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G05-1551 Multiple-Year Droughts in Nebraska

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NebGuide

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G1551

Multiple-Year Droughts In Nebraska

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"When the well is dry, we know the worth of water."
Benjamin Franklin

This NebGuide discusses the history and impact of drought in Nebraska.

Most people understand that droughts have had a major impact on Nebraska in the past. Yet, many Nebraskans continue to be surprised when drought occurs. It is important to remember that droughts, including multiple-year droughts, are a normal part of Nebraska's climate. This NebGuide discusses the history of drought in Nebraska, and aims to help Nebraskans better understand the range of climatic variability when they plan for drought.

Past Nebraska Droughts

Although there were some sporadic attempts to collect weather information in Nebraska in the mid 1800s, the systematic collection of weather data in the state began in the late 1800s. Over the years, additional stations have been added to create a dense weather observation network. As a result, there are currently 358 weather stations in operation across Nebraska. Although these stations collect a great deal of information, they only provide roughly a century of data on climatic parameters such as rainfall. Therefore, when you hear that the 1930s drought period was Nebraska's "worst drought on record," it generally means that this was the driest series of years since the late 1800s. However, studies using other methods to look further back in history reveal that Nebraska has experienced a broader range of drought conditions.

Soil scientist Harry Weakly with the USDA Soil Conservation Service (now the Natural Resources Conservation Service) looked at tree-ring records in Nebraska and put together a record of multiple-year droughts of five years or longer between 1210 and 1958 (Weakly, 1965). The most complete record was obtained from buried and surviving trees at Ash Hollow, near the western Nebraska town of Lewellen *(Table I)*. His research revealed that the 1930s drought was not an unusual event. In fact, the "Dirty Thirties" look rather tame compared to some of the previous "mega-droughts," like the 38-year drought in the late 1200s and the 26-year drought in the mid-1500s. Certainly, not every year in the multiple-year droughts was dry, but the overall trend was dryness. These and subsequent droughts have caused significant environmental effects, and had a great impact on Nebraska settlement patterns and agricultural operations.

Based on Weakly's and a wide variety of other paleoclimate studies, Woodhouse and Overpeck (1998) concluded in their recent analysis that the droughts during the 20th century are not representative of the full range of drought conditions experienced in the Great Plains over the last 2,000 years. Basically, the residents of

Table I. Drought periods of 5 or more years duration at Ash Hollow, Nebraska (Weakly, 1965).

First Year	*Last Year*	*Duration of Drought (years)*	*Years Between Drought*
1220	1231	12	
1260	1272	13	29
1276	1313	38	3
1383	1388	6	33
1438	1455	18	16
1493	1498	6	38
1512	1529	18	13
1539	1564	26	10
1587	1605	19	23
1626	1630	5	20
1668	1675	8	38
1688	1707	20	13
1728	1732	5	21
1761	1773	13	29
1798	1803	6	26
1822	1832	11	25
1858	1866	9	25
1884	1895	12	18
1906	1913	8	10
1931	1940	10	17
1952	1957	6	11

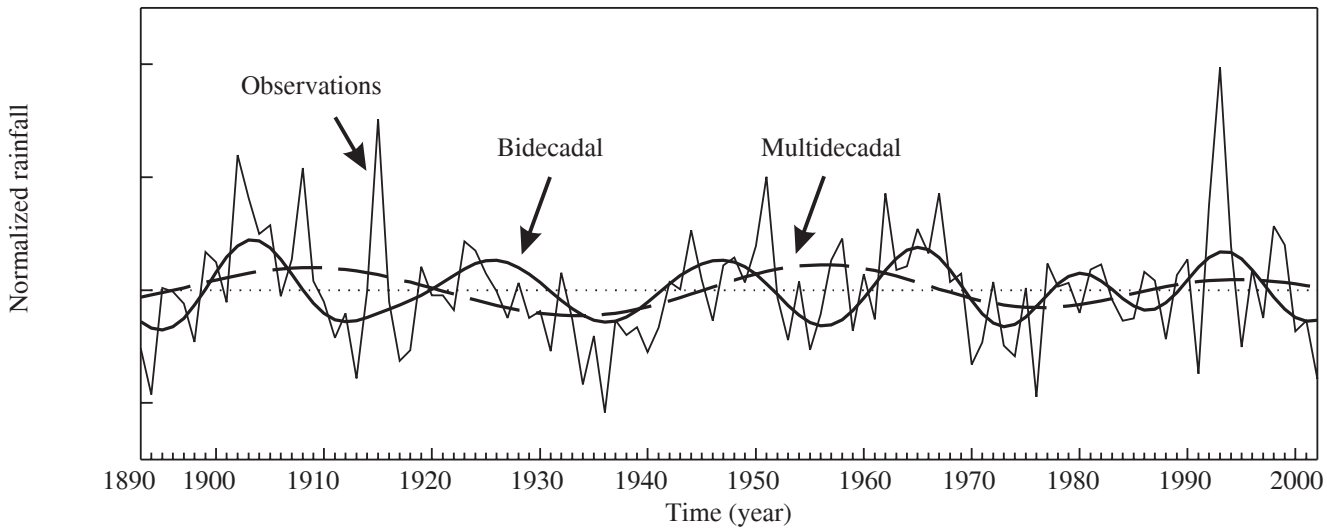

Figure 1. Nebraska summer rainfall variation from 1895 to 2003.

