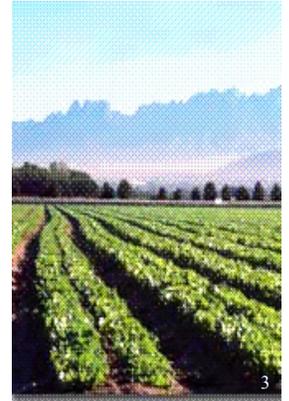


POTENTIAL EFFECTS OF CLIMATE CHANGE ON NEW MEXICO

A compilation of published reports



This is a summary of a report prepared by state agency personnel as directed by Governor Richardson's Climate Change and Greenhouse Gas Reduction Executive Order 2005-033. This report assessed the potential impacts on New Mexico from climate change that could be brought about by global warming in the 21st century. Information in the report was compiled from previously published national and regional climate change impact assessments, papers in scientific journals, and assessments by experts on the climate of the Southwest.

The full report, "Potential Effects of Climate Change on New Mexico", is available from the New Mexico Environment Department (www.nmenv.state.nm.us, phone 505-827-1494).

Se encuentra disponible una traducción en español de este informe.



POTENTIAL EFFECTS OF CLIMATE CHANGE ON NEW MEXICO

Summary

Greenhouse Gases and Climate Change

Human activity is changing the global climate by increasing the concentration of carbon dioxide, methane and other greenhouse gases in the atmosphere. These gases trap heat near Earth's surface. The greatest human-caused contribution to the increased greenhouse effect is the large amount of carbon dioxide produced by burning carbon-based fuels such as coal, oil, gasoline and natural gas. Other human-caused sources of greenhouse gases include land-use changes and emissions from some industrial processes. Fortunately, we can reduce the impacts of climate change if we take action to reduce greenhouse gas emissions (see page 8).

Increased warming of Earth's surface changes the complex interactions of air, land, water and ice, as well as the circulations of winds and ocean currents that make up the global climate system. Computer models of the climate system are used to estimate global patterns of future climatic conditions under various scenarios of future greenhouse gas concentrations. Some changes projected by these models, such as significant warming and decreased snow and ice cover in Arctic regions, appear to have already begun in the last few decades.

Projected Changes in New Mexico's Climate

The projected changes are based on a "business-as-usual" scenario for future emissions, meaning the estimates assume no measures will be taken to reduce global greenhouse gas emissions.

Climate models project substantial changes in New Mexico's climate over the next fifty to one-hundred years, including:

- Warmer air temperatures by 6-12°F on average [see box];
- Greater warming in winter, at night, and at high elevations;
- More episodes of extreme heat, fewer episodes of extreme cold, and a longer frost-free season;
- More intense storm events & flashfloods;
- Winter precipitation falling more often as rain, less often as snow;
- Average precipitation could either increase or decrease; and
- Higher evaporation rates because of warmer temperatures.

Where is it 6°F warmer?

One way to imagine what a 6°F increase in average annual temperature would be like is to find other places that are currently 6°F warmer.

This place would be..... as warm as this is today:

Eagle Nest	→	Cuba
Farmington	→	Tucumcari
Santa Fe	→	Silver City
Albuquerque	→	Carlsbad
Las Cruces	→	Dallas, TX
Carlsbad	→	Tucson, AZ

Tree-ring records and other paleoclimatic data show that New Mexico typically experiences a severe long-term drought about once every century. Climatologists expect that a severe multiyear drought like that of the 1950s is likely to recur during the 21st century, regardless of human-caused climate change. But the effects of future drought will be more severe with warmer temperatures, which increase evaporation rates from vegetation, soil, and reservoirs. Higher evaporation rates will also tend to offset any increases in precipitation that might occur.

Water Resources

Many areas of the state are already facing potential shortages in meeting the water needs of our growing cities, agriculture, and manufacturing industries. Projected climate changes could make our water supply problems even worse:



Projected climate changes could make our water supply problems even worse...

- Warmer temperatures would reduce mountain snow packs;
- Peak spring runoff from snowmelt would shift to earlier in the season;
- A longer and hotter warm season will likely result in longer periods of extremely low stream flow and lower minimum flows in late summer;
- Because of earlier runoff, water supply systems with limited or no storage capacity (e.g., many acequia systems and small municipal reservoirs) may suffer seasonal shortages in summer;
- Large reservoir systems may suffer shortages from a reduction in average runoff; and

- Impacts of a severe, long-term drought, like that of the 1950s, would be greater due to warmer temperatures, increased population, and greater demand for water since the 1950s.

Infrastructure

Climate-sensitive infrastructure include those for flood control and drainage, climate control in buildings (e.g., air conditioning), electrical power distribution, sewage, water supply, and transportation.

