NEW MEXICO Climate

A service of NMSU's Climate Center | Winter 2001
Office of the State Climatologist | Department of Agronomy and Horticulture
College of Agriculture and Home Economics | Agricultural Experiment Station

Current, Past, and Future Climate of New Mexico

by Ted Sammis
State climatologist & NMSU Professor

New Mexico spans approximately five degrees of longitude and three degrees of latitude. The maximum number of days without killing frost (220 days) occurs in southwestern New Mexico along the lower end of the Rio Grande Valley and in the Pecos River valley south of Carlsbad. The northern part of the state has 100 frost free days. Because the altitudes ranges from 3,000 ft to 13,000 ft, temperatures vary widely: from a maximum average monthly temperature of 94 degrees in Deming in the southern desert part of the state to 81 degrees in Chama in the northern mountain part of the state in the summer, and to an average minimum temperature of 24 degrees in Roswell compared to 10 degrees in Taos during the winter. The low relative humidity prevents either extreme from being too unpleasant.

New Mexico climate has changed throughout the ages. Axelrod (1983) postulated a gradual change in the climate and vegetation from a tropical savanna in the late Cretaceous (70 m.y.a) through dry tropical forest and short tree forest in the Paleocene through the Oligocene (60-20 million years ago). As the drying trend continued, elements of modern woodland, grassland, and deserts began to develop during the Miocene (18-20 million years ago). From the Miocene to the present a gradual drying trend continued and the fossil plants of Miocene period and later are very similar to the current vegetation types (Figure 1).

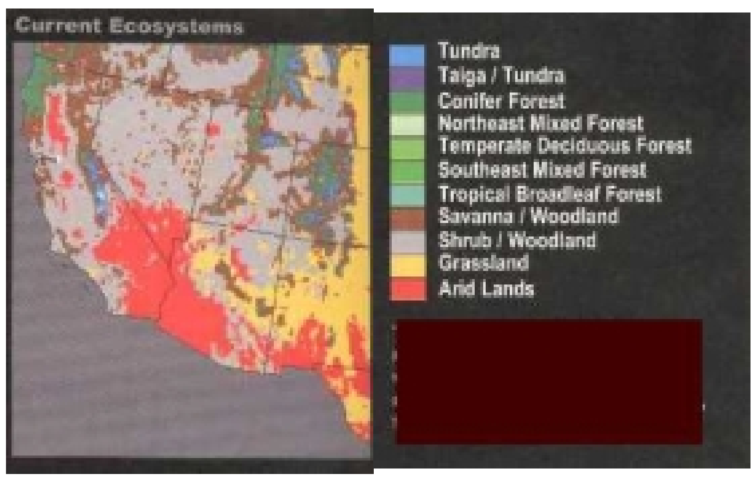

Figure 1. The current vegetation in the western United States including New Mexico. From: The Potential Consequences of Climate Variability and Change (NAST 2000).

The climatic trend resulted from a variety of factors, including the uplift of the Sierran-Cascade axis, the Rocky Mountains, and the Sierra Madre of Mexico. The area of New Mexico, and the southwestern United States, lies in a double rain shadow that came into existence during the late Tertiary. The rain shadows caused a decrease in precipitation, and forests and woodlands retreated from lower elevations while deserts and grasslands took their place.

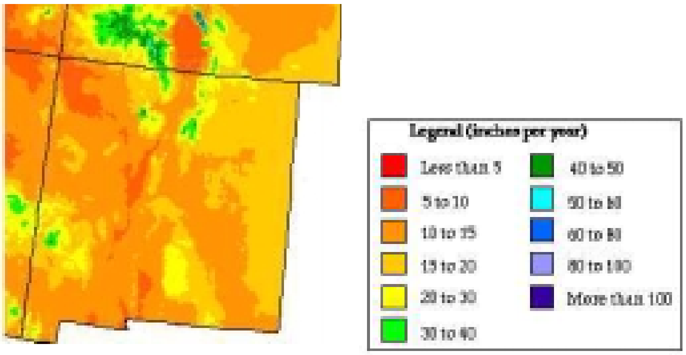

Figure 2. Precipitation over New Mexico. Produced by Spatial Climate Analysis Service, Oregon State University.

The present rain and snowfall also remains variable over the state (Figure 2).

