost income from diseases caused by the environment (for example, by air pollution) are often equal to or greater than expenditures necessary to address the environmental risk in question.

MEXICO'S STRATEGY FOR DEALING WITH CLIMATE CHANGE

Within the framework of the National Strategy for Climate Change (ENACC) and the Special Program for Climate Change (PECC), the Ministry of Health is implementing strategies to prevent and mitigate the effects of climate change on public health, particularly that of vulnerable populations. The Ministry of Health is:

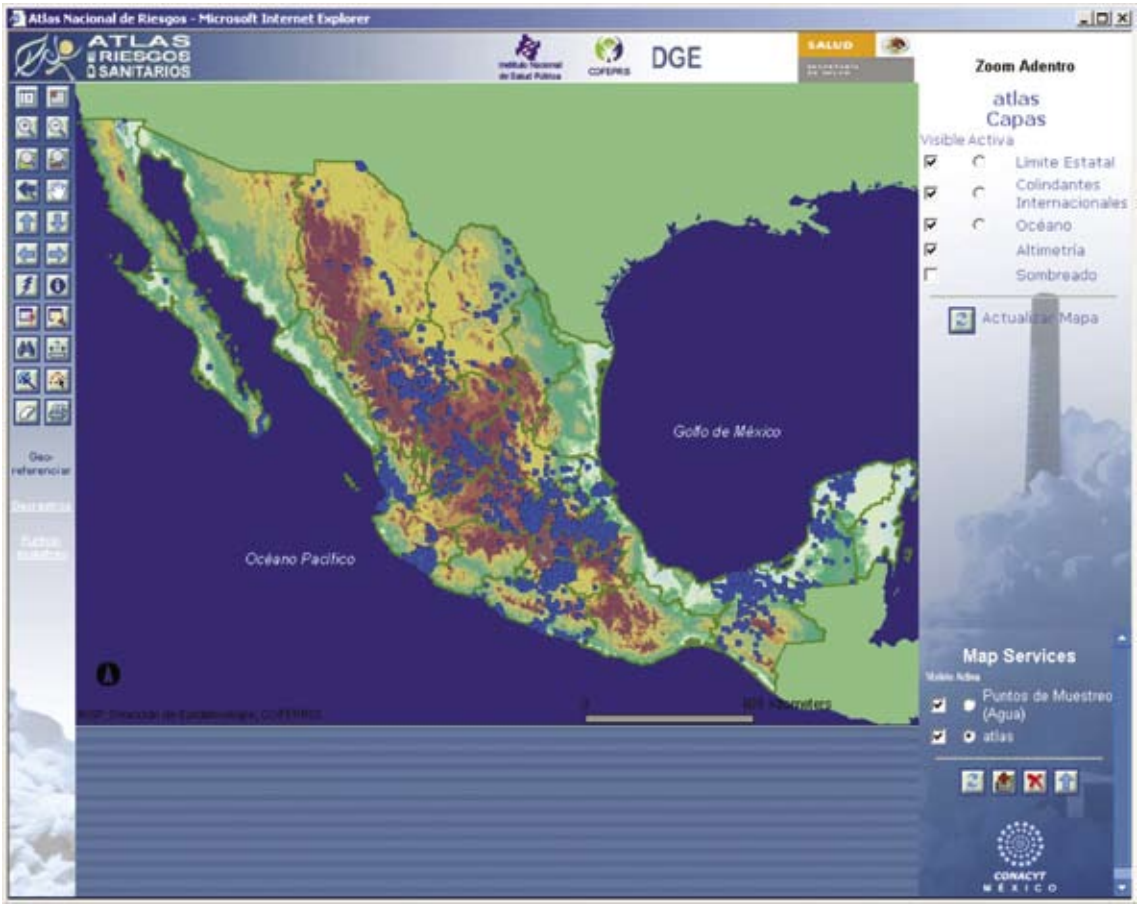
1. **Assessing climate change scenarios for different social groups, based on demographic projections.**

   The creation of the National Atlas of Sanitary Risks by the Federal Commission for Protection against Sanitary Risks (COFEPRIS), in collaboration with the National Institute of Public Safety (INSP), the Bureau of Epidemiology, and the National Center for Epidemiological Surveillance and Disease Control (CENAVECE), will enable authorities to prevent and control adverse effects of environmental factors in exposed populations by providing early warning in situations where environmental risks can arise.

   How:

   - Collect information about at risk populations. Risks to be considered are, among others, those arising from burning fossil fuels and biomass, quality of water for human consumption, hospital care infrastructure, environmental contaminants (both inside and outside the nation), etc.
   - Produce thematic maps showing morbidity and mortality as they relate to important sanitary risks.
   - Create forecast models for risk assessment.
   - Create economic scenarios about the effects of exposure to various environmental contaminants on human health.

Figure 1: Preparation of maps detailing vulnerable areas



2. **Developing public health action plans based on temperature warning systems.**

   By creating epidemiological surveillance systems to identify vulnerable populations and protect them against climate change (floods) and to prevent drops or rises in temperature in the country.

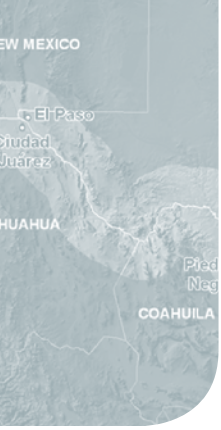
   Indicators:

   - Vulnerable population.
   - Morbidity rates for respiratory ailments due to lower temperatures.
   - Mortality rates due to temperature increases.

3. **Establishing surveillance programs for vector-borne diseases.**

   To be developed by CENAVECE.

4. **Conducting activities to raise awareness and involvement on the part of the general public in efforts to avoid risks to the population.**



5. **Assessing climate change scenarios for various social groups based on demographic projections.**

   From exposure to toxic or hazardous substances.

   Reduce concentrations and volume of greenhouse gasses.

   Protect the population against physical, chemical, and biological substances and agents arising from the use of pesticides, fertilizers, chemical precursors and essential chemicals.

   How:

   Identify and develop plans to manage toxic substances, pesticides, fertilizers, chemical precursors and essential chemicals in the atmosphere at the local, regional and global level.

6. **Creating maps of vulnerable areas.**

   Risks from environmental factors.

   Cut down on the release of greenhouse gasses into the atmosphere cased by combustion (industry, vehicles, burning of biomass).

   How:

   Establish impact measurements and indicators for health risks to the population from exposure to substances and emissions resulting from combustion processes.

7. **Devising public health action plans based on early warning systems providing information about temperature change.**

   Basic sanitation

   Contribute to reduced generation of greenhouse gasses coming from waste generated in hospitals, slaughterhouses, and other places.

   How:

   - Reduce emissions from burning of hazardous waste.
   - Reduce CO_2 emissions arising from combustion of biomass in rural areas of the country.
   - Conduct campaigns to avoid exposure to substances harmful to health and step up recycling and reuse of materials.

To achieve adequate institutional capacity and instrumentation for combating health problems relating to climate change, the Ministry of Health must adopt a preventive approach grounded in multisectorial cooperation in the areas of public health, healthcare, and sanitary interventions, and in the short term it must:

- Review the budget assigned to the health sector to effectively deal with effects of climate change and create a climate action office within the health sector.

- Create a government agency to deal with issues of climate change to be charged with:

a. Research

b. Solving problems stemming from climate change

c. Develop interdisciplinary programs

d. Manage resources

To accomplish these goals, all three levels of government, as well as the general public, must participate in assessing, designing, and implementing programs and strategies to mitigate the impact of climate change on health.

Conduct scientific studies to quantify financial costs that climate change could bring in terms of public health in Mexico.

COFEPRIS has demonstrated, by means of a diagnostic analysis carried out in ten states of southern and southeastern Mexico, as part of the Program to Strengthen Protection against Sanitary Risks, that one peso invested in prevention would save eight pesos spent on treatment. Studies exist that quantify public health costs of the effects of atmospheric pollution, measuring the cost of respiratory diseases. These data support the decision to invest in preventive health. This literature can be consulted on the internet at: www.cofepris.gob.mx

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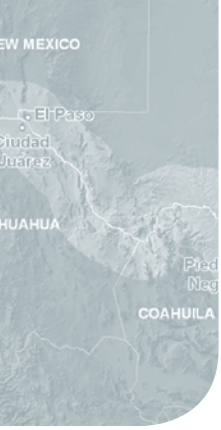

THE IMPACT OF CLIMATIC VARIABILITY ON SOCIETY AND PRODUCTIVITY IN MEXICO

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INTRODUCTION

The onslaught of climate change has had a significant impact on the most vulnerable societies and has demonstrated how fragile ecosystems can be. Moreover, the damage to natural resources which changing climate patterns produce, specifically in developing countries, has taken on alarming proportions. For example, in Mexico, deforestation has affected biodiversity, transforming regional climate in a vicious cycle; erosion of soils has resulted in diminished capacity to meet the demand for foods; additionally, depositing of sediments in water storage facilities has made it more difficult to extract water for diverse purposes (Sánchez, et al. 2008 A).

Human and environmental safety are two of the topics appearing on the international agenda of processes for mitigating the effects of climate change. In human terms, it is mainly a matter of alleviating poverty, while in the environmental context the principal concern is with deterioration of natural resources brought on by various human activities. Assessing the significance of climate disasters is complicated by questions of vulnerability, which may be defined, in practical terms, as the capacity to overcome risk (Sánchez, 2005), or, within a more academic frame, as the conditions brought about by physical, social, economic, and environmental factors which make the individual more susceptible to the impact of climatic threats (O'Riordan, 2002).

Threats to environmental security are related to a cluster of six key factors, representing three natural elements – water soil (degradation and scarcity), and air (pollution, climate change and the diminishing ozone layer) – in combination with three factors dealing with demand: population

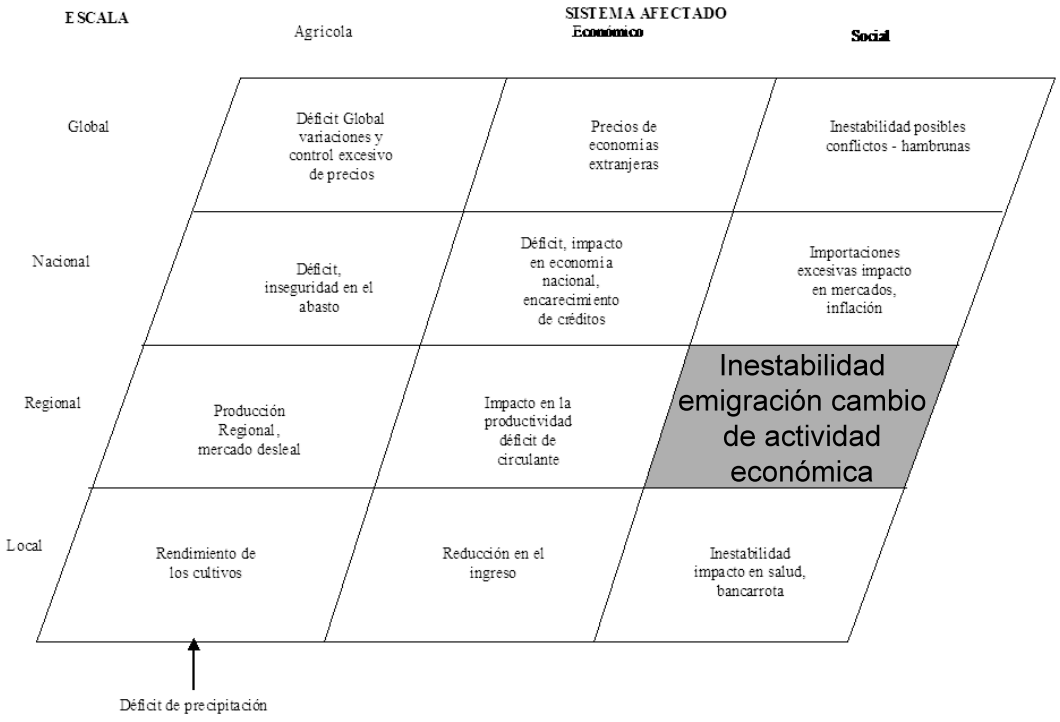
growth, urban issues (urban development, contamination, and contamination caused by man), and rural aspects (agriculture, food production, and minerals). (Oswald, 2007).

In terms of climate-related human safety, in developing countries there are two main causes of migration: surplus of water and shortage of water (Sánchez et al., 2008 B). The effects of these causes can be classified into three principal categories (Knuston et al., 1998):

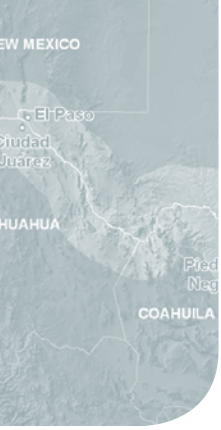
1. Economic
2. Social
3. Environmental

Figure 1 is a matrix of impacts in the presence of an extreme event such as drought. The highlighted box shows the system affected (social) and the scale of greatest impact (regional). Thus, in Mexico, climate uncertainty has spurred change in economic activity as well as migration away from rural areas.

Figure 1: Impact matrix for different scales and systems affected. Highlighted box illustrates the current situation in Mexico. (Sánchez 2005, modified by Warric and Bowden, 1981)



As a function of the vulnerability referred to earlier, the effects of drought on the economy and society, measured in terms of material losses, population affected or loss of human life, took on greater or lesser relevance, leading to situations in which drought is considered catastrophic.



Although vulnerability is not a synonym for poverty, in developing nations there is a close connection between the status of the economy and the capacity to overcome risk. Thus, adverse climatic events impact society as a whole, but the most tangible effects are felt by persons living in poverty. It is clear, then, that the different ways in which society and the economy of a region can suffer the effects of extreme weather events are a function of their degree of vulnerability.