Existing infrastructure may need to be retrofitted or replaced to cope with warmer temperatures, more intense storms, and drought. More intense flash floods may impact flood control and drainage systems, including roadway and railroad bridges and culverts. Water-use restrictions may adversely affect the functioning of sewage systems.

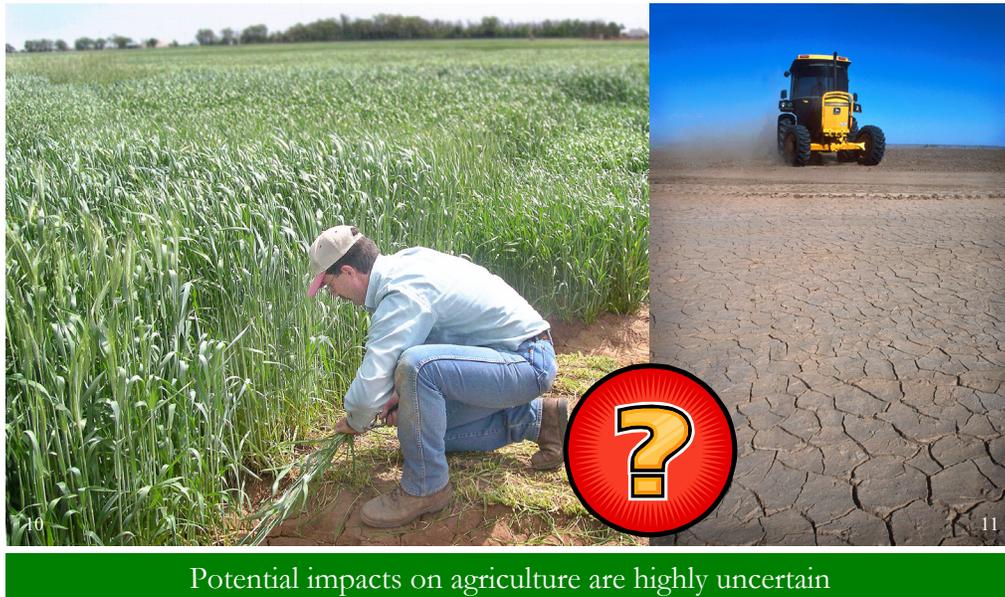
Designing new infrastructure systems will be a challenge while climate is rapidly changing, because historical weather extremes will not be a reliable guide to the future.



Intense flash floods may impact flood control and drainage systems...

Agriculture

Potential impacts on agriculture are highly uncertain. Much depends on whether precipitation increases or decreases.



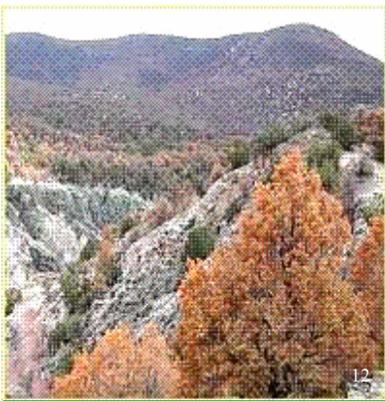
More precipitation would increase crop yields and tend to improve rangeland forage production. Severe drought coupled with warmer temperatures would adversely affect crop and rangeland production. Warmer temperatures will lengthen the frost-free growing season.

Higher atmospheric carbon dioxide concentrations would tend to increase yields of some crops, where water and soil nutrients are also sufficient for increased growth. On rangelands, however, higher carbon dioxide levels may favor woody plants over grasses, which would reduce grazing capacity.

Major uncertainties are the impacts of intense rainfall events, pests, weeds, and pathogens. Warmer conditions may affect pest populations, requiring new strategies for pest control. Farmers can use a number of adaptation strategies to lessen potential yield losses.

Natural Systems, Forests, and Wildlife

Climate change is likely to have significant impacts on the ecosystems of New Mexico's forests, grasslands, deserts, lakes and streams. Predicting the specific impacts is difficult because of the complexity of natural systems, with each species responding in its own way to the physical environment and with multiple interactions among species. Existing plant and animal communities will likely change as new assemblages of species form. Changes in ecosystem structure and functioning will often be abrupt rather than continuous and gradual.



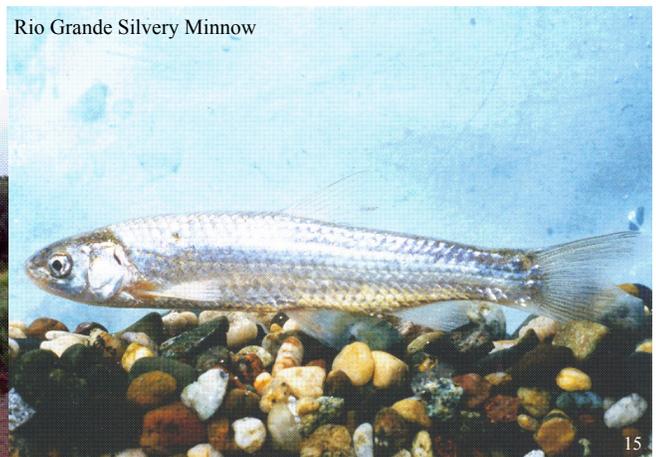
Forests are likely to experience more massive dieback due to drought stress and insect outbreaks, and more catastrophic wildfires.