Nebraska who experienced droughts in part or all of the state in 1999-2004 have not yet seen anything unusual.

Current Drought Studies

Although paleoclimate studies show severe drought occurrences in the past, they don't provide enough information to identify specific patterns or predict when they may occur again. To do this, researchers must rely on the weather information obtained since these records began. As an example of these efforts, Dr. Steve Hu of the University of Nebraska-Lincoln has studied Nebraska's precipitation records to see if they might yield clues about future rainfall trends. He found that, since 1895, precipitation patterns for Nebraska summers reveal approximately 20-year (bidecadal) and 40-year (multidecadal) drought cycles (see *Figure 1*). When both of these cycles become "negative" together, as they did during the 1930s and 1970s, he concludes that especially severe multiple-year droughts occur across the state. Based on the trends in this figure, there is concern for the recurrence of similar multiple year droughts in the early 21st century.

Although such studies are helpful in understanding general climatic tendencies, there are local differences that may affect year-to-year climate. Fortunately, there are resources available that can be accessed to gain a better understanding of historical local conditions. For example, historical drought information can be plotted on-line through the National Climatic Data Center's CLIMVIS program (see contact information on the final page). CLIMVIS can be used to graph historical summaries of drought conditions from 1895 to the present for each climate division within a state. Nebraska is divided into eight climate divisions. For example, climate division seven includes the western portion of the Republican River Valley. Plotting the historical Palmer Drought Severity Index for the climate division reveals that the 1999-2003 drought was not as severe as the series of drought years during the 1930s or the early 1950s *(Figure 2)*. This example points out that, as severe as the drought conditions were in the region from 1999 to 2003, it has been worse in recorded history. This type of understanding helps put current drought situations in historical perspective and demonstrates the need for enhanced drought planning and conservation efforts.

There are also resources available to assist in reconstructing an even more precise climate history of your local area. The National Climatic Data Center, High Plains Regional Climate Center, and Nebraska State Climate Office all have Web-based historical information on weather stations across Nebraska. Access to some of this information is fee-based. Examining these records will help better understand the annual precipitation variations in local areas. For example, precipitation data for Lincoln has been collected since 1887. From 1887 to 2002, the city's average annual precipitation has been 27.6 inches. However, the climate records show that the city has received less than 20 inches of annual precipitation in thirteen of those years, and as little as 14.09 inches in 1936. In fact, the years 1934-1939 averaged 20.8 inches of rainfall per year. This information is valuable for designing your operation or activity to withstand such departures from the average. What changes would you have to make in your activities to survive a 50 percent reduction in annual precipitation? What about a 25 percent departure from average over a period of five years or longer? Is the seasonality of precipitation more important than annual departures from the average?

Drought Planning

In 1998, Congress passed the National Drought Policy Act. This law established the National Drought Policy Commission to develop recommendations for dealing with drought in the United States. The subsequent document, "Preparing for Drought in the 21st Century," was completed in May 2000 (NDPC, 2000). The primary theme of this document revolves

