

DROUGHT IMPACT RESEARCH AT TWO LTER SITES
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The Long-Term Ecological Research (LTER) program was initiated by the National Science Foundation in 1980 to ensure continuing availability of well-documented research sites representing significant and distinctive ecosystems. One of the five research topics defined for LTER sites is the description and study of the pattern and frequency of disturbances to each site. Disturbances include man's actions, insect or disease epidemics, geologic activity, and meteorological events.

The Southeastern Drought of 1985-86 is an event expected to have long-term impacts upon two LTER sites: Coweeta Hydrologic Laboratory in the southern Appalachian Mountains of western North Carolina and North Inlet at the Baruch Institute in the coastal marshlands of South Carolina (Swift and Ragsdale, 1985). To assess those impacts, a coordinated research program is now underway at these sites to determine and compare ecosystem responses that follow a drought.

Objectives of the drought response research include five activities:

1. To characterize the drought event by analysis of climatic and hydrologic data from each site and relate these to other longer-term data series,
2. To determine drought effects upon the water budget through analysis of components such as soil moisture, evapotranspiration, and short-term streamflow responses during the drought and the succeeding year as compared with more normal years,
3. To determine the effect of the event upon precipitation and stream or estuary chemistry with particular emphasis upon nutrient cycling,
4. To determine the effect upon the dynamics of forest and marsh vegetation with emphasis upon both early mortality and reduced vigor or decline symptoms, and