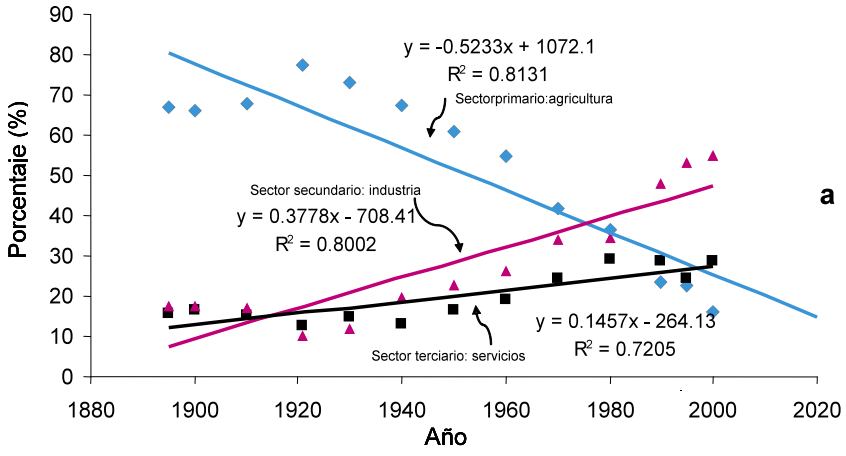
IMPACTS OF CLIMATE VARIABILITY IN MEXICO

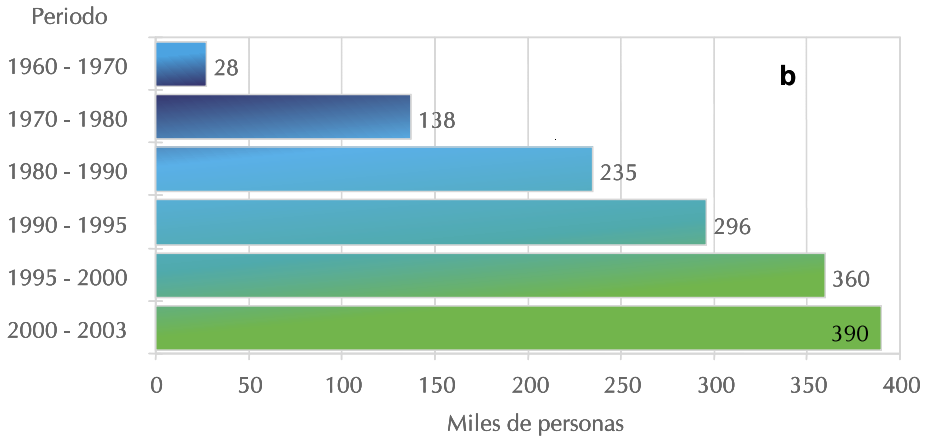
Social impacts

In the agricultural and livestock sector in Mexico, 50% of losses are due to droughts, 23% stem from flooding and 27% to other causes (Tiscareño, 2006). This sector is the principal consumer of water and soil: irrigation agriculture uses 78% of water extracted in the nation, with livestock production accounting for 2%. With regard to use of soil, about 23 million hectares (56.8 million acres) are dedicated to crops, and approximately 112 million hectares (276.6 million acres) to raising livestock. Almost 70% of the nation's land is used in agriculture and livestock production (CNA, 2006), which underscores the extent to which social wellbeing depends on agriculture and livestock production, and therefore the importance of the availability of water for use in these industries.

In Mexico, 23.5% of the population lives of activities related directly or indirectly to agriculture. This population has decreased considerably over time, dropping from 57.4% in 1950 to 23.5% in 2005, representing an annual rate of decline of 3.3%. If this trend continues, rural population will dip to near zero levels in the next 35 years (see Figure 2a). Beginning in 1920, migration from rural areas to cities or abroad rose so dramatically that, at the present time, an average of 400 people leave rural areas each day. The rise in the number of people working in other production sectors is not proportional to the decrease in those working in agriculture, because persons who abandon agriculture emigrate to another country or lack formal employment (see Figure 2b).

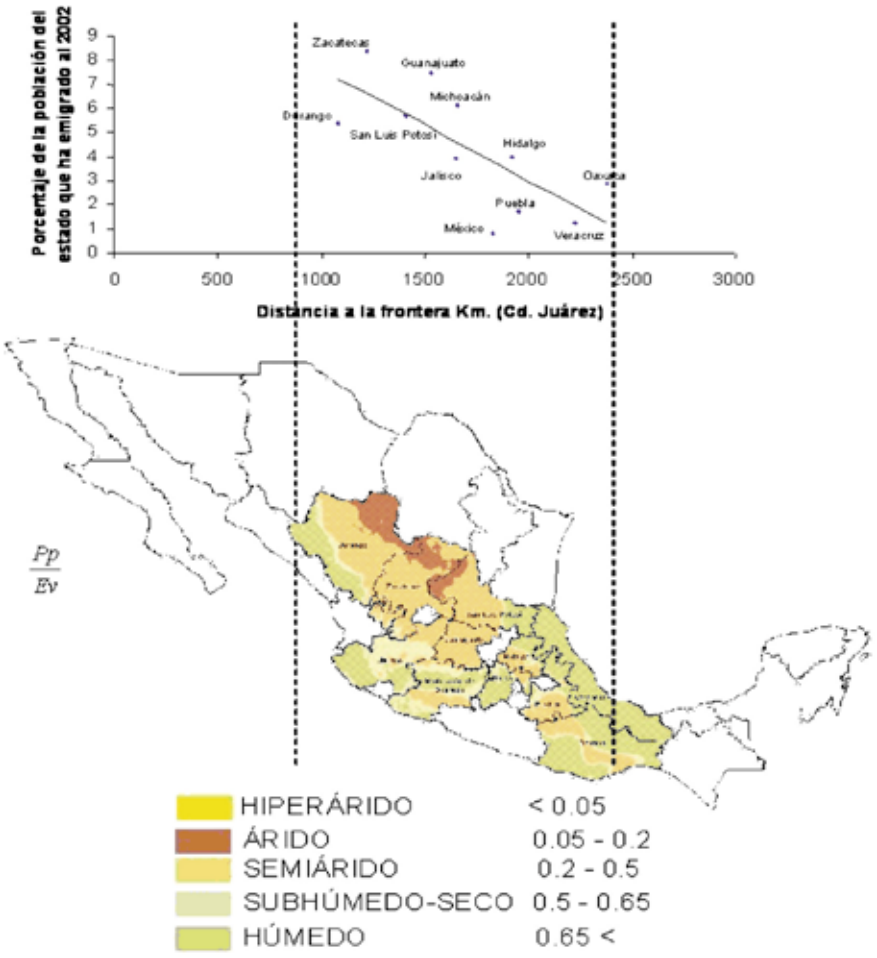
Figure 2: Variation in economic activity in Mexico's productive sectors (a) and levels of emigration away from rural areas (b)





Climate plays a major role in this emigration process, as do other factors to be mentioned later. Figure 3 shows the relationship between emigration from states with the highest emigrant rates and the climate of Mexico. As can be seen, there is a negative correlation between distance to the border and the percentage of the state's population who emigrate. The relationship between the emigration and the degree of aridity can also be observed.

Figure 3: Relationship between distance to the US border, climate and emigration rates in Mexico for states with the greatest rates of migratory flow (Sánchez et al., 2008 A and B)



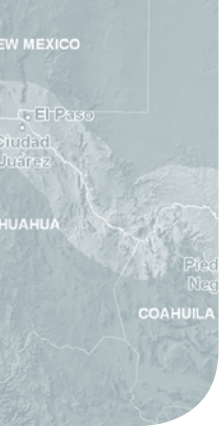
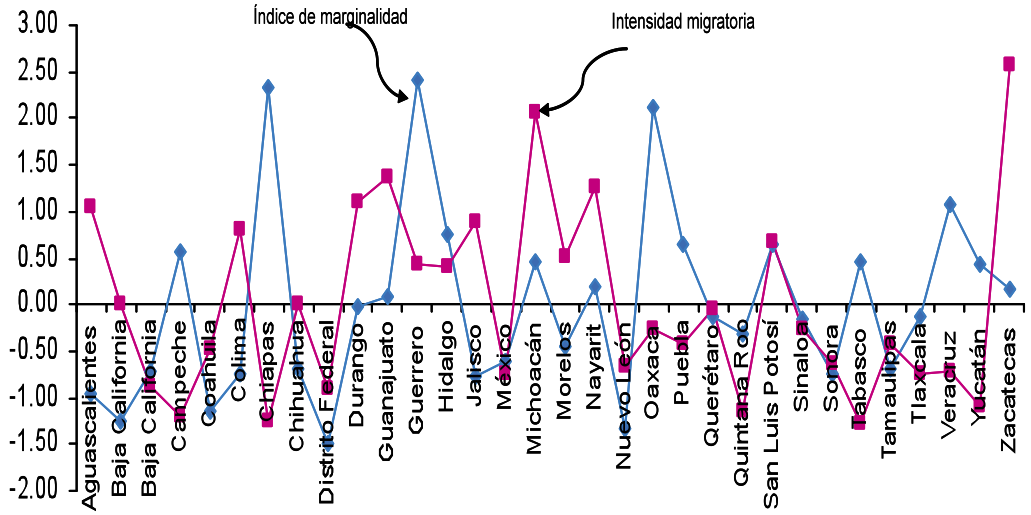


Figure 4 shows the degree of marginalization as compared to migratory activity for Mexican states. Chiapas, Guerrero, Oaxaca, and Veracruz, which have the greatest rates of marginalization, are in the regions most vulnerable to extremes of climate. Figure 4 also shows that the states of Veracruz, Chiapas, Tabasco, Guerrero, Oaxaca and Michoacán have low emigration rates (but high marginalization), given their distance from the US-Mexico border (Sánchez et al., 2008 C).

Figure 4: Marginalization compared to migratory activity in Mexico. (Sánchez, et al., 2007)1



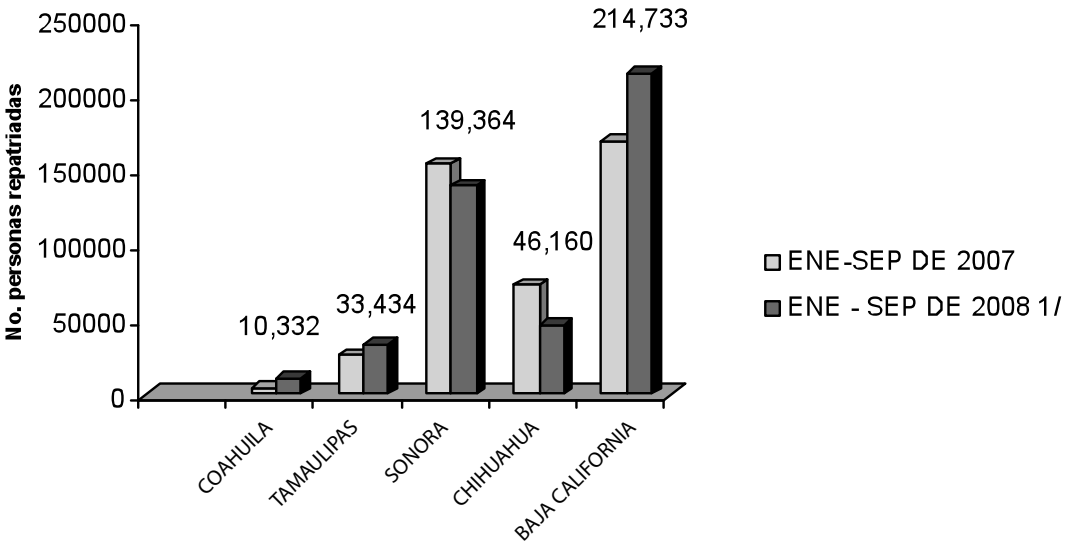
Rural emigration has been a strategy employed by rural producers to mitigate the effects of adverse weather on their primary activities (Conde et al., 2006).

It is important to understand that climate has not been the only cause of rural emigration, but it is one of a complex set of interrelated variables that, beyond ecology, are political, social, and economic in nature (Sánchez et al., 2008 B). Mexico's National Institute of Statistics, Geography, and Informatics (INEGI, 2005) reported that 50% of emigration toward the United States are motivated by labor and family issues; of these, 76% are persons ages 15-34 (59.4% male, 40.6% female), who represent the nation's effective labor force. Unfortunately, 83.4% of these emigrants do not return to their place of origin. As has been reported by several researchers (Kates, 1985; Kaperson et al., 1995), vulnerability is not an exclusively climatic factor, but rather an interaction between climate and society.

An unexpected aspect within the context of migratory flows is the return, voluntary or otherwise, of persons who had left the country and who, facing an economic downturn and toughening of immigration laws, have begun to return to Mexico, where employment prospects are not promising. Moreover, in the area of irrigation agriculture, a conflict is foreseen when people who return to this type of work seek to recover their lands and water rights which they had earlier leased, loaned or sold upon leaving. This situation points toward underemployment or illicit activities that will have a negative impact on society.

1 The index of marginalization is calculated based on nine socioeconomic indicators, and the migratory rate is a function of four indicators. The higher the rates, the worse the situation becomes. See: http://www.conapo.gob.mx/publicaciones

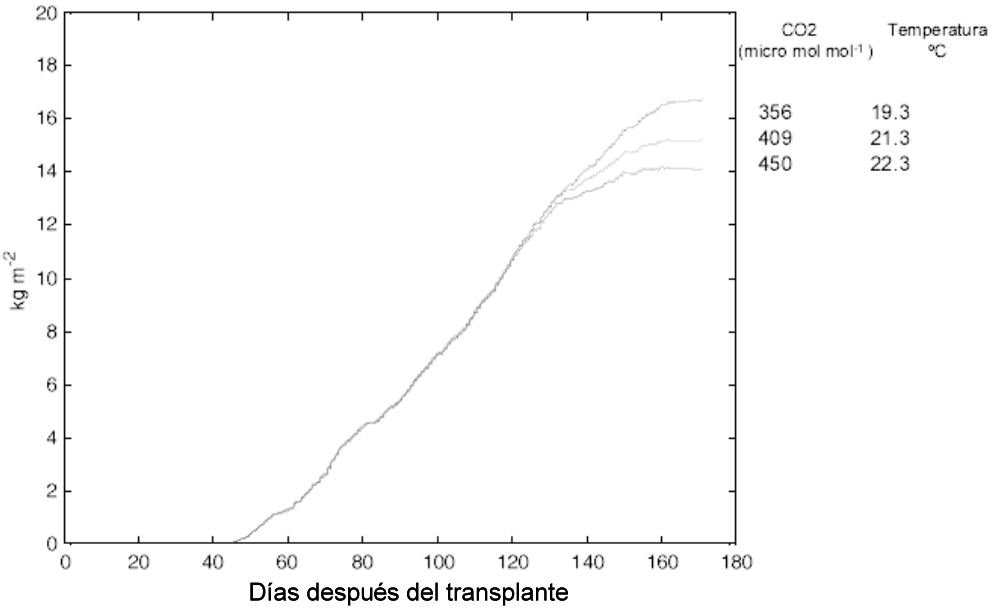
Figure 5: Persons repatriated to Mexico in a safe and orderly way January-September 2007 and January-September 2008. Recorded in border states. (National Immigration Institute, 2008)

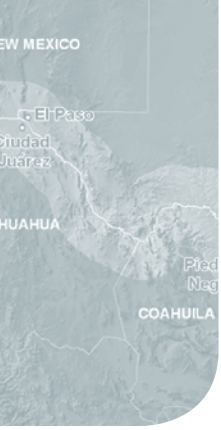


Economic impact

The effects of climate change on crop production depend on the type of crop involved. For example, some crops remain dormant during hot weather (for example, beets require cool temperatures in order to flower), while some weeds flower readily at low temperatures. Ramírez (2008) reports that, in Mexico, tomatoes reach their maximum yield at 356 micromoles of CO_2 at a time when temperatures are relatively low (66 °F) (Figure 6).

