

SONORENSIS

Arizona Sonora Desert Museum

*Climate
Change*

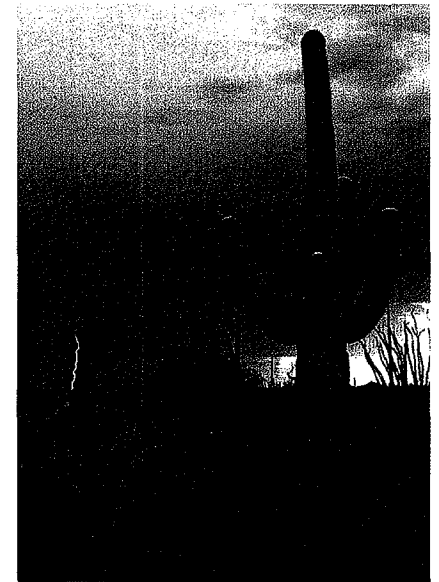
Winter 2004

Introduction

In the movie *The Day After Tomorrow*, a sudden climate change into another ice age causes a tidal wave to inundate New York and freeze instantly. Once again, Hollywood ruined an interesting theme by its ignorance of science. The laws of physics preclude the "flash glacier" and most of the other disasters in the movie. But the theme is a good one because equally horrific climatic disasters are possible; they just wouldn't happen quite as fast.

Consider current reality. A drought began in 1998. Events in the Atlantic and Pacific Oceans suggest the possibility of a megadrought that could last another 15 to 20 years. In the Southwest, many of our most common plants – bursage, jojoba, palo verde trees – died during the nearly rainless year of 2001. Because of poor snowfall in the Rocky Mountains and consequently low flow in the Colorado River, Lake Powell and Lake Mead are now at all-time low water levels and are less than half full.

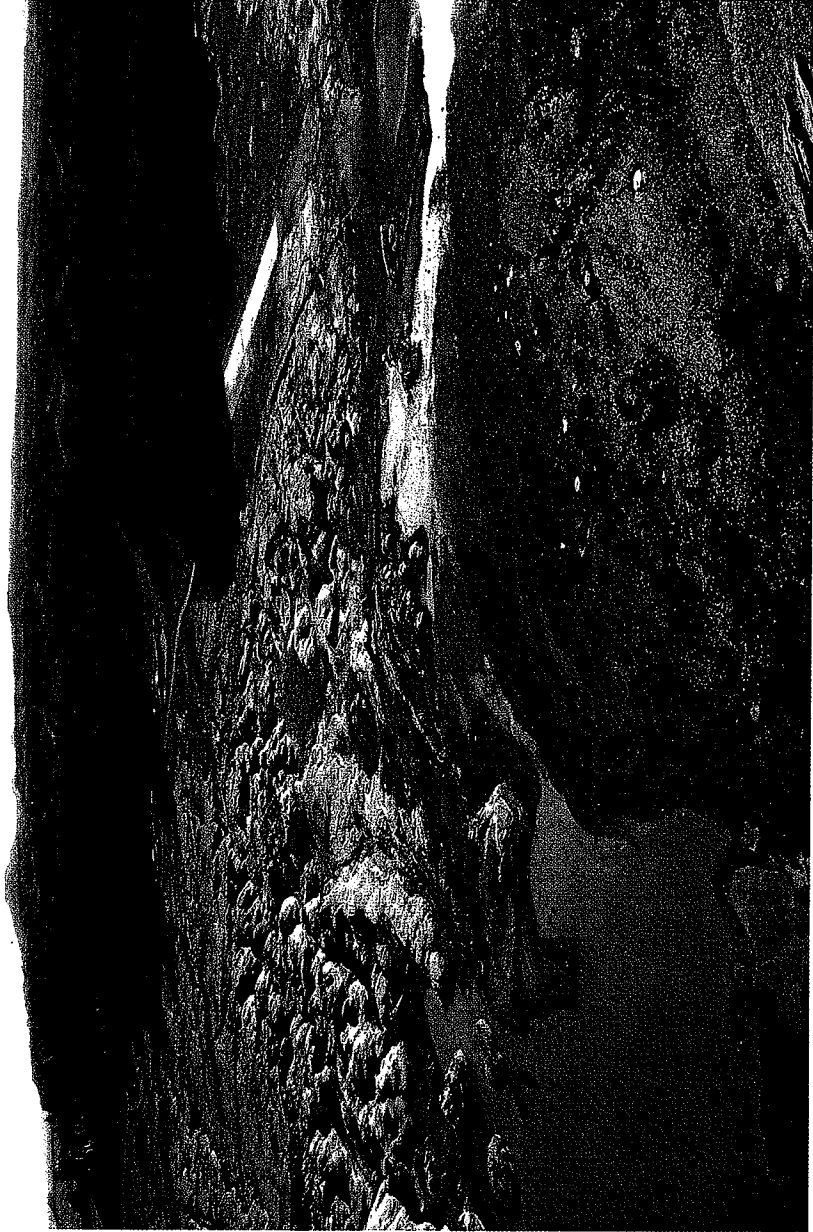
Uncertainty is at the core of current climate modeling; the drought could end next year. But if it continues our future could be a nightmare. According to Colorado River water managers, the reservoirs could fall below the level of the aqueduct intakes by 2007. A widespread drought would produce similar results on the other rivers that supply water for cities and agriculture. The Salt and Verde rivers would go dry. Phoenix and Tucson would have to increase use of CAP water, but Arizona takes the first hit if Colorado River water deliveries are below 7.5 million acre feet. Then Phoenix and Tucson would have to rely on ground water, which would increase land subsidence that could result in massive damage to buildings. ►