Chama in the northern part of the state receives an average of 100 inches of snow during the winter but received 183 inches in 1984-1985. Las Cruces in the southern desert gets only 4 inches of snow annually. Rain usually comes as both frontal storms during the winter months and afternoon thunderstorms during the summer months that cause dangerous flash floods. Rainfall in Las Cruces and Albuquerque averages 9 inches annually, whereas Taos gets 12 inches of rainfall. At any given elevation, precipitation is generally greatest in the eastern third of the state and least in the western portion since the source of most of New Mexico summer moisture is the Gulf of Mexico and the farther one goes from that body of water the less the precipitation.

The El Niño/Southern Oscillation (ENSO) phenomenon is an atmosphere-ocean coupling across the central tropical Pacific which influences climate in many regions of the world. The semi-arid and arid ecosystems of the southwestern United States are strongly influenced by the ENSO phenomenon during fall, winter, and spring when regional climate derives predominantly from the Pacific Ocean. At the Sevilleta Wildlife Refuge, south of Albuquerque, precipitation from October through May increased 53% in El Niño years. Precipitation decreased by slightly more than half in La Niña years when compared to average precipitation over the past 80 years. The linkage between the ENSO phenomenon and summer precipitation in New Mexico is weak.

The southern part of the state has seen a shift in vegetation from a semidesert grassland to desert shrubland in the last 100 years. Weather changes can explain some of the desertification process. The southwest encountered a warming trend from 1900 to 1940 and a resulting increase in winter precipitation tended to encourage the establishment of C3 shrub plants instead of C4 grasses. The summer droughts in the1940's also favored establishment of perennial desert shrubs. Overgrazing during this time period would have acted synergistically with climate change to enhance desertification (Neilson 1986).

State-of-the-science climate models have been used to generate climate change scenarios for temperature and precipitation and other climatic variables for the 21^{st} century. As CO_2 levels increase, the two main models, the Canadian Model and the Hadley Model have similar predictions (NAST 2000); temperatures in New Mexico are projected to increase. The models predict an increase of $5\text{-}11^0$ F. Both models predict an increase in rainfall (Figure 3). Precipitation and temperature changes will result in different vegetation types.

Vegetation models run under the Hadley and Canadian scenarios suggest an increase in plant growth, and a reduction in desert areas. The vegetation will shift toward more woodlands and forests from grassland (Figure 4).

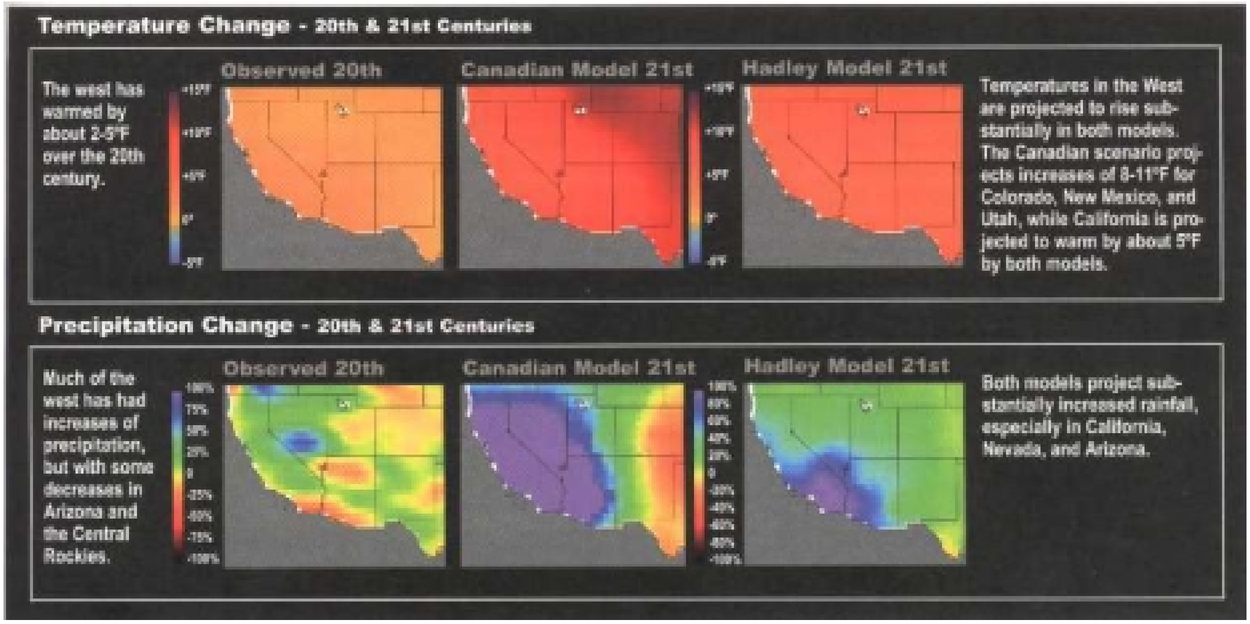

Figure 3. Temperature change that will occur in the 20th and 21st centuries. From the publication: The Potential Consequences of Climate Variability and Change (NAST 2000).