Figure 6: Combined effect of increasing CO_2 and temperature on tomato crop yield (Ramírez, 2008)



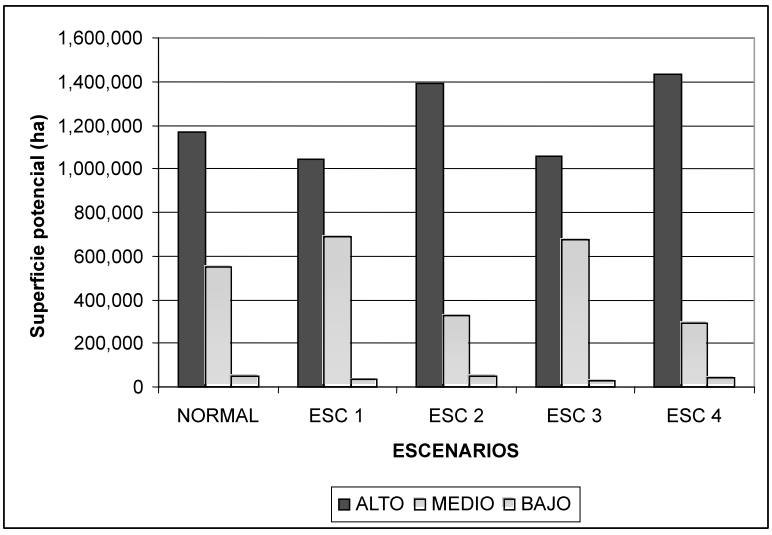


These results indicate that the variable to be considered in measuring the impact of climate on crop yield is photosynthetic efficiency, or speed of exchange of gasses in the process of photosynthesis. This phenomenon is also closely related to moisture in the soil, which in turn depends on rain and irrigation.

Mexico also expects to see changes in the potential yields of its corn crop. For example, in the state of Veracruz, the land area with good yield potential for corn might rise from 1,200,000 to 1,400,000 hectares (2,964,000 to 3,458,000 acres) if temperatures drop 2°C and rainfall is diminished by 10%. However, lands with medium potential for this crop would decrease from 550,000 to 300,000 hectares (1,358,500 to 741,000 acres (see Figure 8). The lower box in Figures 7 and 8 shows the range of values for variables that explain the potential yield for corn. To understand why a reduction of 10% in rainfall and a drop of 2°C (scenario 4) would actually increase potential crop yield, we must realize that optimal water conditions are between 600 and 1,800 mm, so a 10% diminution of precipitation would closely approximate ideal growing conditions.

Figure 7: Variation in corn crop yield in Veracruz state, with different scenarios of temperature and precipitation

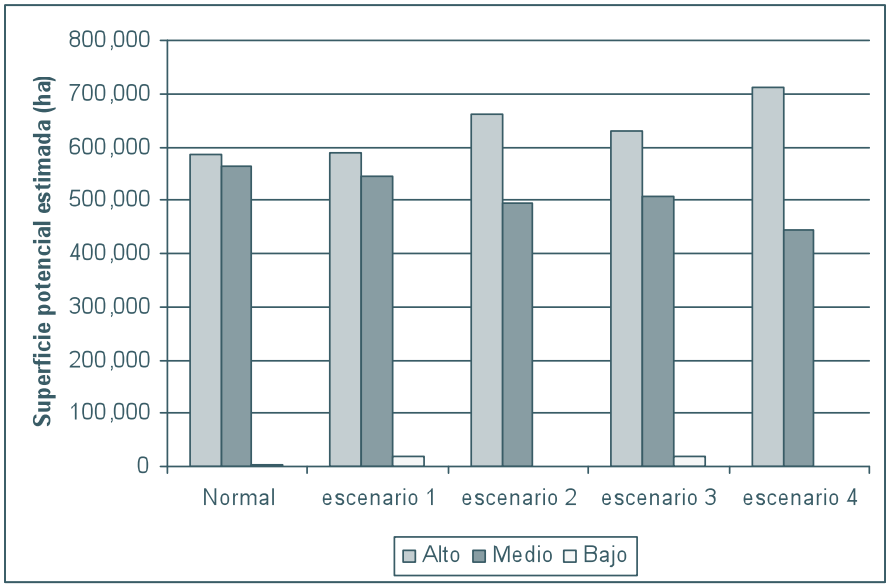
Potencial	Normal	Escenario 1	Escenario 2	Escenario 3	Escenario 4
Escenarios		Tma + 1ºC	Tma + 1ºC	Tma + 2ºC	Tma - 2ºC
		pma + 10% lluvia	pma - 10% lluvia	pma + 10% lluvia	pma - 10% lluvia



Variable	Alto	Medio	Bajo
Altitud (msnm)	0 - 2200	2200 - 3600	> 3600
Temperatura (ºC)	20º - 34º	12º - 20º	< 12º y > 34º
Precipitación (mm)	600 - 1800	1800 - 4000	0 - 600 y > 4000

Figure 8: Variation in corn crop yield in Chiapas state, with different scenarios of temperature and precipitation

Potencial	Normal	Escenario 1	Escenario 2	Escenario 3	Escenario 4
Escenarios		Tma + 1ºC	Tma + 1ºC	Tma + 2ºC	Tma - 2ºC
		pma + 10% lluvia	pma - 10% lluvia	pma + 10% lluvia	pma - 10% lluvia



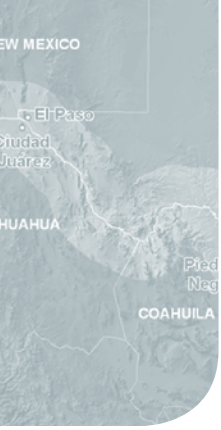
Variable	Alto	Medio	Bajo
Altitud (msnm)	0 - 2200	2200 - 3600	> 3600
Temperatura (ºC)	20º - 34º	12º - 20º	< 12º y > 34º
Precipitación (mm)	600 - 1800	1800 - 4000	0 - 600 y > 4000

Note also that scenarios 1 and 3 result in the most pronounced negative impact for both states, so that in the event of increased temperature and precipitation, land area with high potential crop yields would shrink markedly.

Environmental impact

As we have seen, environmental change brought about by emission of gasses into the atmosphere are clearly occurring, generating multiple and complex effects. Pollution, loss of soil productivity, and altered ecosystems are some of the most tangible impacts affecting people in today's world. Climatic variables are far and away the principal indicators of impact on ecosystems.

In fact, the significance of the types of impacts discussed earlier depends on the decision-making variable under consideration; thus, reduced precipitation (environmental impact) results in reduced crop yields (economic impact), with repercussions as well for the wellbeing of the population (social impact).



In studying environmental change, we must turn to simulation models that provide information about states and can also deal with diverse variables such as precipitation and temperature as they are impacted by increasing levels of gasses in the atmosphere. Nevertheless, main weakness of these methods as applied to developing countries is the lack of a reliable, accurate, and ongoing source of data. Thus, one useful tool is downscaling, endeavoring to make predictions of global measurements to which the General Circulation Models refer.

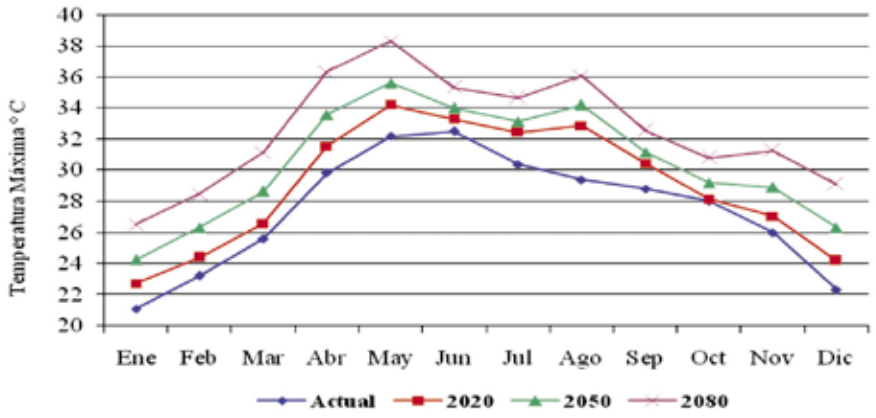
One of the most useful spatial downscaling models in terms of forecasting climate change is based on procedures of statistical regression. The Spatial Downscaling Statistical Model (SDSM) is one of the easiest tools to use and provides a large amount of information (Wilby et al., 2002, Pacheco, 2007).

Applying the SDSM to an arid region of northern Mexico (Cuencamé, Durango) has resulted in the following results:

1. Maximum temperatures

The average high temperature in the decade of the 2020s is observed to be 1°C higher that current levels, yet beginning in July there is a 2°C increase, and the peak of 4°Coccurs in August. In the 2050s, the upward trend in temperatures is 3°C during the first half of the year, with greater increases beginning in July, peaking in August at 7°C. For the 2080s, a similar pattern is seen, and August remains the month with the greatest temperature differential (10°C).

Figure 9: Average high temperatures now and for future time frames in Cuencamé, Durango, Mexico

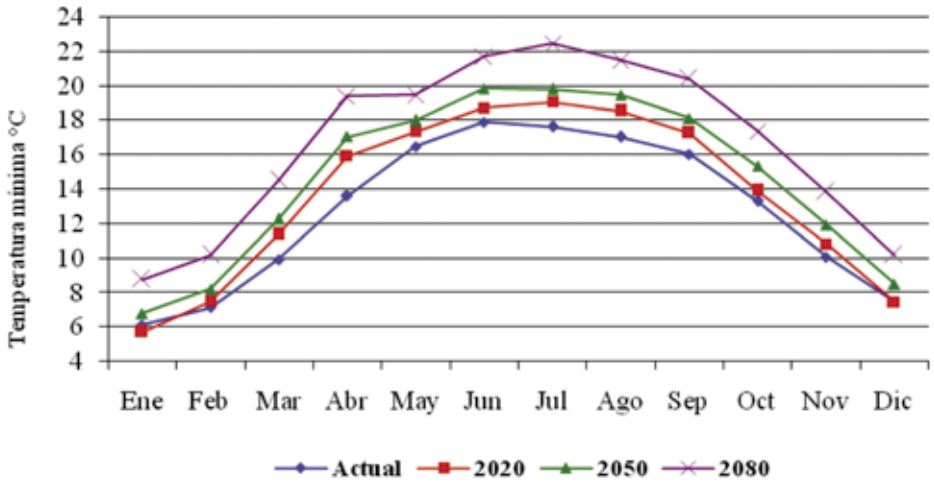


2. Minimum temperatures

Comparing the average low temperatures at the present time with those predicted by the model, we observe a uniform trend. The 2020s are characterized by an increase of about 1°C, with a peak differential of 2°C in April, dropping slightly to 1.5°C in June, July, and August. For the decade of the 50s, the average differential is 1.8°C, with April again exhibiting the highest figure, followed by a 2°C differential from July through October. In the 2080s, the average temperature increase throughout

the year is 3.9°C, trending downward from a maximum of 5.7°C in April to a 4°C differential for July through October. The greatest temperature increases are predicted for April in all three scenarios.

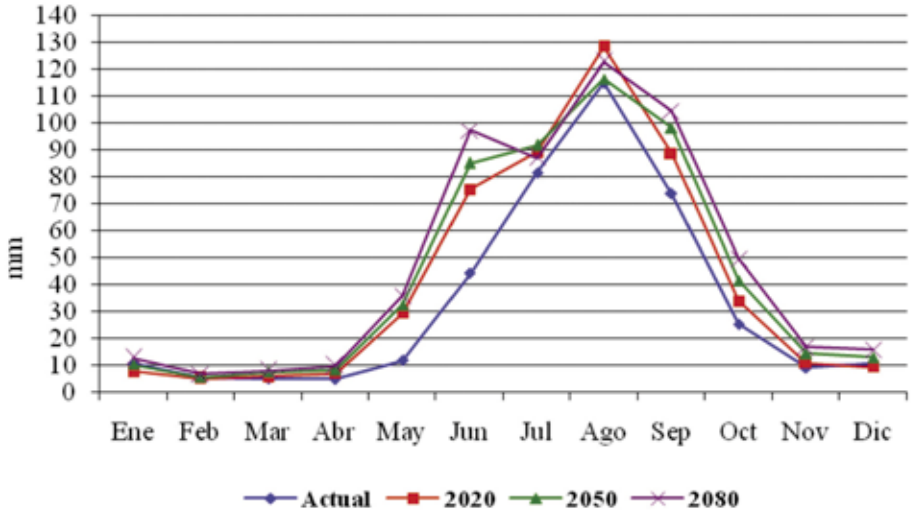
Figure 10: Average low temperatures now and for future time frames in Cuencamé, Durango, México. (Esquivel, 2008)

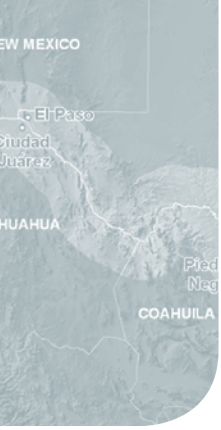


3. Precipitation

For the year 2020, precipitation remains normal until April, and May and June record the greatest increases with 17 and 31 mm, respectively; August, September, and October have an average increase of 10 mm. For 2050 a parallel trend is noted, with increases beginning in May (20 mm), continuing into June (40 mm) and September-October (25 y 16 mm, respectively). This pattern reasserts itself for the year 2080 (May 24 mm, June 53 mm, September 31 mm, and October 24 mm).These three projected scenarios are similar, with precipitation increases ocurring gradually.

Figure 11: Average annual precipitation now and for the future in Cuencamé, Durango, México. (Esquivel, 2008)





In storm regions with average annual rainfall of less than 500 mm (19.7 inches) the preceding panorama could favor corn production by evolving into a precipitation pattern where storm waters would be more widely distributed, providing an opportunity to satisfy crop demand for water at critical times of the year. On the other hand, precipitation increases in humid regions would not necessarily have a positive impact on corn production; rather, they might elevate risks in vulnerable areas, as has occurred in southeastern Mexico in the recent past, specifically in the states of Chiapas and Tabasco. Recent extremely heavy rains in these states triggered emigration to neighboring states by persons so affected, who were then considered environmental refugees.

CONCLUSIONS

The impact of changes in climate patterns is becoming more and more evident each day, particularly on the most vulnerable populations. In Mexico, migration away from rural areas correlates with variations in climate and also with family considerations, health, and economic issues. The variables of climate, in conjunction with socioeconomic data, explain the high rate of migration away from rural areas, and there is a quantifiable relationship between weather in those Mexican states which "expel" the greatest number of producers and the number of persons who migrate.

Climate change scenarios for the country are not very encouraging, principally because the resources available are insufficient to implement measures that would eliminate or mitigate corresponding negative impacts. In addition, there is a great deal of social, economic, and political vulnerability. A high percentage of the population lives in areas of risk, with precarious living conditions and highly polluted soils and bodies of water.

In Mexico there are 23 million people living in vulnerable conditions, principally in the states of Tamaulipas, Veracruz, Querétaro, Puebla, the State of Mexico, Chiapas, Tabasco, and Oaxaca. It is therefore urgent to implement disaster prevention measures targeting extreme weather events, as well as planning for land use regulation. According to the World Weather Organization, "prevention costs six times less than emergency response".

Because climate as a variable creates impacts of varying intensity, it is essential to understand its effects on production activities and implications in the area of climatic uncertainty; it is here that research still has a great deal to contribute, through establishment of medium- and long-term projects grounded in multidisciplinary approaches that seek multiple objectives and involve the participation of multiple institutions.

Simulation models for climate scenarios provide a useful tool in the decision-making and planning processes intended to mitigate adverse effects. However, with regard to production, field research must be conducted in order to assess the true impact of crop yields when alteration of the physical environment occurs.

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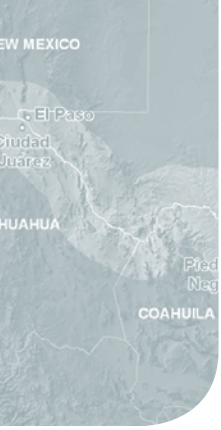

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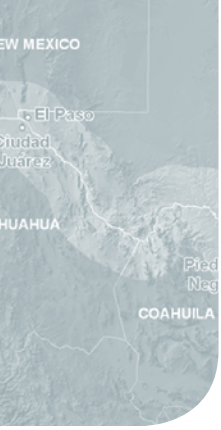

SANITARY SURVEILLANCE ON CLIMATE CHANGE IN THE PASO DEL NORTE REGION

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Epidemiologist, Sanitation District 2, Chihuahua Health Services

Climate change is a worldwide phenomenon that is also affecting our own region.

Our climate is normally extreme, with hot weather in the summer and below-freezing temperatures in the winter. However, in recent years these weather patterns have seen alterations which have resulted in seasons of drought and others of floods, all of which have impacted human activity and health, as occurred two years ago, in July and August of 2006 when torrential rains caused flooding in the Anapra area of Ciudad Juárez and its counterpart, Sunland Park, New Mexico, including risk of water overflowing dikes on the Mexican side, water pollution, and relocation of populations to safer ground.

The graph that follows shows, in red and blue, the Anapra areas hardest hit by the floods of 2006.

One factor that contributes to fluctuations in weather such as these is the greenhouse effect. The release of gasses, principally CO_2, into the atmosphere blocks the sun's rays, producing thermal inversions in both Ciudad Juárez and El Paso, characterized mainly by warmer temperatures in winter.

No one doubts that the greenhouse effect will impact human health, but there is another human behavior that raises the likelihood of adverse effects on the community. Unplanned urban development results in natural resources not being properly utilized and many times wasted altogether, thereby raising the degree of vulnerability to climate change.

PUBLIC HEALTH ACTIVITIES

As suggested earlier, climatic variability in our region directly affects the health of area residents, particularly the prevalence and severity of diseases other than those that would normally occur at particular times of the year.

For this reason, one of the main public health activities that have come to prominence as a consequence of climate change is epidemiological surveillance or sanitary surveillance.

Many of the diseases that occur at present in our region show behaviors divergent from the norm. One group is the vector-borne diseases, especially those transmitted by mosquitoes, whose growth and survival have been facilitated by developments in the weather. Among the principal diseases that already manifest themselves here in greater proportion than usual are dengue and West Nile virus, and a rise in malaria cases is expected in the coming years.

The response of health systems to these realities has prompted public and private institutions on both sides of the border to work together, through the creation of health safety committees.

These committees serve various purposes, including implementing prevention and education campaigns and offering health services at the federal, state, and local levels, as well as binationally.

CONCLUSIONS AND RECOMMENDATIONS

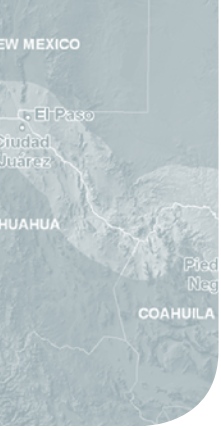
Climate change is exerting a direct effect on populations worldwide.

In our border region, this impact is felt in the form of thermal inversions which result in an elevated incidence and greater severity of diseases, particularly those spread by mosquitoes.

It is essential to know what health institutions exist in our area and the level of care offered at each. Unfortunately, there are no third-level care facilities in our region, in spite of the population density here and the economic impact that the presence of such a facility would have.

In Mexico there is a Health Safety Commission, which analyzes health data.

A single, binational surveillance system should be established whereby activities could be planned and carried out in an organized manner to produce the desired results. It is important to understand



that little is to be gained from an arrangement in which activities are conducted independently on both sides of the border, since this structure cannot adequately take transborder continuity into account.

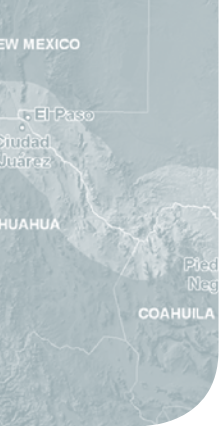
In addition, there must be an adequate flow of communication to each side of the border. In this way, for example, information could be shared regarding what diseases are most prevalent, what preventive actions are being or should be taken, and what health interventions both border populations require.

Information should be shared so that the appropriate decisions can be made at all levels affecting the welfare of each side of the border as well as the border region as a unit and so that coordinated responses can be mounted and duplication of effort and inefficient use of resources can be avoided.

One of the first initiatives to be undertaken should be actions leading to health promotion, as this is an effective strategy and proves less costly than having to treat disease.

We must have an effective epidemiological system that can deal with new and existing diseases on both sides of the border.

It is important to take advantage of the help and expertise offered by PAHO in the coordination of activities on both sides of our border.



CLIMATE CHANGE EFFECTS ON HEALTH AND THE PAN AMERICAN HEALTH ORGANIZATION

Sally Edwards
Regional Advisor in Environmental Epidemiology, PAHO/WHO

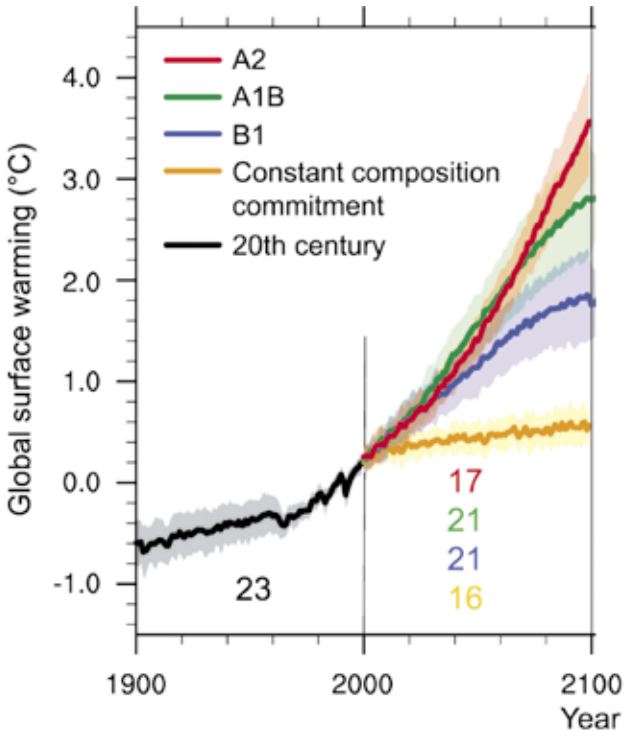
The face of Climate Change has traditionally been one of the plights of the polar bear. With melting ice caps, these animals have been highlighted for loosing their hunting grounds. However, PAHO would like to change that image and put a human face to Climate Change to highlight the effects on health that climate change is already and will further bring.

There is solid scientific evidence showing that the world's climate is changing and there is clear consensus on this within the scientific community. This change is due, in great part, to diverse human activities related to the burning of fossil fuels, deforestation and agricultural practices. The Intergovernmental Panel on Climate Change released its 4th Assessment Report in 2007 which compiled the work of over 7,000 studies, more than 2,500 scientists and took over 6 years. This report concluded that the warming of the climate (which includes an increase in climatic variability) is unequivocal based on observed increases in global average air and ocean temperatures, the widespread melting of snow and ice, and rising global average sea level. Despite there remaining some uncertainty as to the effects of climate change, there is more scientific evidence backing the projections than there is about the future of financial markets, on which governments make decisions every day.

In "The economics of climate change: The Stern Review", Sir Nichols Stern defines adaptation as "the only response available for the Climate Change impacts that will occur over the next several decades before mitigation measures can have an effect".

Figure 1 shows that adaptation is needed for at least the proportion of warming occurring under the Constant Composition Commitment Scenario. This is the warming that will happen even if we ceased emissions in 2000. However, this did not happen and therefore we are more certainly going to be facing increases in temperature suggested by the other scenarios (A2, A1B or B1). The numbers under the lines represent the number of models that were used to create each scenario.

Figure 1: SRES Mean Surface Warming Projections

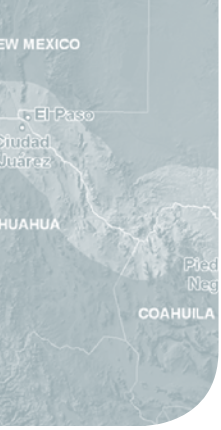


IPCC, WORKING GROUP 1 TECHNICAL SUMMARY, 2007

Climate change affects everybody, but the health impacts are local, depending mainly on the state of development, and particularly of health services. On the other hand, the ultimate course of climate change will depend on the choices that we make as individuals, communities and nations. PAHO/WHO considers climate change as an important threat to health and has been the leading voice on the health implications of climate change within and outside the UN system. PAHO/WHO has assembled and reported the evidence of the links of climate change to health, quantified past and projected future impacts, identified vulnerable populations, and given guidance on assessing climate risks and responding to specific threats, such as heatwaves, floods and vector-borne disease. The PAHO Directing Council approved a Regional Plan of Action on Climate Change and Human Health in September 2008, which is fully in line with the WHO Global Plan of Action and within which several activities are being carried out jointly.

The general response of health system within the region has been good. Ministries of Health have participated actively in events during 2008 with PAHO, including the preparation of Country Profiles, a meeting in Brasilia where the Plan of Action was drafted, a country Consultation to gain concurrence for Plan of Action and in the Directing Council where a roundtable was held and the plan was reviewed.

The most effective response to ongoing climate change will be through strengthening existing core public health interventions, protecting health from the climate change that we are already committed to, supporting "new" interventions for specific risks, and encouraging behaviors that are good for health and the environment. Changing health behavior through health promotion is one of the most important ways to address the threat of climate change.



Climate Change could jeopardize the achievement of the Millennium Development Goals, including the health-related Goals, and undermine the efforts of the Secretariat and Member States to improve public health and reduce health inequalities globally. This and in light of the strong, global scientific consensus that warming of the climate system is unequivocal and is affecting human health, governments, PAHO and WHO take specific policy action to address the problem. In May 2008 the World Health Assembly adopted a resolution (WHA61.19) which REQUESTS the Director-General of the World Health Organization to:

- Draw to the attention of the public and policy-makers the serious risk of climate change to global health and to the achievement of the health-related Millennium Development Goals.
- Engage actively in the United Nations Framework Convention on Climate Change (UNFCCC) Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change.
- Work on promoting consideration of the health impacts of climate change.
- Develop capacity to assess the risks from climate change for human health and to implement effective response measures.
- Consult Member States on the preparation of a work plan.

In line with this resolution, PAHO developed a Regional Plan of Action which has the goal to empower, equip and strengthen the capacity of health systems locally and nationally to protect human health from risks related to climate change. The specific aims are to:

- Ensure that concerns about public health security be placed at the center of the response to climate change,
- Support the development and implementation of adaptation strategies at local, national, and regional levels to minimize the health impacts of climate change, and
- Encourage the adoption of energy measures to mitigate climate change and avoid further and potentially disastrous impacts on health.

Under these aims, there are five strategic objectives:

1. **Evidence:** Promote and support the generation of knowledge on health risks associated with climate change and on the response of the public health sector to this phenomenon. Specific actions under this objective are to create an observatory of climate and health, to create and strengthen surveillance systems, research promotion, the generation of information and the exchange of information.

   An example of why evidence is important is the Global Burden of Disease study showing that good data can lead to appropriate interventions.

2. **Sensitization:** Create awareness of the effects of climate change on health among both the general public and in different sectors including health sector personnel, by promoting communication and dissemination of information in a multidisciplinary approach. Specific actions under this objective are to increase awareness, to promote education, information and risk communication strategies, and to develop education, training and information guides.

An example of a sensitization activity that took place during 2008 was the Latin American Award for Health Journalism. This competition has the aim to inform and create awareness amongst Journalists in the Region of issues related to Climate Change and Health, and was held from 9 April to 15 September 2008. 38 Stories were received and 20 selected from 10 countries.

Another example of a sensitization activity that took place during 2008 was the publication of "Climate Change and Human Health: Risks and Responses Revised Summary 2008". The document was updated according to new IPCC 4th Assessment Report projections and launched on World Health Day in Washington DC. It was translated into Spanish and Portuguese.

3. **Resources:** Promote the strengthening and development of human resources, financial resources, institutional development, and policy development. Specific actions under this objective are to strengthen the national regulatory framework, to strengthen human resources and to identify funds for all the activities identified in this plan.

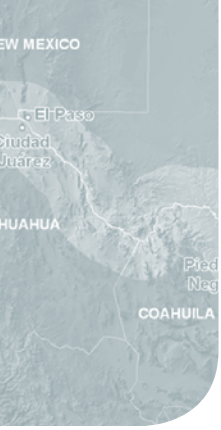
   An example of a mechanism that has been used to fund activities related to climate change and health is the UNDP – Spain MDG Achievement Fund. Panama and Peru have been successful in obtaining financial resources for work on Climate Change and health through this mechanism.

4. **Adaptation:** Strengthen and develop the capacity of health systems to design, implement, monitor, and evaluate adaptation measures with the aim of improving response capacity to prepare for and effectively respond to the risks of climate change.

   Specific actions under this objective are adaptation evaluations (design and to execute national plans of action), adaptation priorities (implement and evaluate adaptation measures), work with other sectors (evaluation of the health implications of actions of other sectors), and emergency response related to climate change (improve capacity to support health systems, and respond to public health and emergency problems that result from climate change).

5. **Partnerships:** Promote, articulate and establish cross-disciplinary, interagency and intersectoral partnerships to ensure that health protection and promotion is central to climate change policies. Specific actions under this objective are mitigation policies in the health sector, strengthening the health sector, a network of experts, intersectoral work, to evaluate the benefits of measures applied in other sectors, inter-institutional action, cooperation between countries, sub-regional cooperation, a regional forum and collaborating centers

In summary, strengthening needs to be done in Primary Health Care in order to be better able to deal with the problems of today as well as to be better prepared for what the future holds. Surveillance systems need to be strengthened and the information generated needs to be included in an Observatory of Climate and Health. Research is needed in several areas where currently there is insufficient epidemiological information, and disaster management plans need to take Climate Change projections into account. All these contribute to the necessary adaptation of the health system to climate change. Most of all however, health needs to be put at the forefront of the Climate Change debate, and a human face given to the issue.



CLIMATIC VARIABILITY AND ITS IMPACT ON THE AVAILABILITY OF WATER SUPPLY

Karl Woods
Director of Water Resources Research Institute. New Mexico State University

INTRODUCTION

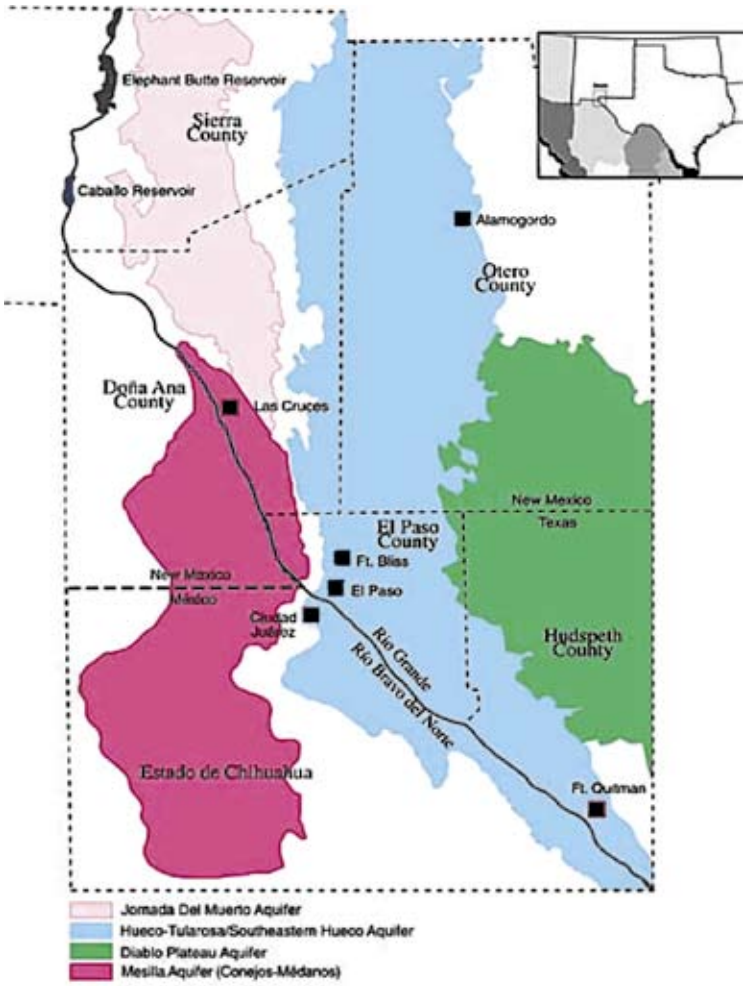
In relation to water, the US – Mexico border has 4 problems:

- Water is located in the wrong place.
- It comes at the wrong time.
- It occurs in the wrong quantity (too much or too little).
- It is on undesirable quality.

WATER IN THE PASO DEL NORTE REGION

The region has:

- One major river (Rio Grande)
- Four underground basins
- Arid climate
- Extremely high evaporation rates
- Prolonged droughts and frequent floods
- Three major cities
- Six counties and municipios
- Three states
- Two countries
- An exploding human population (moving in and having more children)



Present surface water supplies:

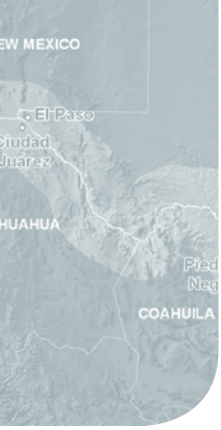
One source of water supplies are the reservoirs “Elephant Buttle” y “Caballo”, which had a combined stored capacity of 2,396,520 acre-ft.

At December 1st 2008 there were 617,580 acre-ft, a 26% of total capacity, which is pretty good assuming that 2 years ago, it was only 5% (due to extreme drought).

The average annual release from both reservoirs is 790 000 acre-ft, meaning that the rivers has a 3 year supply.

Its management is complex. The Rio Grande surface water is managed by:

- US Bureau of Reclamation and the State of New Mexico (Elephant Butte Reservoir and the Rio Grande Project).
- State of Texas (Rio Grande from El Paso to Fort Quitman, Texas).
- Comisión Nacional de Agua (Rio Grande downstream from Juárez).
- International Boundary and Water Commission.



The waters were divided according to the treaty of 1906, which take into account the amount of acres irrigated and nor the population served. In this way:

- New Mexico receives 57% of supply (4,160,100 acre-ft),
- Texas: 43% (313 000 acre-ft), and
- Mexico: Less than 10% (60,000 acre-ft).

Groundwater:

Groundwater is managed by:

- New Mexico: Office of the State Engineer
- Texas: Individual landowners
- Mexico: Federal government

There are 3 totally different ways to manage groundwater for the same bolsons.

In our area, as average, each person uses the following average amount of water per day:

- Las Cruces: 194 gallons,
- Ciudad Juárez: 104 gallons,
- El Paso: 140 gallons,
- National average: 150 gallons (half in the home and the other half in the outside).

Differences between cities are due mainly to landscaping.

Sources of water:

Each city gets its water from:

- Las Cruces y Juárez: 100% from groundwater
- El Paso: 50% from groundwater y 50% from Rio Grande

In the near future, Las Cruces y Juárez also will get water from the river.

Each irrigation district gets its water from:

- Elephant Butte Irrigation District: 87% from Rio Grande and 13% from groundwater.
- Distrito de Riego 009: 34% from Rio Grande, 33% from groundwater and 33% from treated waste water.
- El Paso Water Improvement District # 1: 100% from Rio Grande.

How much fresh underground water is available?

- Mesilla Bolson: 86 million acre-ft.
- Hueco Bolson: 3.9 million acre-ft in NM, 3 million acre-ft in TX and 600,000 acre-ft in Mexico.

Actually the Hueco Bolson is being recharge very slow, contrary to the Mesilla Bolson.

Groundwater withdrawal greatly exceeds recharge. In Mexico, it's predicted severe withdrawal problems in Hueco Bolson by 2005-2015 and in Texas by 2020.

Other water entities in the Paso del Norte Region include hundreds of individual home well users and small private domestic companies.

FLOODS

There has been a big concern since August 2006 about the occurrence of floods in our region. The region needs better protection from most floods with better levees and catchments dams.

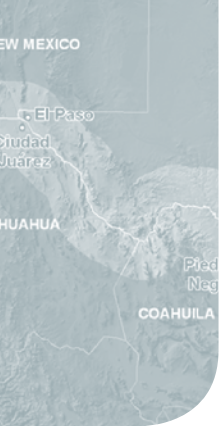
Local flooding is still greatly possible. An example is the city of Hatch, which two years ago suffered severe floods for an unexpected strong monsoon season.

The amount of water relates directly to its quality. When the river flow is lower, water quality is poorer; at the contrary, when the river flow is high, then quality is of little concern, the important is getting more water.

Water supply	Water quality
• Quite visible	• May not be visible
• Easy to measure	• Visibility may be deceiving
• Easy to say if too much or too little	• Often difficult to measure
	• Difficult to say if too much or too little

Specific Topics Critical to the Regions Water Quality:

- Potable water
- Wastewater disposal
- Wastewater reuse
- Irrigated agriculture
- Dairy operations
- Extractive industries



Water supplies contain:

- Natural elements or compounds such as:

    1. Salts Pathogens
    2. Organic matter
    3. Arsenic
    4. Fluoride
    5. Boron
    6. Uranium

- Human introduced elements or compounds such as:

    1. Salts
    2. Pathogens
    3. Organic matter
    4. Perchlorate
    5. Uranium
    6. Lead
    7. Pharmaceuticals
    8. Nitrates

SOLUTIONS TO WATER QUALITY PROBLEMS

- Meaningful Water Quality Standards. Verified by research.
- Fast and affordable detection. Verified by research.
- Outreach and Education. Supported by research.
- Government support where needed. With monitoring and verification.

RESEARCH

Existing research programs:

- Alternative adsorbents for treatment of drinking water.
- On-site wastewater treatment.
- Nutrient management in water.
- Groundwater and surface water quality and quantity monitoring.
- Dairy waste management.
- Agricultural drainage management.
- Effects of natural evaporative processes on water quality.
- The nature and occurrence of brackish waters in southern New Mexico and west Texas.

New focus programs:

- Colonia water issues such as health problems, development needs, and wastewater treatment.
- Mutual Domestic Water Users Associations treatment systems.
- Agricultural Community mitigating agriculture impacts.
- Development of Desalination Technology. Affordable for big cities.
- Beneficial use of marginal quality water such as graywater, domestic and industrial wastewater, agricultural drainage, desalination reject water, and naturally brackish groundwater.
- Extractive Industry water quality issues.

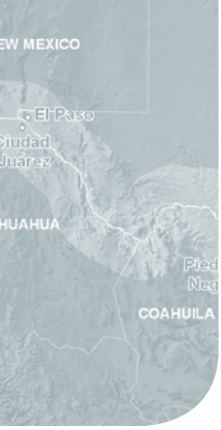
CONCLUSIONS

On one hand, we have lived with these climate extremes in the past with less sophisticated technology.

On the other hand, human populations were much less in the past, so, what work there, is not necessary useful in the present or in the future.

Municipalities and agriculture are developing 40-year plans to meet water needs:

- New sources:
    1. Desalination
    2. Importation
    3. Aquifer assessment
    4. Water markets for surface water
- Conservation of present sources
- Water supply solutions are promising, but not assured.



IMPACT OF CLIMATE CHANGE ON THE BORDER REGION

Mario Vásquez Valles
Director of Planning and Technical Assistance, Border Environment Cooperation Commission (BECC)

There is no question that climate change occurring worldwide is affecting the US-Mexico border region.

BECC AND NADB

The Border Environment Cooperation Commission (BECC) and the North American Development Bank (NADB) were created in 1993 within the framework of the North American Free Trade Agreement to address environmental impacts arising from the dynamic activity triggered by NAFTA.

BECC's purpose is to develop and certify environmental infrastructure projects, to be funded subsequently by the NABD and other institutions.

In 1993, the topic of climate change was no under discussion and is therefore not present in the charters of the aforementioned organizations. This does not mean, however, that consideration and support have not been given to projects designed to combat its harmful impact.

Therefore, this same action model can be implemented in the fight against the adverse effects of climate variability.

Parallel agreements to NAFTA:

- US-Mexico Border Environment Cooperation Agreement, October 1993.
- Border Environment Cooperation Commission: Protect, preserve and enhance the border region by identifying, developing, certifying, implementing and overseeing environmental infrastructure projects.
- North American Development Bank: Fund the construction of projects certified by the BECC.

Board of Directors:

Its structure is unique in the region: a single governing board for both institutions:

United States	Mexico
• Treasury Department • State Department • Environmental Protection Agency (EPA) • State government representative • Civilian representative	• Ministry of the Treasury • Ministry of Foreign Affairs • Ministry of the Environment and Natural Resources (SEMARNAT) • State government representative • Civilian representative

Such a structure is innovative and unique among binational organizations in its inclusion of representatives of the general public on its Board.

STRATEGIC FRAMEWORK

Vision of a sustainable border:

In the foreseeable future, residents of the US-Mexico border region will enjoy sustainable water supplies and sanitation and waste management services, as well as clean energy, quality breathable air, and sufficient natural resources to improve quality of life and ecosystems.

The foreseeable future consists of the next 25 to 30 years, without incorporating the effects of climate change into the equation.

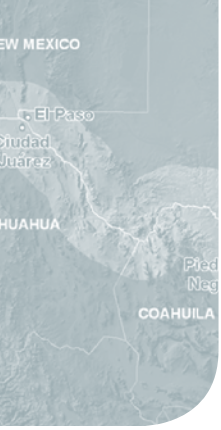
Mission of the BECC:

The BECC works to preserve, protect, and enhance human health and the environment of the US-Mexico border region by strengthening cooperation among the interested parties and supporting sustainable projects through a transparent binational process, in close coordination with the NADB, federal, state and local agencies, the private sector, and civil society.

BECC programs:

- Institutional capacity building

- Technical services
  - Definition of the scope of projects
  - Coordination with financial and regulatory agencies
  - Bidding for contracts
  - Consultancy in public participation processes
  - Binational coordination
  - Strategic planning (10 states)
  - Technical reviews
  - Reference and information sources



- Technical assistance
    - Environmental impact assessments
    - Technical, economic and financial feasibility studies
    - Preliminary and final design studies
    - Community participation programs
    - Operational and maintenance programs and institutional capacity building
    - Sustainability assessments

BECC and NADB programs focusing on environmental objectives:

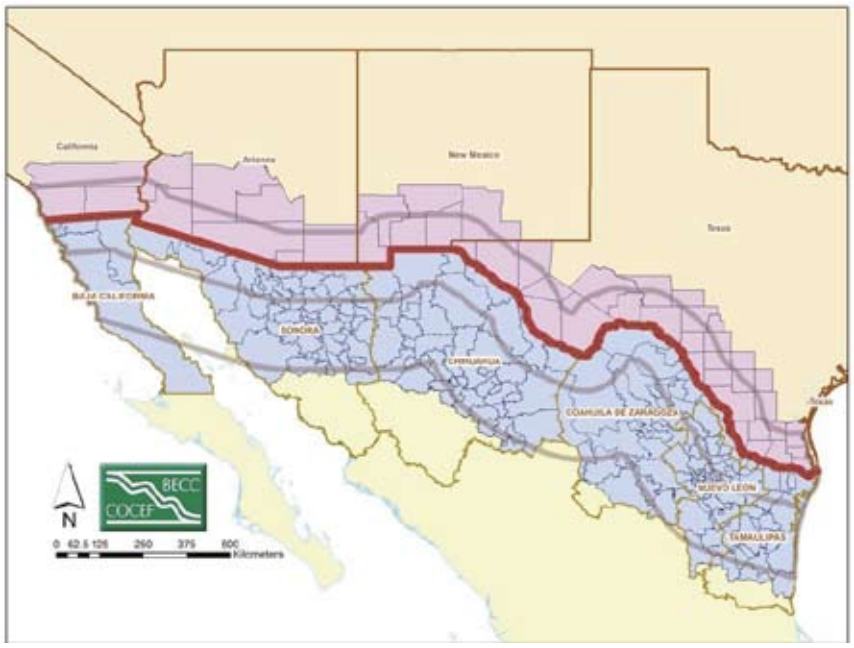
- US-Mexico Border Program *(funded by the EPA through PDAP and BEIF):* Water, sewage and sanitation projects.
- Border 2012 and Special Grants *(funded by the EPA):* Focuses on objectives of the Border 2012 Program.
- Solid Waste Environmental Program: Program of NABD subsidies for municipal solid waste projects.
- NADB Construction Loan Program: Applies to water, waste water, municipal waste, air quality, and energy projects.
- Technical Assistance Program for all sectors: BECC and NADB provide subsidies for conducting studies and development projects.
- Institutional Capacity Building: BECC and NADB provide training to project promoters through workshops and the Utility Management Institute.

JURISDICTION

The zone of influence for projects extends along the border 100 km (62 miles) into the United States and 300 km (186 miles) into Mexico.

29.7 million people inhabit this area of approximately one million square kilometers (386,000 square miles), which includes population centers such as San Diego, Tijuana, Hermosillo, Ciudad Juárez, El Paso, Chihuahua, Monterrey, Laredo, Brownsville, and Matamoros. (Figure 1).

Figure 1: Zone of influence for projects



Population statistics for the border region:

In Mexico, about 8 million people currently live within the strip of land stretching 100 kilometers southward from the US-Mexico border. Broaden the band to 300 kilometers and the figure rises to 16.7 million. This population is predominately urban (91%). Mexico's National Population Council (CONAPO) projects that by the year 2030 this region will have a population of 22.5 million.

