Drought prediction model development and dissemination in Wyoming

Basic Information

Title:	Drought prediction model development and dissemination in Wyoming
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Publication

Problem and research objectives:

Timely, locally relevant, within year drought prediction tools for each major land resource area within Wyoming are not available. The few sites with existing data have not been developed or extent of their geographic relevance examined. The overall goal of this proposed research is to develop a timely, locally relevant, within year drought prediction tool for each major land resource area within Wyoming, focusing on the relationships of precipitation variables and annual forage production on rangeland by accomplishing the following objectives.

1. Cooperatively with CES and land management agencies, establish herbage yield and quality measurement sites representative of the predominant soils and precipitation pattern/amounts in major land resource areas in Wyoming and continue sampling the existing long-term forage production harvest site near Saratoga.
2. Locate and access existing annual forage production data from agency files within Wyoming.
3. Obtain and summarize relevant precipitation records for reporting stations nearest to vegetation sampling sites.
4. Analyze relationships of monthly and seasonal precipitation with annual peak standing crop forage yields and quality.
5. Provide cooperators with sampling and analysis tools for each to continue to strengthen predictive capabilities for their site.
6. Widely disseminate to the broad constituency of land managers and users in Wyoming, the most useful drought prediction methods resulting from this study.

Methodology

Cooperating agencies will establish vegetation production sampling sites in different land resource areas in Wyoming near their weather site or existing weather recording stations. Existing sources of long term vegetation production/weather records were sought. These included those from Cheyenne, USDA-ARS-HPGRS and records of Natrona County collected by BLM. A 17 year record of productivity and weather data from a site near Saratoga will be continued.

Regression techniques will be used to determine the best seasonal or monthly weather variable for prediction of the upcoming growing season productivity. Multi-variate regression analysis and time series analysis will examine the precision of the predicted forage production associated with adding successive climatic inputs received during the year prior to cessation of plant growth. An analysis goal is to identify a weather variable existing early enough in the year for livestock producers to respond to predicted forage production by making relevant stocking level adjustments before financial hardship or resource damage are probable.

Results will be disseminated through the CES web site and county offices statewide. Other print and visual/audio media will also be used.

Principal findings and significance

A graduate assistant has conducted sampling and analysis duties. Additional students have participated in field sampling. Cooperator production sites(15) were established including the following counties-cooperators, Converse-CES and HS, Platte-CES, Laramie-CES (HPGRS), Cambell-CES, Johnson-CES, Washakie-TNC, Sublette-CES, Park-Meeteetsee CD, Goshen Co-CES, Crook Co-CES, Natrona Co-BLM, Carbon Co-NRCS/CD. The site in Carbon County, maintained for 17 years jointly by UW and Saratoga Cons. Dist., was again sampled. In aggregate, these sites provide a geographic dispersion oriented largely toward east of the

continental divide where effective precipitation for forage growth largely comes in spring. We assisted cooperators with aid in sampling and weighing materials as needed. Long term data sets recruited for this effort in addition to the data from the Saratoga site, includes a 20+ year set from HPGRS near Cheyenne and a multiyear sets from BLM Casper area.

Analysis of data from the Saratoga site indicates, as has previous treatments of this data, that winter precipitation is not an effective predictor of growing season productivity. Normal winter precipitation wets the upper few centimeters of the soil providing moisture for early growing species. Precipitation received in April (Fig. 1), particularly 12-19 April. produces the highest level of correlation with forage yields of the months/season tested. May and June precipitation are less effective predictors of growth but are valuable in extending the green season and maintaining higher forage quality. Soil moisture in May (Fig. 2) is also an effective predictor, however an end of April decision point for stocking decisions related to predicted forage production, is better for economically effective decisions for most managers.

Additional analysis of Saratoga data indicates that there is a distinct window of time in April that produces the highest level of correlation between precipitation and summer forage yields. HPGRS data (Fig. 3) indicates an earlier starting, wider window extending into summer. Casper area data (Fig. 4) are less definitive with a early start date and indistinct end date. