Great Sand Dunes

National Park Service
U.S. Department of the Interior

Great Sand Dunes
National Park and Preserve

Wetland Loss at Great Sand Dunes

The Questions

Are the interdunal wetlands surrounding the dune complex at Great Sand Dunes disappearing? If so, what is the cause of the change?

Anecdotal reports suggested that the region west of the dunes, known as the sand sheet, had once included more extensive wetlands than are presently seen. The existing wetlands, including both ponds and marshlands, are a unique feature in this arid landscape. They attract wildlife ranging from elk and bison to migratory birds, salamanders, and insects. Park managers wanted to know if the wetlands really are shrinking. And if they are, what was the likely cause? There was some speculation that groundwater pumping by agricultural operations in the San Luis Valley was causing a decline in the number of wetlands areas. Others thought that drought or other natural processes were involved.

The Projects

Use aerial photos to examine changes in size and distribution of wetland area. If wetland area is declining, use isotopes, groundwater modeling, and weather data analysis to understand regional hydrology and determine the cause of wetland disappearance in the Great Sand Dunes area.

This study actually occurred in two phases. In the first, funded by the Colorado Historical society and carried out by Dave Hammond and others at Colorado State University, researchers used aerial photos from different time periods to examine changes in wetland area. The need for aerial photography limited the study to the years after photos became available. At least one set of photographs was collected for each decade from 1930's to the 1990's. The photos were scanned into a computer, so the researchers could remove lens distortions and then geo-reference all photos. This task was difficult due to the lack of stable landforms in the dune area. However, the researchers were eventually able to print and analyze the digital images using various computer-aided and visual techniques.

In the second phase of the project, Colorado State University graduate student Fred Wurster studied the hydrologic system supporting the wetland area. He used stable isotopes of oxygen and hydrogen to find the source of the water in the interdunal ponds. Wurster compared the specific isotope ratio found in the wetlands with waters from possible sources, including Sand Creek and precipitation. Once the source of the water was identified, 120 shallow groundwater monitoring wells were installed near Sand Creek and the Elk Springs wetland complex to observe groundwater input and flow. Finally, the Palmer Drought Severity Index, a formula that combines data about temperature and dryness, was correlated with changes in the size and number of the wetlands as documented in the photo record.