The 100 kilometer-wide strip along the US side is formed by 44 counties with a combined population of 13.8 million. Official projections call for this population to rise to 20.8 million by the year 2030.

The total border population will therefore exceed 40 million by 2030.

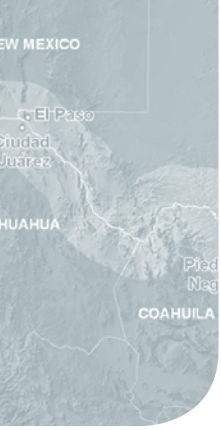
ENVIRONMENTAL FACTORS ADDRESSED

Basic sectors:

- Water
- Sewage
- Sanitation
- Solid waste
- Rainwater drainage
- Reuse of water

New sectors:

- Air quality
- Water conservation
- Public transportation
- Clean, efficient energy



- Industrial and hazardous waste
- Waste reduction and recycling
- Municipal institutional planning and development

PROJECT DEVELOPMENT

Environmental infrastructure projects are certified for funding by the NADB and other institutions. A transparent process is sought, leading to effective programs with broad public participation.

Public participation is very important to project development and sustainability. The BECC endeavors to ensure that this participation is structured, formalized, and highly interactive.

Project certification is based on 6 fundamental criteria:

- Location
- Technical characteristics
- Feasibility of funding
- Active public participation
- Creating a positive impact on human and animal health
- Likelihood of sustainable development from the outset

Currently there are 142 certified projects (66 Mexican and 76 US), for a total of 3,115 billion dollars. Investment on the Mexican side is greater than on the US side.

There are 86 projects in the pipeline, representing $1.579 billion in funding. At the present time, 147 communities have received technical assistance.

Social and environmental benefit:

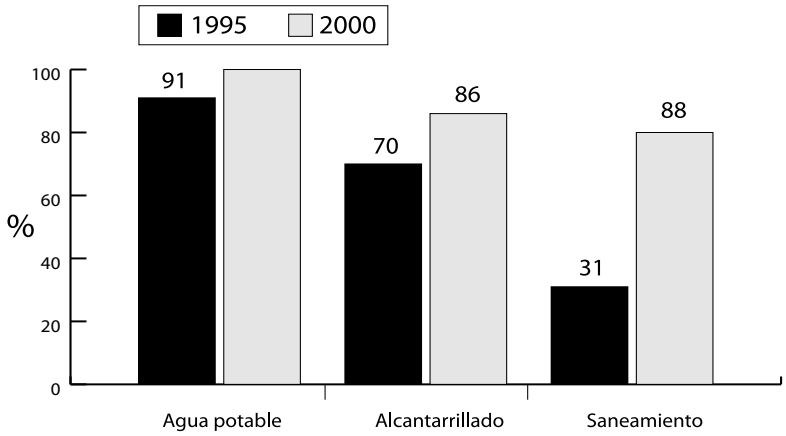
- 1 energy project: Substitute 25 million gallons of fossil fuels annually.
- 15 solid waste management projects: 2.77 million border inhabitants with enhanced waste collection and disposal services and reduced health risks.
- 21 water conservation projects: Estimated annual savings of 440 million cubic meters.
- 11 air quality projects: 4.9 million residents with reduced exposure to air polluted by vehicular traffic and unpaved roads. Elimination of over 100,000 tons of PM10 per year.
- 72 water and waste water projects: Enhanced treatment and distribution of potable water and collection and treatment of waste water to benefit more than 11 million border area residents.

Overall coverage of services:

The following graph illustrates achievements in the area of environmental projects, comparing levels of basic services in 1991 with those in 2005.

This means that the 13 cubic meters of crude waste water dumped into border ecosystems each second are now being adequately treated.

Figure 2: Level of basic services. 1991 – 2005



PROSPECTS FOR NORTHERN MEXICO AND THE US SOUTHWEST

Mexico is facing a depletion of its water resources that will bring grave consequences for public supply, agriculture and economic development. This decline is a consequence of climate change, although the influence of other natural cycles, such as El Niño and La Niña, are also acknowledged.

Mexico's northern border states are this nation's driest region. Although they comprise over 50% of the country's surface area, they receive only 25% of its rainfall, illustrating how the effects of climate change are felt most powerfully in this geographic area. The availability of water will be a problem in the near future.

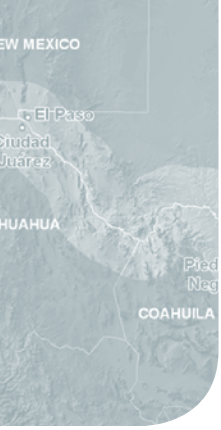
CHALLENGES FOR BORDER INSTITUTIONS

We must be able to find solutions:

- Innovative treatment of waste water, recycling of electronic waste, and air quality enhancement.
- Water conservation practices, including reuse of treated water, improved irrigation systems for agriculture, and efficient use of industrial water.
- Energy efficiency in homes, businesses, transportation, and generation of electric power.
- Development of accessible sources of renewable energies: solar photovoltaic, solar thermal, wind energy, and sustainable recovery and use of methane and biofuels.

What the border region expects of its institutions:

- Determination to mitigate climate change and immediately combat its effects.
- Courage to safeguard the wellbeing of border residents in the future.
- Wisdom to find solutions to environmental degradation. History has shown that drought in this region is cyclical, but it is also true that our ancestors knew how to devise techniques to face such a challenge.
- Generosity in preserving the region and planet Earth in its entirety as the home of all living creatures.



CLIMATE CHANGE AND HEALTH: REFLECTIONS ON RISK REDUCTION

Jorge Jenkins Molieri
Regional Advisor in Environmental Health and Sustainable Development in Border Regions. PAHO/WHO US-Mexico Border Office

INTRODUCTION

The Paso del Norte region is characterized by its arid climate. It is surrounded by the largest desert in North America (the Chihuahua Desert), framed by the Franklin Mountain Range and the Juárez Range, and traversed by the Rio Grande. The rainy season occurs in the summer, with precipitation brought in by the monsoons of the southwestern United States.

In recent years, this region has experienced rapid and often unplanned urban development, resulting in loss of fertile lands and crop growing areas, as well as increased demand for potable water.

Negative effects have been generated largely by floods, which have become more severe in recent years. It is interesting to note that, beginning in 2006, this phenomenon has been occurring with greater frequency and intensity. Processes that contaminate soil and water sources are not lacking: El Paso's petrochemical plant, the maquiladoras in Juárez, and the high volume of human traffic and flow of merchandise are only some of the examples of stresses the environment must bear.

GENERAL CONSIDERATIONS

Science has shown that climate change has always existed, but the phenomenon has been exacerbated by the contaminating activity of humans, which impairs the ability of the environment to adequately adapt to new climatic conditions, producing negative impacts on our planet.

Some of the adverse effects are on human health, but climate change is not the only factor endangering our physical wellbeing. Some of the others are: depletion of the ozone layer, changing ecosystems, contamination and pollution, reduced quantity and quality of existing water supplies, and a process of desertification and diminished quality of soils.

According to the conclusions of the report of the seventh United Nations Intergovernmental Panel on Climate Change (IPCC), the increase in the greenhouse effect is anthropic, that is, man-made: greater production of gasses, deforestation, use and abuse of carbon-based fuels, environmental

pollution, and unplanned urban development based on people's comfort and convenience rather than concerns for preserving a healthy environment.

The greenhouse effect has brought about a rise in average temperatures around the globe. In the 20th century the increase was 0.74°C, and it is estimated that by the beginning of 21st century, temperatures will have crept up another 1.87°C to 4°C if human behavior is not modified to curtail damage to the environment.

IMPACTS OF CLIMATE CHANGE

Climate change impacts many spheres of human life, all of which are interrelated and impinge on aspects of sanitation:

1. **Direct impact on health:**
   - Morbidity and mortality due to heat stress
   - Acute diarrheal diseases
   - Acute respiratory infections
   - Vector-borne diseases
   - Zoonosis

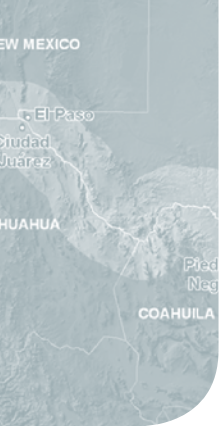
2. **Impact on agriculture and the livestock and fishing industries:**
   - Basic crops and crops for export
   - Demand for irrigation
   - Morbidity and mortality of livestock

3. **Impact on forests:**
   - Forest fires
   - Forest plagues

4. **Impact on water supplies:**
   - Reduction in volume of supply
   - Decline in water quality
   - Conflicts over usage (energy, consumption, irrigation, etc.)

5. **Impact on coastal areas:**
   - Whitening of coral reefs
   - Growth of algae (red tide)

6. **Impact on ecosystems:**
   - Displacement of ecological zones
   - Loss of biodiversity



SEASONAL DISEASES

At the global level:

- 2005 was the hottest year on record.
- Losses: 150,000 deaths attributed to climatic disturbances (1961-1990) and 5.5 million disability adjusted life years (DALYs) in the year 2000.
- More than 5 million sick people.
- In 1980, a heat wave in the United States caused more than 1,250 deaths.
- In 1995, another heat wave caused 700 deaths in Chicago alone.
- A heat wave in Europe in 2003 was responsible for more than 40,000 deaths (70,000, according to WHO).
- In the 1990s, 600,000 deaths were caused by disasters. It is now estimated that an average of approximately 60,000 deaths occur each year from this cause.
- It is estimated that 2.4% of diarrhea cases worldwide and 6% of malaria cases (by year 2000) are caused by direct or indirect effects of climate change.
- Negative effects on sanitation are greater in more vulnerable populations.

IMPACTS ON SANITATION

The World Health Organization has identified the main impacts on sanitation deriving from climate change:

- Drop in food production, accompanied by an increase in hunger and malnutrition (more than 3.5 million cases annually).
- Extreme weather phenomena increase mortality, bodily injuries, and the incidence of epidemics.
- Reduction in the availability of safe water, causing an increase in acute diarrheal diseases (more than 1.8 per year) and malnutrition.
- Heat waves have a direct impact on health, especially on cardiovascular and respiratory diseases like asthma.
- Alterations in the life cycle and distribution of vectors (malaria, dengue, West Nile virus, etc.) lead to more numerous cases of these diseases, as well as to their presence in areas not usually affected.

WATER-RELATED DISEASES AGGRAVATED BY EFFECTS OF CLIMATE CHANGE:

- **Amoebiasis** *(Entamoeba histolytica)*
- **Ascariasis** *(Ascaris lumbricoides)*
- **Balantidiasis** *(Ballantidium coli)*
- **Cholera** *(Vibrio cholerae)*
- **Cryptosporidiosis** *(Cryptosporidium)*
- **E. coli** *(E.coli) (Enteropathogenic, enterotoxigenic, enteroinvasive, O157:H7, etc.).*
- **Giardiasis** *(Giardia lamblia)*
- **Hepatitis** *(Hepatitis A and E)*
- **Leptospirosis** *(Leptospira interrogans)*
- **Typhoid fever** *(Salmonella typhi)*
- **Paratyphoid** *(Salmonella paratyphi, types A, B, and C)*

- **Poliomyelitis** *(Poliovirus types 1, 2, and 3)*
- **Rotaviral gastroenteritis** *(Reoviridae family)*
- **Shigelosis or bacillary dysentery (***Shigella dysenteriae, flexneri, boydii and sonnei).*

The principal vector-born diseases most commonly manifested which can be affected by climate change are:

- Malaria
- Dengue
- Yellow fever
- Encephalitis
- Schistosomiasis
- Plague
- Chagas disease
- Hantavirus
- Leptospirosis
- West Nile virus

Diseases aggravated by changes in ecosystems:

- Rift Valley fever
- West Nile fever
- Hantavirus
- Lyme disease
- Argentine hemorrhagic fever (Junín)
- Ebola (African hemorrhagic fever)
- Sabia virus (Brazilian hemorrhagic fever)

PRINCIPAL PHENOMENA PRODUCED BY CLIMATE CHANGE

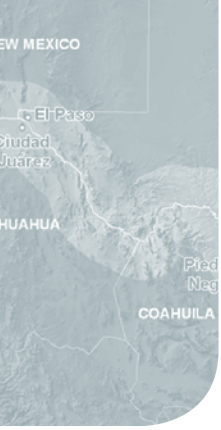
Water-related phenomena have always been present in nature, but the following have increased as a direct result of climatic variability:

1. EL NIÑO (ENOS) / LA NIÑA

Characterized by surface heating of the waters of the equatorial Pacific, occurring most often from December to April.

Features:

- More and more frequent and severe, 2 to 7 years.
- An indicator to measure the heating of the Earth.
- Chief influences: temperature and relative humidity of various countries.
- Associated with increase in certain diseases.
- Need for better methods of surveillance, both climatic and epidemiological.
- Vectors are affected in their life cycles and etiology (behavior).



2. THE CASE OF HURRICANE MITCH (OCTOBER TO NOVEMBER 1998) ON CENTRAL AMERICA

- Mitch was a category 5 hurricane on the Saffir-Simpson scale.
- More than 9,000 dead.
- 11% of Central America's 32 million inhabitants were affected.
- 80% of Honduras's GDP was affected; 49% of Nicaragua's.
- Losses equivalent to 15% of the GDP of the region.
- Total damage: 6,018 billion dollars (direct damage: 3.1 billion), according to ECLAC.
- Persons living in poverty were most severely impacted.

3. THE EL NIÑO PHENOMENON IN PANAMA

- Panama has been affected by the last two occurrences of El Niño.
- In the case of 1982-83[1], there was an increase of 23% in diarrheal diseases, 33% in amoebiasis, and 27% in acute respiratory infections.
- The case of 1997-98[2] was more severe and was responsible for:
  - 281,115 people (25% of the rural population) and over 18,000 square miles of Panama's national territory were affected.
  - Loss of rural income: 4.5 million days' wages.
  - Fires in Darién, Canal Zone, and Patacón Hill (sanitary landfill).
  - Canal water: the Gatún Reservoir: less than 43% of its historical volume (1997).
  - More than 50 million dollars lost in agriculture and livestock raising, with 143,000 acres affected.
  - The heaviest hit populations were poor peasants.
  - Agricultural and livestock industries declared in a state of emergency in September 1997.
  - Low water levels in the Bayano and Fortuna Dams; electric power and water cut off.
  - Worst crisis for the Panama Canal in 84 years of operation.
  - Restricted water displacement of boats passing through the Canal beginning March 12, 1998 and lasting 109 days.
  - Overall loss of nearly 33,000 acres of crops (rice and corn).
  - 801,000 head of livestock affected, about 1,000 lost.
  - Milk supplies dipped by 12.5 million gallons, and milk had to be imported.
  - Fewer corvina and mero fish caught; the catch of dorado fish rose.
  - 275 dry wells.
  - Nutritional effects on 53,600 families.
  - Increase in malaria in Darién.
  - Dengue outbreaks in several sites in Panama.
  - Reports of hepatitis, acute diarrheal and respiratory infections, dermatosis, greater number of reptile and spider bites.
  - Increased local exposure to smoke and dust.

