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February 27, 2001

Release No: 01-17

**AFRICA'S LAKE CHAD SHRINKS BY 20 TIMES DUE TO IRRIGATION DEMANDS, CLIMATE CHANGE**

In the 1960s, North central Africa's Lake Chad was larger than the state of Vermont but is now smaller than Rhode Island. NASA-funded researchers using computer models and climate data now understand why Africa's freshwater Lake Chad has been disappearing over the last 30 years.

Michael T. Coe and Jonathan A. Foley of the University of Wisconsin-Madison cite a drier climate and high agricultural demands for water as reasons why what was once one of Africa's largest freshwater lakes is shrinking. "Lake Chad was about 25,000 square kilometers in surface area back in 1963," Foley noted. Now the lake is about one-twentieth the size it was in the mid 1960s.

Their paper titled "Human and Natural Impacts on the Water Resources of the Lake Chad Basin," is being published today in the American Geophysical Union's *Journal of Geophysical Research*. In their paper, Coe and Foley used an integrated biosphere model (IBIS) with long time-series climate data. They simulated the exchange of energy, water and carbon dioxide between vegetation, soil and the atmosphere, and tracked the changes in Lake Chad since 1953. They input the data from the biosphere model into a hydrological model and were able to estimate changes in river discharge, the amount of water in wetlands and in Lake Chad.

Using model and climate data, Coe and Foley calculate that a 30 percent decrease took place in the lake between 1966 and 1975. Irrigation only accounted for 5 percent of that decrease, with drier conditions accounting for the remainder. They noticed that irrigation demands increased four-fold between 1983 and 1994, accounting for 50 percent of the additional decrease in the size of the lake.

"NASA Landsat satellite imagery taken of the lake over the last 30 years really capture the model conclusions and visualize them very well," the researchers noted.

Lake Chad and the Chari/Logone river system, which transports 90 percent of the runoff generated in the area basin, are important water resources for the local population. The lake is 820 feet (250 m) above sea level and is shared by Chad, Cameroon, Nigeria and Niger. Lake Chad has always undergone seasonal and inter-annual fluctuations because it is less than 23 feet (7 m) deep. In recent decades, during wet periods the lake expands up to 10,000 square miles (25,900

square km). The warming climate and increasing desertification in the surrounding Sahel region have dropped water levels far below the average dry season level of 4,000 square miles (10,000 square km) to only 839 square miles (1,350 square km).

The Northern Africa Sahel region has experienced numerous devastating droughts over the last three decades. "Climate data has shown a great decrease in rainfall since the early 1960's largely due to a decrease in the number of large rainfall events," Coe said.

Lake Chad's primary source of water comes from the monsoon rains that typically fall in June, July and August. Meanwhile, the use of water for irrigation has increased, in response to the drier climate. Over the last 40 years, the discharge from the Chari/Logone river system at the city of N'Djamena in Chad has decreased by almost 75 percent, drastically reducing the input into the lake. Between the increase in agricultural water use and the drier climate, there has been a massive decline in the amount of water in Lake Chad.

With a drier climate and less rainfall, agricultural areas become more desperate for water to irrigate their crops, and will continue draining what is left of Lake Chad. Foley said, "The problem is expected to worsen in the coming years as population and irrigation demands continue to increase."

Regional officials have noticed the dramatic effect the shrinking lake is having on its surrounding inhabitants. In the summer of 1998, the President of Chad hosted the 10th Lake Chad summit with leaders from Nigeria, Niger, the Central African Republic, Cameroon and Sudan to discuss how to boost water levels.

NASA's Earth Observing System funded the Lake Chad study. The overall goal of NASA's Earth Observing System is to advance the understanding of the entire Earth system on a global scale by improving our knowledge of the components of the system, the interactions between them and how the Earth system is changing.

Images and additional information can be found at:

<http://www.gsfc.nasa.gov/topstory/20010227lakechad.html>