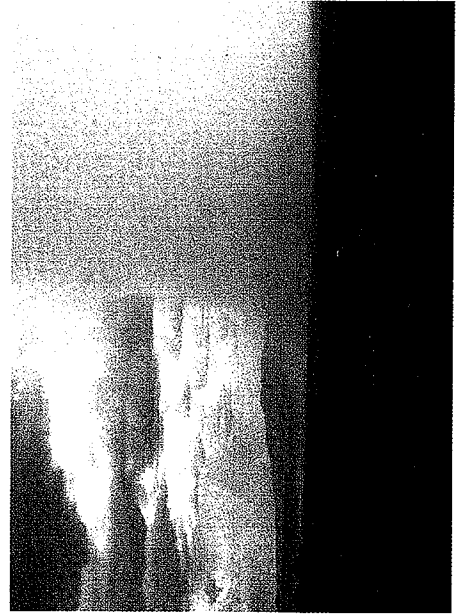
In a prolonged drought the Sonoran Desert would change dramatically. Most of the palo verde trees, jojoba, bursage, and saguaros would die; most of the montane forests would burn to the ground. (There is precedence for this – it actually happened during past droughts in the 12th and 16th centuries. The Hohokam culture vanished during such a period.) Cities would enact draconian water rationing. The landscapes in parks, resorts, and home gardens would die (including most xeriscapes). Tourism would crash. Industries that use water would lay off much of their work force. The economies of the desert states could collapse.

Isn't this just as scary as the events in *The Day After Tomorrow*? Can we predict and plan for such a crisis and avoid the fate of the Hohokam if the worst really happens? Even a modest climate change will have major effects on our lives. It bears directly on such issues as our flood and fire insurance rates, our water and electrical bills, and the probability of a good wildflower bloom or pleasant weather on the day of the family picnic.

Has a long-term climate change begun? Consider this. In the summer 2003 European heat wave 15,000 people died in France alone, and even Britain recorded over 2,000 heat-related "excess deaths" during the month of August. A group of German scientists calculated that the statistical probability of such an event was 0.0001 – in other words, a heat wave on the magnitude of 2003 should only happen once ever 10,000 years! Every year the number of deaths due to "tropical diseases"



Jeff Phillips



climbs (e.g., malaria, dengue, pathogen-based diarrhea) as warm climates and tropical pathogens extend their ranges northward. Dengue has pushed itself nearly to the Arizona-Sonora border, and this year thousands of cases are expected to be reported in Hermosillo. In Alaska, spruce bark beetles have killed 2.3 million acres of trees since 1992, the worst insect outbreak ever to hit North American forests, and it is directly related to higher temperatures. The threshold of thermal tolerance is already being crossed for tropical coral reefs, which suffer "coral bleaching" when sea surface temperatures get too high. Bleaching reached epidemic proportions in the 1998 El Niño event, when a sixth of the world's coral reefs were destroyed. And, as the permafrost melts in Alaska and northern Canada, more and more buildings are collapsing into the softening soil. A recent paper in the prestigious science journal *Nature* (by Chris Thomas and his colleagues) concluded that 20-30 percent of the earth's species could be wiped out by global warming as soon as 2050. Even if all greenhouse gas emissions stopped tomorrow, most models predict that the climate would continue warming for decades into the future – probably by double that experienced over the last century. This would make the planet hotter than at any time since the end of the last ice age. In fact, the upper range of global warming estimates is higher than anything experienced in the last 40 million years, and well outside the temperature range ever experienced by humanity or the other species with whom we share this planet.

Unlike past warming episodes that ended ice ages, our current situation would take us from an already warm inter-glacial period to an ever hotter world, where temperatures could be outside the evolutionary experience of most living species. It would be short-sighted to ignore these trends.

This issue of *sonorensis* summarizes what we know about weather and climate in the Southwest, and what the future may hold for us. Paul Huttner defines the terms weather and climate, and he explains how meteorologists and climatologists measure them. He goes on to describe some of the astronomical phenomena that cause the climate cycles that in turn influence our weather. Tom Van Devender uses the fossil record to describe the tremendous changes in vegetation of the Southwest that have occurred in the past two million years due to climate changes. Robert Webb and Ray Turner document changes that have happened during the past century as revealed by same-site repeat photography. Melanie Lenart, Jonathan Overpeck, and Gregg Garfin present the latest evidence for global warming and discuss the environmental and social consequences of climate change in the Southwest.

The Desert Museum is proud to present this contemporary overview of climate in our region. We hope our readers find this issue both engaging and informative.

Mark A. Dimmitt, Director of Natural History
Richard C. Brusca, Executive Program Director
Robert Edison, Executive Administrative Director