1 Panamanian Government. Estrategia de asistencia crítica para mitigar los efectos del Niño. 17 de octubre de 1997.
2 Jenkins Molieri, J. Principales consecuencias del Fenómeno El Niño en Panamá. Jornadas Nacionales de la CSS. July 1998.

4. DROUGHT IN CENTRAL AMERICA (2001)

El Salvador:

- 63 municipalities severely affected: Usulután, San Miguel, Morazán, and La Unión.
- 43% less rain than yearly average for the past 20 years.
- Over 110,000 acres of agricultural land affected.
- 80% of crop lost (corn 80%, beans 93%, maicillo corn 75%).
- Poor farmers were most affected.
- Loss of 38% of average annual income (342 million dollars).
- Prices of basic grains climbed (corn +55%, beans 33%, maicillo 40%, rice 9%).
- 1.6 million people affected (according to the World Food Program).

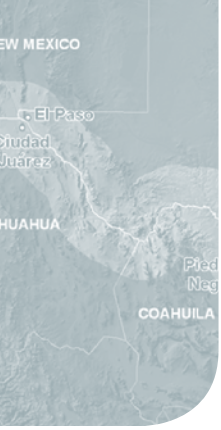
Consequences:

- Growing poverty: there was no second harvest.
- Lack of income opportunities.
- Effects compounded by coffee crisis.
- Increase in malnutrition in children under the age of 5.
- Environmental changes with human health effects.

LOCAL LEVEL

Our Paso del Norte region has a structural vulnerability that is complicated by:

- Location and structure of dwellings.
- Demography (high density of urban population favoring transmission of certain diseases).
- General state of health.
- Degree of economic development (resources).
- Uneven distribution of income.
- Access to food, water, and sanitation.
- Access to services in the areas of health, education, and housing.
- Environmental conditions.
- Poor preparedness for extreme weather events.
- Low level of social cohesion, solidarity, altruism, cooperation.
- Problems of social equity.



It is therefore necessary that the people and the authorities devise measures to adapt to climate change. Some of these measures are:

- Enhance resiliency of health services and reduce structural, architectural, and operational vulnerability of facilities.
- Improve health services in terms of human resources, climatic epidemiological surveillance (public health surveillance), actively seeking cases, and greater efficiency in coordinated and participative management.
- Prevention and control measures.
- Preparedness for emergency scenarios and disasters.
- Interagency and community coordination.
- Promoting equity.

CONCLUSIONS

In the Paso del Norte region, weather phenomena which have historically been present have been exacerbated by climatic variability.

Among the most important of these are heat waves (due to rapid urban development, waterproofing of ground, effects of islands of heat, etc.), droughts, strong winds and dust storms, and heavy rains (monsoons).

The principal consequences in terms of people's health are: deaths due to heat stress, especially in persons with pre-existing conditions; cardiovascular diseases; Cerebrovascular diseases; respiratory diseases such as asthma, allergic diseases, conjunctivitis and dermatitis; and vector-borne diseases such as West Nile virus.

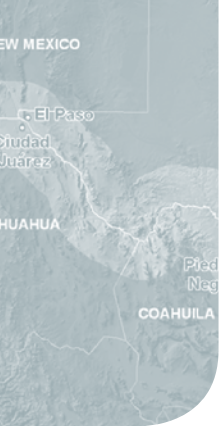
RECOMMENDATIONS

In order to mitigate adverse effects, the following steps must be taken:

- Incorporate the topic of climate change and health into the agendas of organizations that handle emergencies and disasters.
- Fine tune existing emergency and disaster response plans.
- Integrate epidemiological surveillance with climatic and environmental surveillance.
- Establish Climate Change and Health Observatories.
- Implement Faces, Voices and Places (of the Millennium Development Goals) to empower communities, combat inequities, and further the attainment of MDGs.
- Place emphasis on vulnerable populations.

The PAHO/WHO US-Mexico Office has five lines of action with regard to climate change, according to WHO guidelines:

- **Testing:** Improve and integrate epidemiological surveillance; conduct interdisciplinary and multisectorial research; incorporate academic sector, research institutions, local and state governments, observatories, indicators, assessments, modeling (Juárez Valley).
- **Raising awareness:** Dissemination of knowledge (Border Virtual Health Library, web pages); local mobilization (Faces, Voices and Places); information provided to mass media; preparation of strategies and guidelines.
- **Resources:** Training in water resources; proposals for assessments, research and interventions; financial management, International Development Bank, World Bank, NADB, and private sector; production sector (maquiladoras).
- **Adaptation:** Emphasis on health services; intervention assessment; incorporate sectors of agriculture, water management, sanitation, energy, urban development, education, economy, environment and disaster management.
- **Partnerships/Alliances:** Civil society, NGOs, private sector; mass media, WHO collaborating centers.
- **Strengthen** urban planning in terms of stormwater drainage, water containment systems, reforestation, conservation of natural resources, alternative energy sources, reuse and recycling, and reducing vulnerability.



BINATIONAL WORKSHOP ON CLIMATIC VARIABILITY AND HEALTH

Camino Real Hotel
December 5, 2008
El Paso, Texas

MINUTES

INTRODUCTION

The impact of climatic variability on our planet and the responsibility of human beings in generating this phenomenon have long been topics of discussion. Controversy, disagreement and disparate points of view have resulted from contradictory or incomplete scientific evidence; moreover, conflicts among competing interests, political pressures, and even lack of concern have denied this issue a central place in conducting debate and taking action to prevent adverse events of greater magnitude on earth and the devastating effects they can exert on all life.

Constant efforts on the part of international organizations, some governments, many scientists, and groups committed to safeguarding the wellbeing of humanity have led to consensus with regard to diagnosing and planning actions to be taken in reducing the impact now and in the coming years.

In 2008, the World Health Organization selected the motto “Protecting Health from Climate Change” to mark its World Health Day. Documentation has been prepared which articulates the principal aspects of this initiative:

- Climate change is occurring and is accelerating.
- Sea levels are rising as glaciers melt.
- Precipitation patterns are changing.
- The frequency and intensity of extreme weather phenomena are changing.

This final point is of great concern to the Paso del Norte Region. It is a demonstrated fact that temperature variability has increased, causing certain natural phenomena to become more aggressive. Rainy seasons are also more extreme, bringing floods such as those recorded in our

region in 2006 and 2008. Hurricanes have also struck, the aftermath of one of which affected the US state of New Mexico, when heavy rains caused rivers to overflow their banks in the city of Ruidoso in August of this year.

It is essential to clarify the role that regional authorities will have in mitigating the effects of climatic variability, specifically with regard to impact on human health. New or more common outbreaks of communicable diseases are occurring, since weather conditions have become more favorable for their transmission. Vector-borne diseases, such as malaria and dengue, are prime examples; waterborne diseases like diarrhea (in seasonal cycles) could represent a greater threat if seasonal climate changes are altered.

Outside the area of health, climate change also has an impact on the economy and social wellbeing of underdeveloped nations, most notably in terms of food safety, erosion of coastlines, diminished agricultural productivity, etc.

WHO sums up the crisis as follows: “In the long run, the greatest health impacts may not be from acute shocks such as natural disasters or epidemics, but from the gradual build-up of pressure on the natural, economic and social systems that sustain health, and which are already under stress in much of the developing world. These gradual stresses include reductions and seasonal changes in the availability of fresh water, regional drops in food production, and rising sea levels. Each of these changes has the potential to force population displacement and increase the risks of civil conflict”.

BACKGROUND

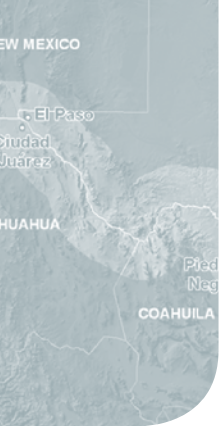
No place on the planet has been spared from the effects of climatic variability, as the Paso del Norte Region confirms. We have witnessed heavy flooding events that affected our tri-state area in August and September of 2006, testing the ability of local authorities to respond and coordinate their efforts.

More recently, in the summer of 2008 (July), a new wave of floods hit the region[1], leaving some areas of El Paso under water and causing traffic disruption, rock and mudslides, and the temporary closing of certain streets. The Sunland Park children’s park, located near the banks of the Rio Grande, was also affected.

In Ciudad Juárez the situation was considerably worse, particularly in the southern part of town known as El Barreal. This area had already been flooded in July-August 2006, and as a result some temporary earthen dikes had been built, including the Santa Elena 1 dike, which failed, near the Bordo de la Laguna de Patos, causing flood waters to encroach into the subdivisions of Villas del Sur 1 and 2, Alborada, Los Naranjos, Las Almeras, Palmas, and Praderas del Sol. According to newspaper estimates, a total of 3,100 families were affected. Submerged roads in most of the subdivisions cited increased the risk of diseases such as West Nile virus, dermatitis, gastrointestinal disorders and diseases of the eye, among others.

Another local event happened in late July 2008 in New Mexico in the wake of Hurricane Dolly. Lincoln County (including the city of Ruidoso and surrounding areas) suffered floods on July 26-28, leaving one person dead, 200 homes damaged, impassable roads, 13 bridges destroyed, communities cut off from communication, 900 people rescued and millions of dollars in damage. The intense rains

1 For additional details see: Jenkins, J. and Iturralde G., Lessons learned from 2006 floodings in the Paso del Norte region.



struck during the weekend, causing the Ruidoso River to overflow and the consequent evacuation of everyone who lived near its banks, including tourists who were visiting the area at the time.

The real causes of recurrent flooding in this part of the Paso del Norte region must be sought in uncontrolled human activity affecting the environment, especially rapid urban development in the absence of adequate urban planning, the lack of overall management of river basins (particularly in a binational context), the lack of an effective rainwater drainage system, and failure to achieve pervasive attitudes and behaviors of prevention based on lessons learned from previous floods.

Moreover, as in other parts of the world where climate changes have been observed, the foregoing types of instances have become noticeably more numerous and severe.

It is within this framework that the "Binational Workshop on Climatic Variation and Health" was planned and implemented.

The workshop was organized and directed by the Colegio de la Frontera Norte (COLEF), the Border Environment Cooperation Commission (BECC), and the Pan American Health Organization/World Health Organization (PAHO/WHO), with support from other concerned institutions including: The City of El Paso, Municipality of Ciudad Juárez, US Environmental Protection Agency, New Mexico Health Department, El Paso City-County Emergency Management Department, the Texas Commission on Environmental Quality (TCEQ), the Ministry of Urban Development and Ecology (SEDUE) of the State of Chihuahua, the Ciudad Juárez Municipal Government Office of Ecology and Civil Protection, UTEP, SEMARNAT, NMSU, COESPRIS, and COFEPRIS, among others.

A total of five meetings were held in preparation for the workshop, on September 10 and 30, October 31, November 19, and December 1, with attendance by representatives of the various participating entities. At these meetings, decisions were taken with respect to the workshop's date, topics, objectives, expected outcomes, guests, roles of each sponsoring institution, and related aspects.

The workshop's overall objective was to contribute to efforts to lessen the current and expected impact of climate change on health and the environment in the US-Mexico border region, focusing particularly on the Paso del Norte region.

In particular, we wished to explore the ways in which manifestations of climate change on both sides of the border, as well as the environment and social determinants of health are interrelated and to provide follow-up on the initiatives and commitments stemming from World Health Day and its motto "Climate Change and Health".

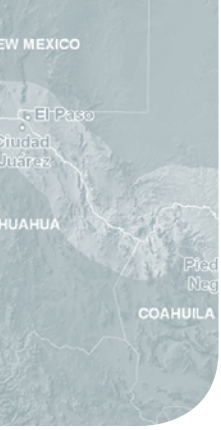
The outcomes of this event are recorded in this volume, which presents the principal conclusions and recommendations intended for use by institutions and authorities in educating themselves about the adverse impact of climatic variability in our geographic area.

The workshop was held Friday, December 5, 2008, from 8:00 a.m. to 6:00 p.m. in the Brahma Room of the Camino Real Hotel in El Paso, Texas, with the participation of 58 experts in the field.

PROGRAM

Coordinator: **Dr. Jorge Jenkins**
Recording Secretary: **Dr. Gustavo Iturralde**

8:15 am	Posthumous tribute to Commissioners Carlos Marín and Arturo Herrera1	Consul Raymond McGrath Consul Roberto Rodríguez
8:30 am	Opening ceremony Workshop objectives and methodology	MSc. Daniel Chacón Dr. Gustavo Córdova Dr. Maria T. Cerqueira Lic. Clemente Villalpando Dr. Jorge Jenkins
8:45 am	Variability in the interaction between atmosphere and lithosphere and its possible effects on the health of residents of the Paso del Norte Region	Dr. Thomas Gill
9:05 am	Climatic variability in Central America and its impact on the economy: A case study	Dr. Francisco Mayorga
9:35 am	Emergency and disaster preparedness in the City and County of El Paso	Chief Carlos Carmona
10:15 am	Climate Change Program of Mexico's Ministry of Health to prevent the effects of climatic variability	Biol. Guadalupe de la Luz González
10:30 am	The impact of climatic variability on Mexican society and productivity	Dr. Ignacio Sánchez
10:45 am	Public health initiatives to reduce the impact of climatic variability	Dr. Héctor Puertas
11:00 am	The effects of climate change on health and the PAHO/WHO Regional Program	MSc. Sally Edwards
11:15 am	Climatic variability and its impact on available water supplies	Dr. Karl Woods
11:30 am	The impact of climatic variability on the United States-Mexico border region	Ing. Mario Vásquez
11:45 am	The impact of climatic variability on public health	Dr. Jorge Jenkins
2:15 pm	Working groups	
4:15 pm	Closing plenary session and presentation of the book "Lessons Learned from 2006 Floodings in the Paso del Norte Region"	
6:00 pm	Workshop concludes	



WORKING GROUPS

GROUP	TOPIC	FACILITATOR	RECORDER
1	Possible extreme weather phenomena and their consequences for the Paso del Norte region	Lourdes Romo	Gonzalo Bravo
2	Mitigation and adaptation strategies applicable to climate change (health sector)	Paul Dulin	María Sisneros

PROGRAM EVENTS

POSTHUMOUS TRIBUTE TO COMMISSIONERS CARLOS MARIN AND ARTURO HERRERA

The program began with homage being paid to Carlos Marín and Arturo Herrera, members of the International Boundary and Water Commission, who died when the airplane in which they were traveling to inspect flooding near Presidio crashed. The full text of this tribute can be found in an early chapter of this volume.

OPENING CEREMONY

MSc. Gonzalo Bravo – representing MSc. Daniel Chacón – BECC

Mr. Bravo spoke about Arturo Herrera, who played a role in the creation of the BECC and was a board member of both BECC and the North American Development Bank, working to create links between IBWC and BECC. His leadership brought growth to the IBWC, and his influence in training engineers and diplomats was decisive. He promoted the creation of conflict resolution networks in the border region and the participation of many persons in regional development.

Mr. Bravo expressed Daniel Chacón's appreciation to PAHO for the linkage that made it possible for the various institutions to share experiences and information on topics of health, environment, and natural disaster risk management, as well as publications such as the proceedings of the December 2008 workshop focusing on flooding and workshops on issues of paving and health, analysis of environmental management, and others.