Forests are likely to experience more catastrophic wildfires, and more massive dieback due to drought stresses and insect outbreaks. Some researchers believe that the existing piñon die off in northern New Mexico is a sign that climate change is already impacting our state.

Aquatic ecosystems are particularly vulnerable to climate change because they will be impacted not only by warmer temperatures but also by changes in the timing and amount of water available.

Climate change is expected to result in a significant loss of aquatic habitat. Habitat suitable for cold-water fish (e.g., trout) is expected to shrink, with replacement by warm-water fish species. Extinction rates of many endemic species of the eastern plains is expected to increase. Riparian (streamside) ecosystems are expected to experience losses and decline in quality, with a reduction in species diversity.



Losses in aquatic and riparian habitat would reduce species diversity...

Change in **terrestrial ecosystems** will include shifts in the timing of seasonal life history events such as breeding of birds, insects or amphibians, and flowering of plants.

Geographic ranges are expected to shift to the north and to higher elevations.

As habitat zones shift upwards, some species trapped on isolated mountain ranges could become locally extinct if the mountain is not high enough.

Invasions of non-native species are likely, but species diversity may be reduced. Shrubs such as mesquite and creosote bush are likely to further invade grasslands.



Alpine meadows and the species that depend on them may largely disappear from New Mexico...

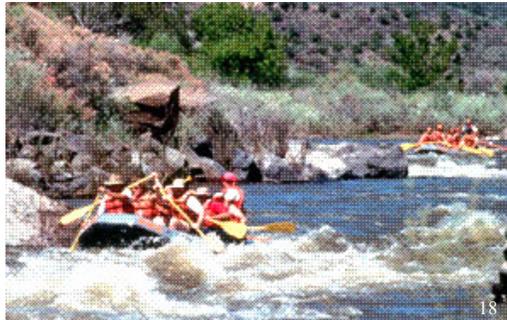
Outdoor Recreation and Related Tourism

Warmer winter temperatures are likely to severely reduce opportunities for snow sports, and ski resorts will suffer economically. Periods of high fire hazard may further restrict access to wild lands for picnicking, camping, hiking, hunting, bird watching and other outdoor activities. The attractiveness of our scenic vistas may be diminished by more air pollution episodes.



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Lower water levels in lakes and rivers will adversely impact water sports such as boating, angling, and whitewater rafting.



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Ski resorts will likely suffer due to warmer winter temperatures.

Reduced opportunities for outdoor recreation will not only impact the quality of life for New Mexicans, but will likely harm the state's economy because outdoor activities are a major attraction for tourists.

Environmental Quality and Health

Climate change is likely to increase air pollution in New Mexico. Warmer temperatures and more air stagnation episodes are projected to increase ground-level ozone (smog) concentrations. Wildfires and dust storms associated with drought are likely to increase particulate air pollution.

Dust Storm, Sunland Park-El Paso area



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Episodes of extreme heat are expected to become more severe and much more frequent, resulting in increases in heat-related illnesses and mortality.

Disruption of ecosystems and natural controls may lead to outbreaks of infectious diseases that are transmitted or carried by rodents, birds or insects. Such diseases include hantavirus, plague, dengue fever, and arboviruses such as West Nile virus. Warmer temperatures and increased dust storm activity may result in greater incidence of Valley Fever.



Disruption of ecosystems may lead to outbreaks of infectious diseases carried by insects and rodents.



Deer mouse (hantavirus carrier)

Environmental Justice and Native Peoples

The potential impacts of climate change will disproportionately affect communities of color and low-income communities, thereby raising issues of environmental justice. These communities have limited resources available to adapt and cope with additional impacts.



Traditional Native American subsistence systems (farming, grazing, hunting) are likely to be severely impacted by climate change. Local extinctions of plants and animals integral to the cultural and spiritual life of Native American communities will be highly disruptive to their cultural identity.