5. To use available simulation models to investigate potential long-term effects of several drought and non-drought scenarios.

Because both LTER sites have extensive cooperative research programs, other on-going studies also contribute to our understanding of drought effects. Investigators wishing more information about the LTER program or the research described herein may contact site coordinators at addresses given below.

The regional characteristics of the drought event were summarized by Bergman and others (1986); the historical context of this and other droughts will be described by Karl and Young (1987). Precipitation during December 1985 through July 1986 was 43 percent of normal at the mountain LTER site (Coweeta) and 49 percent of normal at the coastal site (North Inlet).

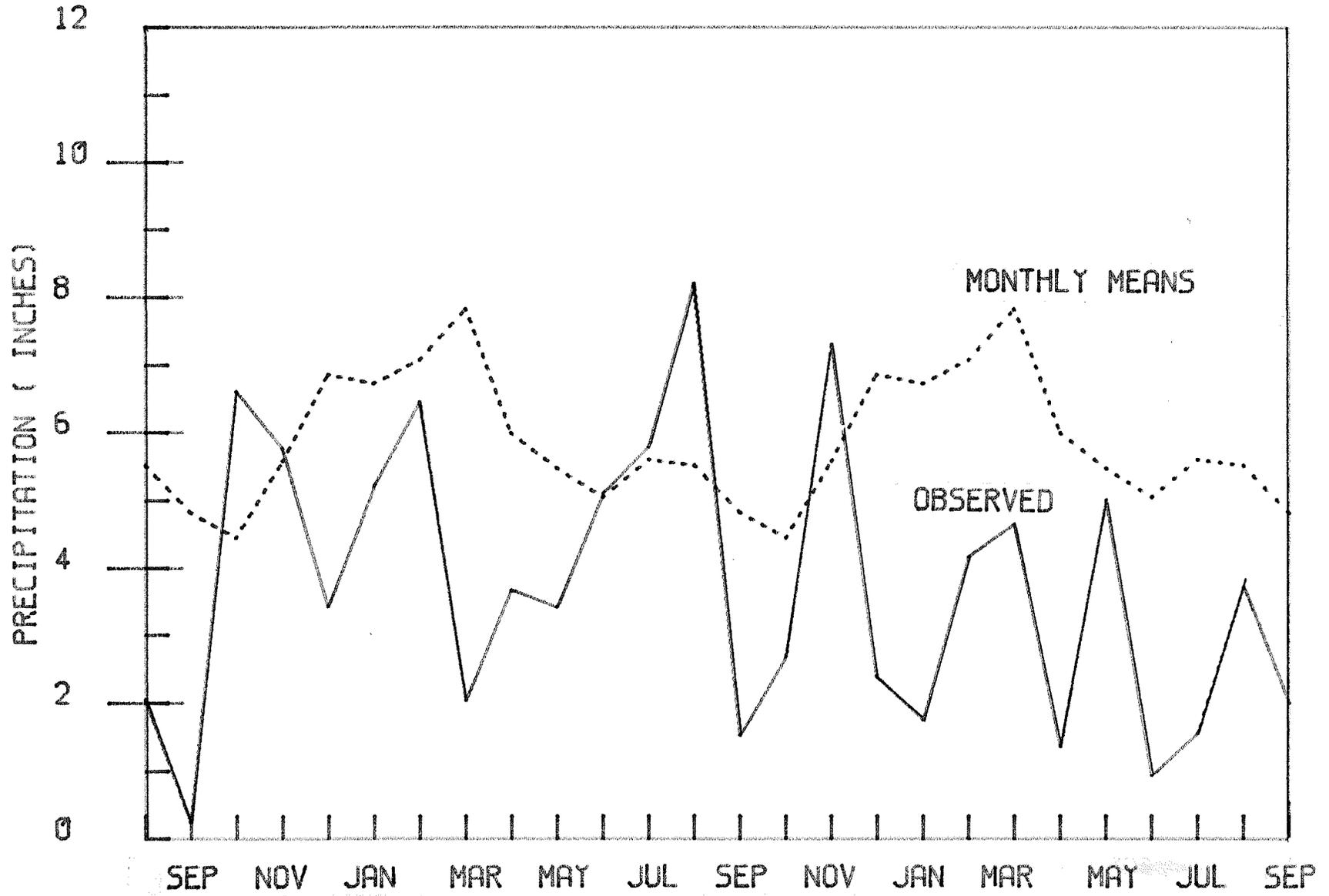
At Coweeta, the 1986 drought began with below-average precipitation in late summer 1984. Between August 1984 and September 1986, monthly precipitation totals were at or above the 52-year averages for only 6 of these months; four record monthly minimums were set. Precipitation during the dormant season or soil-moisture recharge period (November through April) in both 1984-85 and 1985-86 was 67 and 54 percent, respectively, of the long-term seasonal average. Consequently, soil moisture storage was below normal at the beginning of both the 1985 and 1986 growing seasons. Potential evaporation usually exceeds growing season rainfall, thus growth of dense forest vegetation in the mountains depends upon stored soil moisture. Precipitation in the 1985 growing season was 87 percent of normal, placing additional stress upon trees on dry sites. Furthermore, growing season precipitation in 1986 was only 66 percent of normal, giving a 2-year cumulative deficiency of 33 percent below normal.