Two other key cooperative efforts have been the Border Health Virtual Library, which gives people practical access to health and environmental information, and institutional cooperation between BECC and PAHO for monitoring and studying water in the Juárez Valley, to improve sanitary habits in water consumption and provide for continuity in the process of measuring health indicators implemented by the BECC along with other entities. Enough information has now been gathered to trace the epidemiological profile of the Juárez Valley with respect to issues of soil and water.

These key mechanisms have promoted border development in the areas of health and reducing vulnerability to natural disasters and have led to investment topping three billion dollars.

This workshop is important because analysis of climatic variability lays the groundwork for assessing the availability of water supplies affecting agriculture and border health, as well as droughts and heavy rains that can bring devastating effects. Knowledge in this area will help prepare citizens, particularly those who are most vulnerable, to be better prepared and to change their behaviors.

Dr. Roberto Hurtado – representing Dr. Gustavo Cordova – COLEF

Dr. Hurtado recognized Commissioner Arturo Herrera as a valued contributor to the work of the Colegio de la Frontera Norte in training professionals. He added that COLEF feels honored to be participating, along with PAHO and BECC, in exploring issues of great interest to the region such as those of this workshop.

The workshop is important because it focuses on the full spectrum of causes of climate change, including depletion of the ozone layer, and paves the way for corrective measures to be taken to benefit future generations.

Dr. María Teresa Cerqueira – PAHO/WHO Representative

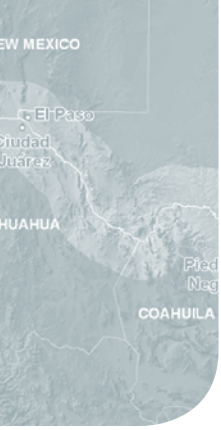
Dr. Cerqueira began by thanking both the organizations who provided support for the workshop and those who were in attendance.

She stressed the urgency which the issue of climatic variability has taken on in recent years, with its effects on health and productivity worldwide.

The PAHO/WHO US-Mexico Border Office is immersed in the process of raising awareness through dissemination of information. The organization seeks to actively involve all health-related institutions in efforts to safeguard the environment and lessen the harmful effects of climate change, empowering citizens, and finding new ways to live in harmony with nature.

She expressed her hope that this workshop, planned jointly by BECC and COLEF with support from numerous other Mexican and US organizations, will serve as the starting point in a joint process leading to improve living conditions and enhanced readiness in the face of probable adverse future events which will come as a result of damage already sustained.

She then announced the conclusion of the opening ceremony and set the stage for the presentations to begin.



PRESENTATIONS

The remainder of the morning session was dedicated to the presentations slotted for this time period. The content of these may be referenced in the corresponding articles appearing in this volume.

QUESTIONS, COMMENTS, AND ANSWERS

- Paul Dulin: The prime issue here is preparedness on the part of the population for adverse events.

  Sally Edwards: The key to success is for citizens and organizations to organize and coordinate efforts in adapting to climate changes that affect human life.

- Carlos Rincón: Will today's discussion topic be incorporated into the agenda of the meeting of border state governors?

  María T. Cerqueira: The topic will be included in the two working group sessions of that meeting focusing on health and environment.

- Gilberto Velásquez: What data do health centers have regarding vector-borne, respiratory, and gastrointestinal diseases? Is this information available to researchers?

  Álvaro Valenzuela: Data are gathered by health workers and reported weekly to the appropriate organizations. This information is available to researchers.

- María T. Cerqueira: There is a problem with water loss and evaporation in open irrigation channels. Is there any possibility of negotiating with the agricultural sector to change this practice?

  Ignacio Sánchez: The law requiring that when water is scarce it must be allotted first to the general population and then to other use is not strictly enforced. Current negotiations are focusing on reducing subsoil water consumption and modifying irrigation methods, thus reducing waste and enhancing efficiency.

WORKING GROUPS

Each of the two focus groups had a coordinator and a recording secretary.

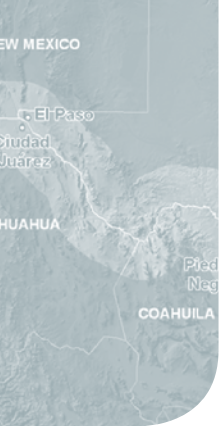
GROUP 1: Possible extreme weather phenomena and the consequences for the Paso del Norte Region

Across-the-board recommendations for all phenomena: Support in all parameters to increase investment in scientific research in these topics, in instrumentation and capacity through binational legal measures.

Phenomenon	Possible causes	Type of intervention conducted	Positive impact	Negative impact	Recommendations
1. Extremely heavy rains due to hurricanes or increased humidity over the Gulf of Mexico or Pacific Ocean (with greater effect in the Gulf of Mexico due to lack of natural barriers).	Increase in humidity of the air because of rising temperature of the oceans.	Reactive for 2006 flooding. Preparation of rainwater drainage systems.	Replenishment of reservoirs and possible replenishment of aquifers. Increase in vegetation with greater efficiency of photosynthesis and carbon capture. Atmospheric cleansing.	Flooding. Pollution. Spread of contaminants. Contamination of aquifers. Increase in transmission vectors. Long-term water stagnation. Reroutes channels. Deterioration and destruction of infrastructure (roadways, bridges, waste water treatment plants, water purification plants, contamination of wells, etc.). Elevated levels of asthma, allergies and harmful fauna due to increased vegetation and fires. Acid rain.	Coordinated binational early alert systems. Standardization in the measurement patterns in real time, especially higher basins rather than lower ones, with telemetry and radar compatible with early detection. Recording of events and ways they were managed. Clearly defined jurisdictions for maintaining basins and subbasins. Urban planning and zoning with specific regulations. Engineering analysis of precipitation, draining, and design. In-depth analysis of new patterns of periods of return to design new urban infrastructure, including updating of historical precipitation patters. Training workers in the environmental health sector. Stricter building regulations to avoid real estate development in streams and raise awareness of its risks, in view of possible historic conditions. Participation of civilian population in ensuring enforcement of regulations. Expand the network of weather stations. Implement rainwater drainage management policies.

2. Increase in intensity of precipitation in shorter time periods and occurring in more localized areas.				Ponding. Flooded areas. Peak rainfalls.	Identify geographic areas of precipitation and rates of recurrence. Establish a larger network of weather stations. Early detection of weather phenomena through enhanced training and coordination in a binational framework, by means agreed to by both parties. Soil and vegetation management.
3. Fluctuation in amounts of snowfall.	Changing global circulation patterns.	More reactive than preventive.	Enhanced drainage and water replacement. Accidents more minor.	Less water and water replacement and lower quality water for Elephant Butte dam. Persistence of pests from one season to the next. Change to tropical humidity, with diseases more typical of a tropical rather than a semiarid region. Great impact on seasonal diseases. Negative impact on the economy. Higher salinity in the basin.	Enhanced education and awareness campaigns. Greater use of technology in the field, with crops having greater aggregate value and reduced use of water.
4. Increase in heat waves.	Global climate change. Islands of heat in urban areas.	High-impact education and training programs.		Rising morbidity and mortality from dehydration, especially among vulnerable populations. Negative impact on the economy, reduced productivity, increase power usage, elevated water consumption at greater cost. Impact of flooding on ecosystems.	Reforestation. Use of insulation materials in construction. Use of alternative sources of energy. Shelters. Prevention and public education. Incorporate energy saving technologies into the appropriate building codes. Use of dark concrete in paving.

5. Rainstorms (groups of cells) or severe storms.		Reactive.	Possibility of localized replenishment. Lightning increase nitrogen levels.	Flooding. Hail storms. Negative economic effects. Risk of death or physical impairment. Disruption of urban mobility. Flash flooding. Psychosis, panic. Damage to infrastructure.	Prevention through education and binationally coordinated early alert system. Safety features to protect dwellings and owners housed in shelters. Expand networking of community weather spotters and weather officials for sharing information.
6. Changes in wind patterns.			Cleans the air.	Damage to infrastructure. Economic impact. Air pollution. Respiratory diseases due to more particulate matter in the air.	Enhanced monitoring of pollen.



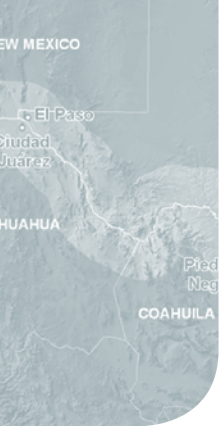
GROUP 2: Mechanisms to mitigate and adapt to climatic variability (Health Sector)

- **The group first defined the terms mitigation and adaptation.**
    - Mitigation: Action that can be taken to reduce an activity which people have not adapted (for example, reducing emissions).
    - Adaptation: Accepting the impact and bringing about change in people rather than in an activity (e.g., all measures taken in the health sector to lessen the impact of global climate change on the health sector).
- **List of impacts on the health care sector and health systems:**
    - Respiratory problems (e.g., air quality).
    - Dysentery/gastrointestinal diseases (related to availability of water or water quality; flooding).
    - Diseases transmitted by vectors/insects: (West Nile virus, dengue, malaria).
    - Social inequality (e.g., air quality has a greater impact on the poor; work-related stress; air conditioning without adaptation mechanism).
    - Colder climates (poor heating systems cause carbon monoxide poisoning).
    - Infectious diseases aggravated by increasing population density (e.g., rural populations with tuberculosis migrate to cities).
    - Mental hygiene affected by factors mentioned previously.
    - Eye and skin disorders due to loss of accessibility to water (e.g., lack of hygiene).
    - Extreme weather events (chronic health consequences: flooding or drought leading to changes in the land, increased dust with concomitant worsening of air quality).
    - Acute health effects (e.g., drowning due to flash floods).
    - Nutritional impact of climate change affecting crop raising area, with consequent local food shortages; there is also an economic impact of reduced local production of chiles or nuts.
    - Changes in agricultural practices (e.g., use of pesticides/insecticides) and costs.
    - Health system stressed by increasing frequency of disasters and rising number of persons seeking medical attention.
    - Education about risks to the population and what can be done.
- **What kind of mitigation and adaptation responses can occur?**

EXTREME EVENTS: MITIGATION				
Mechanism	**Description**	**Entities that have been involved**	**Actions taken**	**Recommendations**
1. Climate change impacting the planet.	Better planning. Coordinated, coherent response. Education for the community regarding its vulnerability. Policy changes. Better urban planning, land use, mass transportation.	Health authorities. Schools. Community health centers. Fire departments. Red Cross. First aid. Health services. NGOs.	Education and research. Training. Lessons learned workshops. Mock scenarios, simulations.	Need for effective regional communication capabilities in cases of emergency. Greater political support. Financial assistance. Ongoing training in preparedness and binational response capability. Ongoing public education.
ENVIRONMENTAL POLLUTION				
2. Effects on health.	Improved agricultural practices. Street paving projects. Reforestation with trees. Public education and information. Changes in technologies and processes. Promoting mass transportation. System for reporting infectious diseases	Universities. Private industry. NGOs. Health sector.	Training in improved agricultural practices. Paved roads. An educated public.	Expanded paving projects. Improved ongoing regional planning. Integrated information systems. Education

QUANTITY AND QUALITY OF WATER				
3. Education on vectors.	Ways to eliminate vectors in communities. Paving roads. Drainage projects.	Local government. Universities. Health sector entities. NGOs. Community.	Education on vectors. Hygiene education at an early age. Tire elimination project (reduces vector breeding grounds). Water and drainage infrastructure in rural communities. Urban and regional planning.	Continue water and waste management infrastructure projects. Pursue ongoing improvement of regional plan. Continue to develop vaccines against waterborne diseases. Continue public education.
MENTAL HEALTH				
4. Mental health.	Training health personnel and public in aspects of mental health.	Governments. Health sector. Universities. NGOs.	Training health personnel in aspects of mental health. Consultancy courses. Public education. Training trainers.	Capacity building: more mental health providers, bilingual personnel. Work force development. Improve access to healthcare services. Ongoing public education.

AGRICULTURAL PRACTICES				
5. Changes in agricultural practices.	Changes in crops. Greater numbers of insects. Crop pests.	Governments. Health sector. Universities. NGOs. Farmers.	-------	Become better prepared for a situation that could affect the industry. Conduct studies to predict potential change in the region in order to improve planning procedures.
INFECTIOUS DISEASES				
6. Increase in infectious diseases and zoonosis.	Frameworks for action (planning and dissemination of binational epidemiological surveillance). Develop a surveillance system on the US side of the border. Public education.	Governments. Health sector. Universities. NGOs.	---------	Need for a binational component in surveillance systems. Financial assistance to develop a binational surveillance system. Ongoing public education.



PLENARY SESSION

- It was noted that the conclusions and recommendations of the working groups must be made available to workshop participants as soon as possible, without waiting for publication of workshop proceedings.

- The need to provide authorities in both countries with the conclusions and recommendations of the workshop was reiterated, which will allow them to take these points into account while designing and subsequently implementing policies.

- The working groups were asked whether they took up the issue of the El Niño phenomenon as it related to the appearance and severity of disease. The groups responded that climate in general was discussed, but no specific event or type of event was singled out.

BOOK PRESENTATION: "LESSONS LEARNED FROM 2006 FLOODINGS IN THE PASO DEL NORTE REGION"

Dr. Jorge Jenkins, in making the official presentation of this book, made the following observations:

- The book contains the collected reflections and conclusions expressed at the workshop held on this topic in December 2007. The workshop, conducted in collaboration with COLEF, attracted a sizable audience (130 participants).

- The articles collected for publication are very complete and informative.

- The book's contents were summarized, and information was given about the authors.

- Some of the problems encountered in putting together the volume were discussed, including delays in submission of manuscripts, shortage of photographs, translation issues, and difficulties in printing the volume.

- It is hoped that this volume will become an obligatory reference for local authorities and universities in the area of disaster management in the Paso del Norte region

- The proceedings of this workshop will be published in February 2009, relying on presenters to submit their manuscripts and graphic materials in a timely fashion.

- Follow-up on conclusions and recommendations should be carried out by an oversight system involving input from all three states represented in our region, and in particular by the three governors. An excellent opportunity for this to occur will be at the border governors' meeting (10 states of Mexico and the United States).

CLOSING REMARKS

John Cook
Mayor of city of El Paso

It is an honor to address all the attendees at this Binational Workshop on Climactic Variability and Health that has been long overdue.

El Paso is very fortunate to have its roots and geographical location on an international border. As a border community, we have a distinct privilege to be a part of a very unique relationship between neighboring cities, states and countries. With this privilege comes the opportunity to look collaboratively at issues that are of mutual effect and interest to our border community. In this day and age, we see just how volatile and unpredictable our environment and climate can be. With this in mind, it is our duty to work together to deal with environmental, climate and health issues that affect our border. We can learn from those ordeals we have already faced in order to take improved action and use what we know about our region's climactic, environmental and health status to be proactive in dealing with those ordeals that may arise.

We have an amazing border region. Let us continue to work together to preserve and safeguard this beautiful asset. This conference was a total success and I hope that this is just the first of many opportunities to get together and discuss how we can make a difference.

Thank you.

CLIMATE CHANGE AND HEALTH
UNITED STATES – MEXICO BORDER