Photos courtesy of:

- 1) NOAA/National Weather Service, Albuquerque
- 2) Shelley Nolde, City of Santa Fe
- 3) New Mexico Department of Agriculture
- 4) U.S. Fish and Wildlife Service
- 5) U.S. Department of Transportation
- 6) New Mexico Department of Tourism, photo by Mike Stauffer
- 7) Grand Canyon Trust, photo by Rick Moore
- 8) U.S. Geological Survey
- 9) NOAA/National Weather Service, Albuquerque
- 10-11) New Mexico Department of Agriculture
- 12) U.S. Department of Agriculture, Forest Service
- 13) New Mexico Environment Department, Air Quality Bureau
- 14) U.S. Geological Survey
- 15) U.S. Fish and Wildlife Service
- 16) Judy Bunn, Cloudcroft, NM
- 17-18) New Mexico Department of Tourism, photo by Mike Stauffer
- 19) Taos Ski Valley, photo by Michael Holmquist
- 20) Webcam image from Texas Commission on Environmental Quality
- 21-22) U.S. Centers for Disease Control and Prevention
- 23) New Mexico Department of Tourism, photo by Gary Romero

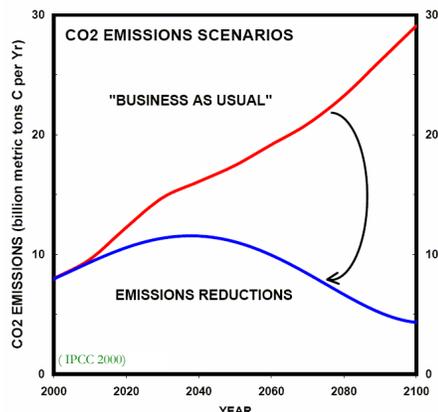
Información en español sobre cambio de condiciones climáticas:

www.pewclimate.org

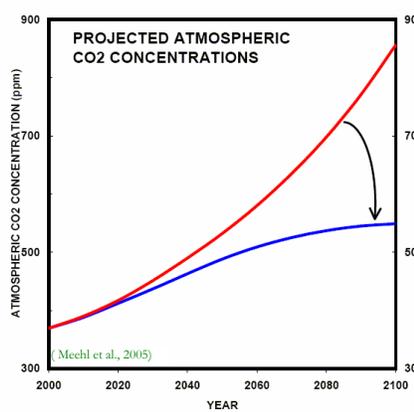
www.ipcc.ch

Reducing Future Climate Change Impacts

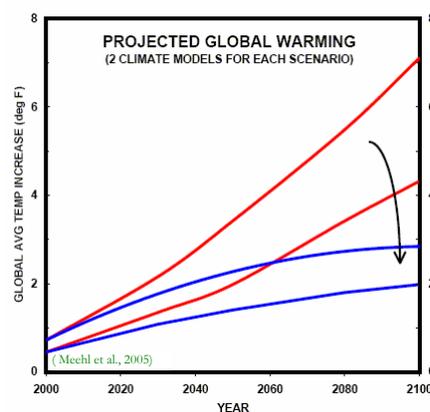
The report looks at potential impacts of climate change that would result if greenhouse gas emissions and atmospheric concentrations continue to increase at a “business-as-usual” rate. We can reduce future climate change impacts by reducing emissions of greenhouse gases.



IF...we act now to reduce global greenhouse gas emissions...



...then we can reduce future increases in atmospheric greenhouse gas concentrations...



...and reduce the chances of catastrophic climate change in the future and reduce chances of adverse impacts to public health and the environment.

Reducing Greenhouse Gas Emissions

Governor Bill Richardson and the New Mexico Environment Department are taking action to address climate change by reducing greenhouse gas emissions in New Mexico. The Governor's Climate Change and Greenhouse Gas Reduction Executive Order mandates a serious evaluation of methods for achieving emissions reductions to **2000 levels by the year 2012, 10% below 2000 levels by 2020 and 75% below by 2050**. In addition, New Mexico became the first state to sign on to the Chicago Climate Exchange, committing to reduce greenhouse gas emissions in state government operations. For more information on both of these initiatives visit our website at www.nmclimatechange.us.

There are many ways to address climate change by reducing energy use and corresponding carbon dioxide emissions. Using less energy at home and practicing efficient driving habits will save money and reduce greenhouse gas emissions. For more information on how to limit your carbon footprint, you may want to visit the following Web sites:

- www.fightglobalwarming.com
- yosemite.epa.gov/oar/globalwarming.nsf

For more information about climate change impacts:

Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report – Climate Change 2001

The IPCC is a prestigious international body of experts in climate and other sciences. At regular intervals, they provide an authoritative assessment of the state of knowledge on climate change.

www.ipcc.ch

US National Assessment of the Potential Consequences of Climate Variability and Change (2001)

A detailed overview of the consequences of climate change and mechanisms for adaptation; for New Mexico, see especially the Regional Assessments for Southwest, Rocky Mountain/ Great Basin, and Great Plains (Southern)/ Rio Grande.

www.usgcrp.gov/usgcrp/nacc/default.htm

New Mexico Environment Department's Climate Change Initiatives web page

Has links to the full report summarized here, slide shows on the science of climate change, Governor Richardson's Climate Change and Greenhouse Gas Reduction Executive Order, and more.

www.nmemv.state.us/aqb/cc