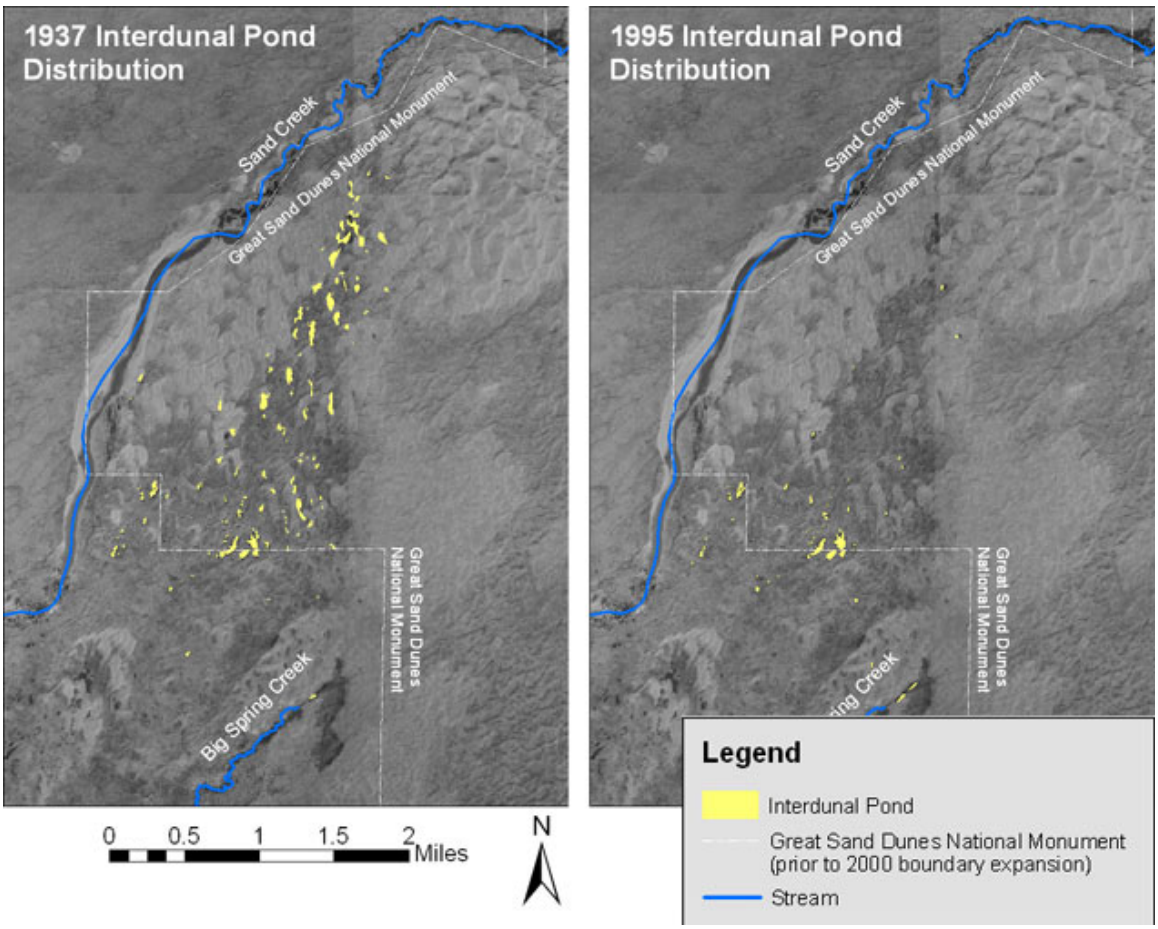
The Results

Anecdotal reports were correct; total acreage of wetland areas had decreased significantly. The loss of acreage can be attributed to sand movement, the incision of Sand Creek in its channel, and long periods dry weather.

Aerial photo analysis showed that both the number of interdunal ponds and the total acreage of wetlands had decreased between 1935 and 1995. Examination of the digitized images revealed that the greatest loss of wetland area occurred between 1935 and 1953, when the number of ponds dropped from 114 to 38, and the total wetland area from about 70 acres to about 21 acres. All of that reduction took place in the northern half of the study area, with no change in the southern portion. The number of ponds and total acreage continued to drop throughout the 1960s and 1970s. By 1979, there were a total of 22 ponds with an area of about 20 acres. The 1980s and 1990s saw a reverse in the trend. Several new ponds developed in the southern portion of the study area, accounting for a thirty percent increase in total wetland acreage between 1975 and 1995. These changes, first a decline and then a modest increase, correlated well with changes in the Palmer Drought Index during corresponding time periods.

Isotopic analysis revealed that nearby Sand Creek was the source of the water in the interdunal ponds and that very little of the pond recharge came from precipitation. The ground water wells allowed Wurster to create a three dimensional model of water flow. He concluded that the interdunal ponds occur where groundwater fills depressions in the landscape and that groundwater flows through the ponds in a down-slope direction. Based on the groundwater model, groundwater pumping in the agricultural areas of the Valley does not appear to be currently affecting the groundwater in the the Great Sand Dunes area wetlands.

The analysis, comparing changes in wetlands to climate patterns as revealed by the Palmer Drought Index, suggests that interdunal ponds are temporary features. Over time, burial by migrating dunes, entrenchment of Sand Creek, and decreases of groundwater discharge, such as those correlated with the Drought Index, have likely all contributed to the disappearance of the ponds. These natural processes, not agricultural activity, seem to have caused the decline of the unique, biologically rich wetlands at Great Sand Dunes. Perhaps future periods of abundant precipitation will reverse this trend.



The information above is taken from unpublished reports submitted to the park. This brief overview of research results is not intended as a statement of park policy. For more information on the park's research program, see www.nps.gov/grsa/resources/research_intro.htm or contact Fred Bunch, Natural Resource Management Specialist, at Fred_Bunch@nps.gov or (719) 378-6361.