Total flow for mountain headwater streams is only partly due to stormflow. The majority of total annual flow derives from slow drainage of soil moisture from the large soil mass upslope from the stream. Thus, the 1984-86 pattern of low precipitation during soil moisture recharge periods is reflected by falling streamflow levels. At the beginning of the growing season in May 1986, cumulative streamflow over 18 months was 59 percent of the 52-year mean. Minimum monthly flow records were set for 6 consecutive months, April through September 1986. Although Coweeta precipitation for October 1986 through January 1987 was 30 percent above average for those months, the lag due to soil moisture recharge requirements kept streamflow 18 percent below levels normal for the first of February.

At North Inlet, similar regional precipitation deficits have been observed since 1984. The absolute deficit and seasonal patterns are modified, however, by tropical storms occurring each year. Between August 1984 and September 1986, monthly precipitation totals were at or above 30-year averages for only 7 months. Growing season precipitation between May and October was 79 percent of normal during 1985 and 65 percent of normal during 1986, giving a 2-year cumulative deficiency of 26 percent. A deficit of 50 percent of the seasonal mean occurred during the recharge period (November to April) in 1984-85 but no deficit occurred in 1985-86 because of a November hurricane.

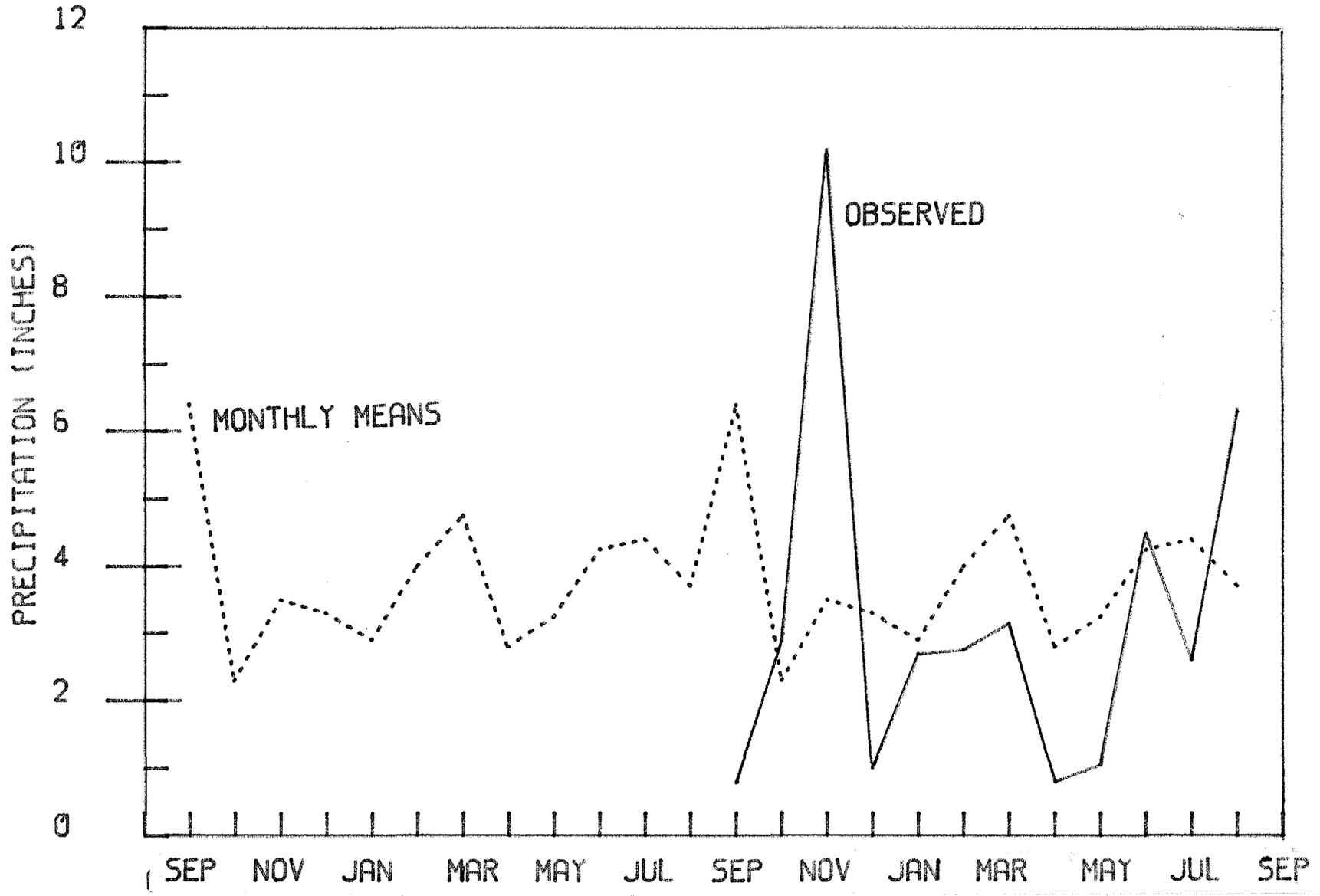
The low topography and sandy soils at North Inlet contribute to substantial differences in ground and surface water response to precipitation compared with Coweeta. The rainfall deficit in 1985 resulted in below average ground water levels and a 34 percent decrease in surface water runoff compared to the previous year. Although the ground water table was completely recharged by the November hurricane, an overall 41 percent rainfall deficit (December to April) resulted in a rapid decline in ground water and concurrent 41 percent decrease in surface water flow from 1984 levels.

COWEETA LAB NC



SEPTEMBER 1984 - SEPTEMBER 1986

NORTH INLET SC



SEPTEMBER 1984 - SEPTEMBER 1986

REFERENCES

- Bergman, Kenneth H.; Ropelewski, Chester F.; Halpert, Michael S. 1986. The record southeast drought of 1986, *Weatherwise* 39(5):262-266.
- Karl, Thomas R.; Young, Pamela J. 1987. The 1986 southeast drought in historical perspective. In: Fifth Conference on Applied Climatology of the American Meteorological Society; 1987 March 10-12; Baltimore, MD.
- Swift, L. W. Jr.; Ragsdale, H. L. 1985. Meteorological data stations at Long-Term Ecological Research sites. pp. 25-37. In: Hutchison, B. A.; Hicks, B. B., eds. *The Forest-Atmosphere Interaction: Proceedings of the Forest Environmental Measurements Conference*; 1983 October 23-28; Oak Ridge, TN. Boston: D. Reidel.

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