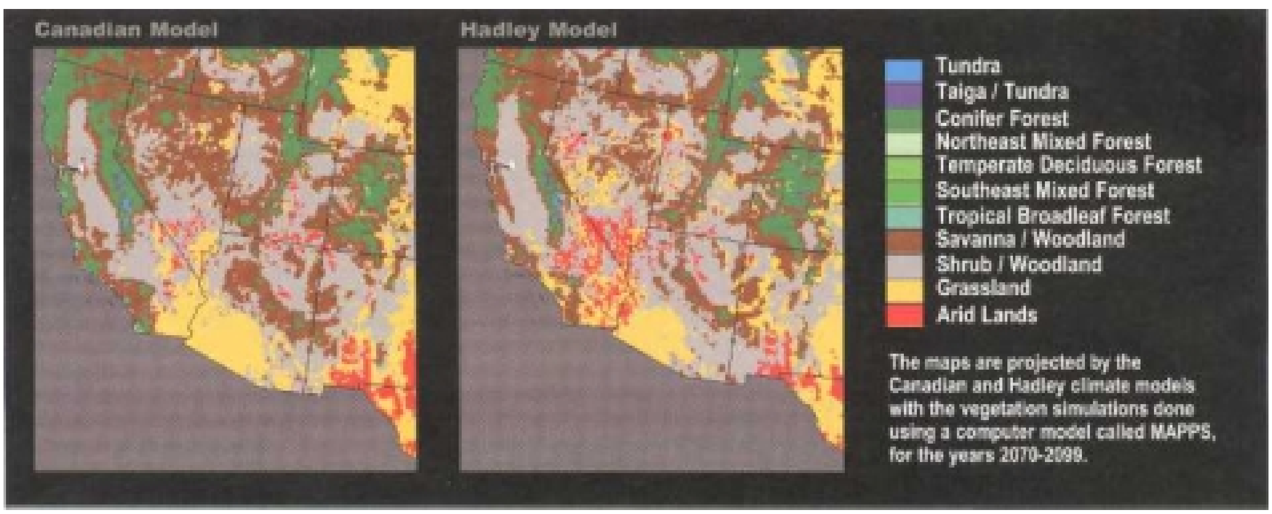

Figure 4. Future vegetation in the western United States for the years 2070-2099. From the publication: The Potential Consequences of Climate Variability and Change (NAST 2000).

References:

Axelrod, D.I. 1983. Paleobotanical history of the western deserts. In. S.G. Wells and D. R. Haragan eds. Origin and evolution of Deserts. University of New Mexico Press Albuquerque. Pp. 113-129.

Nelson, R.P. 1986. High-resolution climatic analysis and southwest Biogeography. Science Vol. 232:29-33.

National Assessment Synthesis Team, Climate Change Impacts on the United States (NAST) 2000. The Potential Consequences of Climate Variability and Change, US Global Change Research Program 4000 Virginia Avenue, SW, Suite 750 Washington DC, 20004.

About NMSU's Climate Center

NMSU's Climate Center is home to the state climatologist who helps New Mexicans understand the impact of climate changes on the environment, human health, and agricultural production.

The state climatologist is responsible for archiving weather data and distributing climate information to the public. Unlike meteorologists, climatologists do not provide weather forecasting or up-to-the-minute bulletins. Instead, they use a computerized data collection system to provide statewide weather reports for previous days, as well as for historical information.

The state climatologist puts climate data into a form people can use to make decisions about their lives. During fire season, people use climate data to assess potential fire hazards and to evaluate fire-fighting conditions. Engineers use information about rainfall and flooding to design bridges, culverts, storm sewers, and sanitary sewers.

Business owners use climate data to evaluate new business or relocation sites. Farmers use it to anticipate outbreaks of insect pests or crop diseases. People also use climate data when making their recreation and travel plans.

For more information:
State climatologist Ted Sammis
Phone: (505) 646-2104
Data services: (505) 646-5082
E-mail: webmaster@weather.nmsu.edu
Internet: http://weather.nmsu.edu

The office of the state climatologist and its head, the state climatologist, are described in New Mexico Statute 75-4-1 through 75-4-4.

Office of the State Climatologist
Department of Agronomy and Horticulture
P.O. Box 30003, MSC 3Q
Las Cruces, NM 88003-8003