Problems of Climatic Changes[1]

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An urgent need exists for more research on the problem of climatic changes as well as the effect of precipitation on forage production. Research men very naturally tend to follow the fields in which there is the most interest or those on which some influence can be exerted. Both range administrators and research men have failed to give these basic factors the attention they deserve. This has probably been due to the feeling that weather is relatively stable and nothing can be done about it anyhow. It is time we all realize that the climate is changing and, if we can not control it, we can plan better for it if we have a better understanding of present trends. For this we need more research on these problems. Our research men will gladly respond if we administrators and stockmen clearly outline our needs and support their efforts.

Our range management plans are based on expectations. These center around expected forage production. This production may vary from year to year or by groups of years and the variations may trend in one direction or another over longer periods of time. Studies of such variation in forage supply by Clawson (1947) pointed out the need for methods of adjusting carrying capacities to fluctuations of forage caused by periods of drought or plentiful precipitation. Clawson's work showed that, in some parts of the country, fluctuations tended to be from year to year while in other areas they occurred by groups of years.

Many Nevada range administrators have basically a difficult problem in operating on lands that in the past have been marginal and in recent years have been submarginal. Vegetation on the desert may be hardy in its resistance to drought but may be easily ruined by improper grazing, particularly during the growing season. Those who manage desert lands have more difficult problems to face than those managing lands with higher precipitation. Conversely they stand in greater need for scientific information on forage production, and particularly on the effect of precipitation on forage production and how to solve the resulting problems.

In an article entitled "What is Happening to the Weather?" in the January 1953 issue of Harper's Magazine, the climatologist C. E. P. Brooks stated that the earth's temperature had fluctuated over extended periods in recorded history though not greatly. He stated "It is not unlikely that an initial fall by five degrees below the present sufficed to account for the Great Ice Age, all the rest of the freezing up being due to the ice itself."

"As regards America, John H. Conover of the Blue Hills Meteorological Observatory recently compiled an index of the severity of winters in New England. When the irregular changes from year to year are smoothed out, he finds that the temperatures of the winter months rose steadily from 1859 to 1897 and then fluctuated from 1897 to 1950, but on the whole were still rising slowly, at least until after 1930. The ten years ending in 1949-50 averaged about four degrees F. higher than the ten years ending in 1859-60. Still more noticeable is the way in which the winters have become shorter; the time between freezing and thawing of a pond was twenty days less in the last ten years than at the turn of the century. The severity of a winter does not depend only on mean temperature; the number of cold days and the depth and persistence of the snow-cover also matter. Each of these has on the whole decreased in recent winters. Taking account of all these factors, the severity of winters at Blue Hill has lessened considerably since 1894, in spite of the fact that the snowiest winter ever experienced was in 1947-48."

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1. Paper presented at the 1954 annual meeting of the Nevada Section at Winnemucca. The author was formerly with the U. S. Bureau of Indian Affairs at Stewart, Nevada.

In closing, Brooks stated "To sum up, the temperate and polar regions have been getting warmer for many years. The process may continue or it may be reversed; the one certain thing is that it will not stand still. If it continues, the northern lands will become more habitable and productive, though probably at the expense of the drier agricultural regions further south . . ." There is considerable evidence that Nevada lies in the southern region that he mentions.

From studies of tree rings, Hardman and Reil (1936) point out a wet period in Nevada climate from 1870 to 1915 that was unequalled in the last 600 years. This was the period in which Nevada's ranching economy was being established. Following this period the climate returned to "normal" for some years, and more recently appears to be in a period of subnormal precipitation and forage production.

In attempting to study these problems we are handicapped by a total lack of forage production records and short, or relatively short, precipitation records; and data that for the most part consists of precipitation only. From this data we must try to reconstruct the history of our forage production if we are able to study past and present forage production and apply that information to range management.

A Precipitation-Forage Index

In its 1952 Annual Report, the Intermountain Forest and Range Experiment Station presented a formula for converting precipitation to forage production based on data obtained at the Desert Experimental Range at Milford, Utah. In this formula, monthly precipitation totals for October, November and December are multiplied by two; those of January, February and March by $1\frac{1}{2}$; and the remainder of the year by one and the totals added. The resulting sum is multiplied by 31.44 and from that result 76.18 is subtracted. Under Milford, Utah conditions the answer in pounds of forage per acre has a probable error of plus or minus 21.33 pounds of forage or about 7 percent.

Most of Nevada's winter range forage is produced under precipitation conditions similar to those of Milford, Utah. Though the production per acre may vary it is believed that the formula provides the best estimate of potential forage and its fluctuation of any method now available. When used with existing data on precipitation, numerous comparisons may be made for analysis. One example is mentioned here although others may be of equal or even greater interest in determining individual range plans.

When the Milford formula is applied to the precipitation record of McGill, Nevada, estimated production for recent years, calculated as percentages of the 1913-52 average are as follows:

Year	Est. Production
1948	39%
1949	63
1950	38
1951	57
1952	113
1953	37

These recent years include the longest and most intense drought period in the 42-year weather record at this station. It contains three of the four years of lowest production. Next to 1934, the years 1953, 1950 and 1948 rank as the poorest in production in that order.

Nevada range conditions are generally less favorable for production than those of the Desert Experimental Range at Milford, Utah. Some of the years of low production probably resulted in practical failures of forage production rather than the 35 to 40 percent of the average as calculated.

McGill, situated at the base of the Shell Range in eastern Nevada, does not fully portray the drought farther west as demonstrated by records and observations at Schurz, Nevada. Application of the Milford formula to the precipitation record at Schurz provides the following data on estimated production based on a 32-year average:

Year	Est. Production
1946	39%
1947	22
1948	2
1949	20
1950	0
1951	55
1952	43
1953	14

The actual production from 1947 to 1952 was practically nil on the sand grass range of the Walker River Reservation, but due to favorable May rains there was a very small crop of sand grass in 1953.

These eight consecutive years of intense drought are believed to be more representative of conditions in most of Nevada than the data from McGill. In either case they give support to many other indications that Mr. Brooks' theories are actually in operation in Nevada.

Summary

We are faced with basic problems which are recognized by far too few men. They are the problems which are determining the direction and extent of our range management plans and programs. Presently far too little understanding and discussion are given to the relationship between climatic changes and range management. Research should provide more facts for the use of range administrators to use in their plans. Likewise, administrators should recognize the situation and support the research efforts needed to provide a clear understanding of the situation confronting us.

In the past we have had many range management plans ruined by these unrecognized forces. Let us now recognize them and prepare our plans to meet a situation that can be fully recognized if not accurately forecast.

LITERATURE CITED

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