



## Memorandum

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Date: October 2, 2002

From: Karen Lewis, Debbie Hathaway

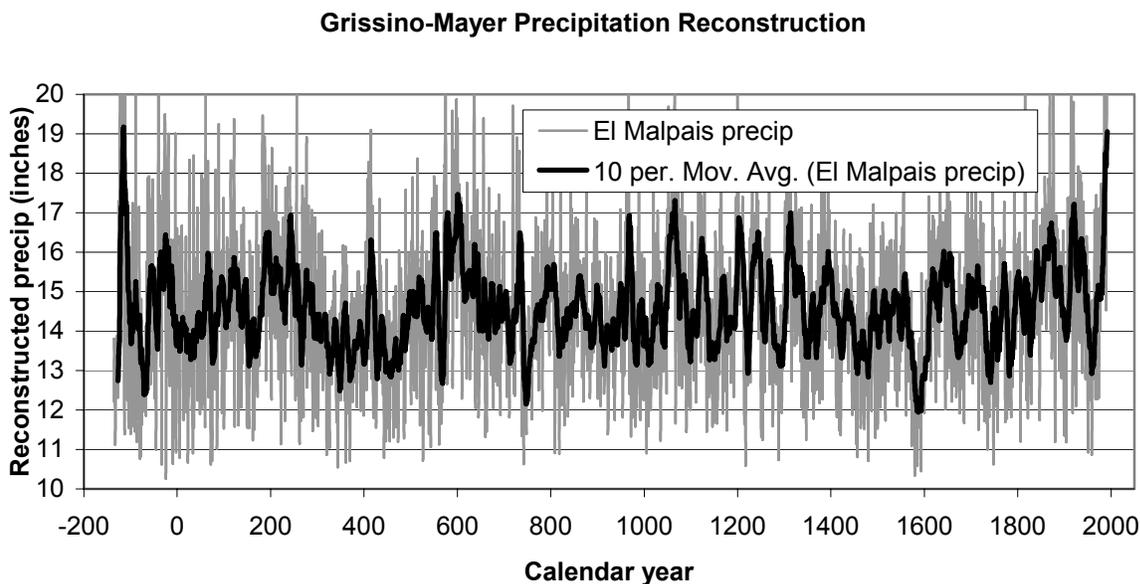
To: Kevin Flanigan, ISC; Mike Velasquez, ACOE

**Subject: Severity of the 1950s drought**

There has been recent discussion in the water planning community concerning the severity of the 1950s drought in the context of the paleo-climate record in the Middle Rio Grande region. Some have suggested that the 1950s drought was representative of “average” precipitation over the past 2000 years, and that this period is a poor representation of what should be expected in a drought. From examination of published paleo-climate data, it appears that this position is not supported; rather, the long-term paleo-climate data indicate that the 1950s drought is one of the worst droughts on record over the past 2000 years. This memo discusses the paleo-climate record and conclusions regarding the severity of the 1950s drought in the context of this record.

In his latest publication (Grissino-Mayer et al., 2002), Grissino-Mayer uses the El Malpais tree ring record, combined with tree ring records from the Sandia and Magdalena Mountains, to reconstruct the division 5 Palmer Drought Severity Index (PDSI) for the Middle Rio Grande basin. In this publication, severe multi-year droughts (and wet periods) were objectively determined by converting the annual series to standard deviation units, fitting the data with a 10-year spline, and measuring all periods that had at least four consecutive years when the standard deviation levels from the 10-year spline fell below the  $-1.1$  ( $+1.1$ ) sd level. Beginning and ending years were pinpointed by inspecting the non-smoothed reconstruction values. Each period was weighted by its duration and drought index values to come up with a ranking. Based on this approach, Grissino-Mayer ranks the 1950s drought as the third worst drought on record since A.D. 622, running from 1945 to 1963. It is exceeded by the 1500s drought, which lasted for 23 years, and the 1200s drought, which lasted for 26 years. Figure 1 illustrates a 10-year running average of the raw Grissino-Mayer reconstructed precipitation data (data from the World Data Center for Paleoclimatology, online; analysis in Grissino-Mayer, 1996). The 1950s drought can be easily seen on this figure and appears to be on par with many of the extended droughts of the past 2000 years.

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**Figure 1: Raw Grissino-Mayer El Malpais reconstructed precipitation (grey) and 10-year running average (black).**

However, an alternate depiction of these reconstructed data in the recent publication “Taking Charge of Our Water Destiny” (Belin, Bokum and Titus, 2002) leads to the interpretation that “precipitation for that 1950s drought was close to the long-term average” (p. 5). This interpretation is based a 100-year smoothing of reconstructed precipitation data (Henri Grissino-Mayer, 1996), reproduced as Figure 1 in Belin, Bokum and Titus (2002). It appears that, because the 100-year smoothed data has been presented without reference to the smoothing it represents, it has been erroneously assumed to represent actual past conditions, rather than a long-term smoothing of past conditions. Since the past two centuries have been abnormally wet, as compared to the full 2129-year reconstructed record (Grissino-Mayer, 1996; Grissino-Mayer et al., 2002), a 100-year smoothing will artificially raise the 1950s drought, making it appear less significant.

We have discussed the use of the Grissino-Mayer data in the Belin, Bokum and Titus report with one of the report authors, Frank Titus. On further review of the data, Dr. Titus agreed that the 100-year smoothed graph was not a good representation of decadal trends, and that their conclusion regarding the lack of severity of the 1950s drought was not supported. However, he also indicated that their report “was not intended to be read as a scientific publication, but rather was to insist that water planning and negotiated problem solving are possible, and are essential if

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New Mexicans are to preserve their ambiance of enchantment and their river environment” (Titus, personal communication).

In summary, long-term paleo-climate data indicate that the 1950s drought is one of the more severe droughts experienced in the Middle Rio Grande region over the past 2000 years. For planning purposes, analysis of alternatives given hydrologic conditions akin to those observed in the 1950s should provide a reasonable “test” of impacts under drought conditions. Further discussion of the paleo-climate trends and implications for water planning can be found in our memo of November 8, 2001 to Mike Velasquez and Kevin Flanigan, prepared as part of the Middle Rio Grande Water Supply Study, Phase 3.

#### References:

Belin, Alletta, Consuelo Bokum, and Frank Titus, 2002. *Taking charge of our water destiny: A water management policy guide for New Mexico in the 21<sup>st</sup> century*. Cottonwood Printing, Albuquerque.

Grissino-Mayer, Henri D., 1996. A 2129-year reconstruction of precipitation for Northwestern New Mexico, USA. *Radiocarbon*, pp. 191-204.

Grissino-Mayer, Henri D., Christopher H. Baisan, Kiyomi A. Morino and Thomas W. Swetnam, 2002. *Multi-century trends in past climate for the Middle Rio Grande Basin, AD 622-1992*. Final Report, submitted to the USDA Forest Service, Albuquerque, New Mexico.