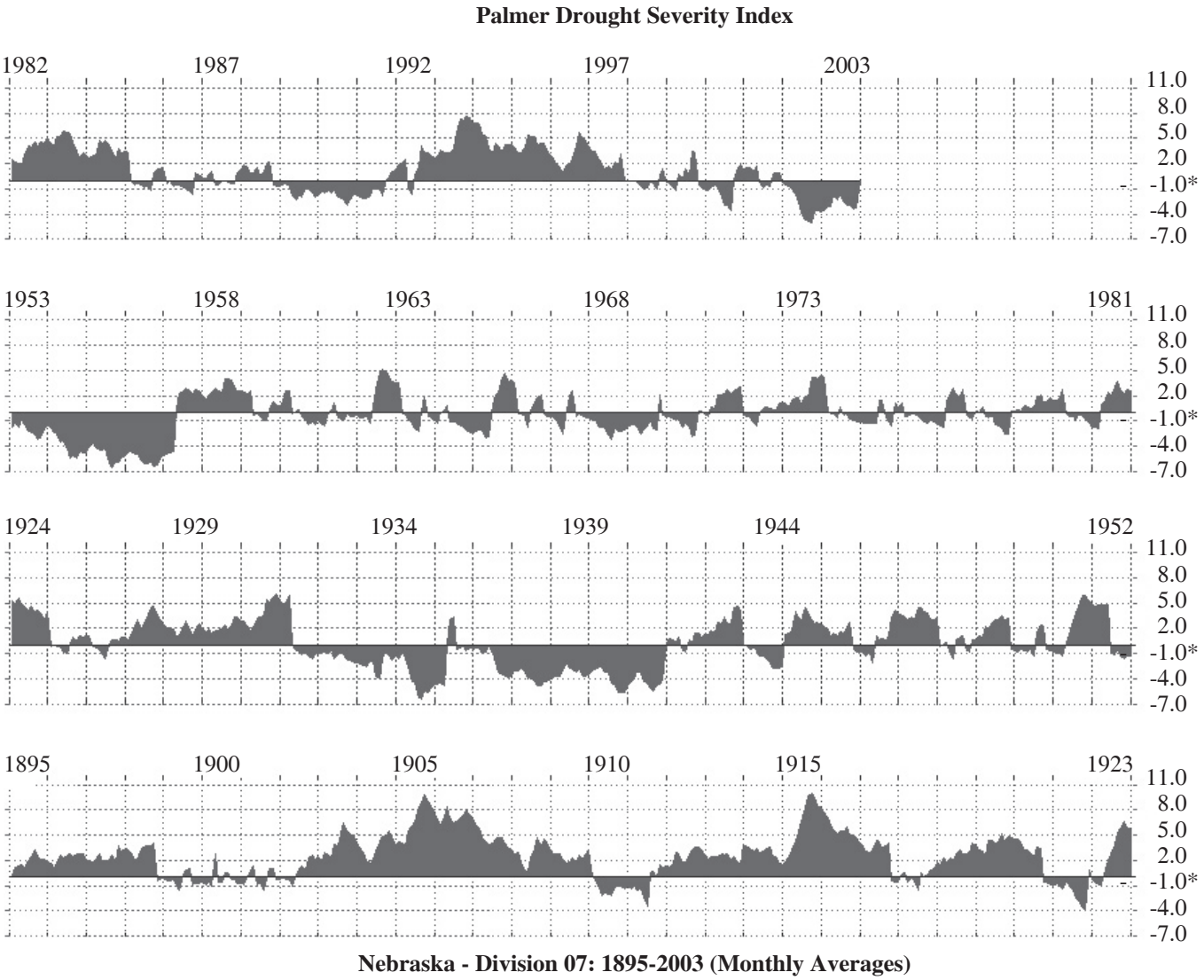

Figure 2. Historical Palmer Drought Severity Index for Nebraska Climate Division 7, generated the National Climatic Data Center's CLIMVIS computer graphing program (2004). *Positive values are wet, values below zero indicate dry conditions.

around the idea of drought mitigation, that is, implementing actions in advance of drought in order to reduce its negative effects whenever it may occur.

In 2000, the State of Nebraska completed a revision of its drought plan, first written in 1986, to include mitigation actions that the state can take to prepare for drought. The state drought plan and working group information can be viewed at the Web site of the Nebraska Climate Assessment and Response Committee. Municipalities across the state, forced into action by the recent severe droughts in 2000, 2002 and 2003, also have begun to look at their drought vulnerability and are starting to consider the process of drought planning. Recent municipal drought impacts and actions taken can be viewed on the web site of the Nebraska Department of Health and Human Services.

Nebraska citizens also can develop their individual plans for drought. Combining an understanding of local climate and actions to mitigate the effects of drought into a coherent drought plan can help people, communities, organizations, and society reduce vulnerability to drought. Additional planning assistance is available from a variety of Web resources, including the National Drought Mitigation Center, Nebraska Department of Agriculture, University of Nebraska Institute of Agriculture and Natural Resources and the University of Nebraska Cooperative Extension.

All Nebraskans need to realize that drought, including multiple-year drought, is a normal part of the state's diverse climate. Drought will undoubtedly play an ever-increasing role in the future as demand increases for the region's finite water resources. Knowledge of the full range of possible climatic scenarios is an essential base on which to make appropriate drought planning decisions. Learning from the past and preparing for drought is necessary in order to maintain the "Good Life" that makes Nebraskans proud of their state.

Resource Sites

Drought Central (Nebraska Department of Agriculture)
Website: *http://www.droughtcentral.org/*

High Plains Regional Climate Center
Website: *http://www.hprcc.unl.edu/index.html*

National Climatic Data Center
Website: *http://www.ncdc.noaa.gov/oa/ncdc.html*
CLIMVIS: *http://www.ncdc.noaa.gov/oa/climate/online-prod/drought/main.html*

National Drought Mitigation Center
Website: *http://drought.unl.edu/index.htm*

Nebraska Climate Assessment and Response Committee
Website: *http://carcunl.dnr.state.ne.us*

Nebraska Department of Health and Human Services
Website: *http://www.hhs.state.ne.us/enh/pws/drought/droughtsummary.htm*

Nebraska State Climate Office
Website: *http://hpccsun.unl.edu/st_climate_ne/home.html*

University of Nebraska Cooperative Extension Service
Website: *http://www.extension.unl.edu/*

University of Nebraska-Lincoln Institute of Agriculture and Natural Resources
Website: *http://ianrhome.unl.edu/drought/*

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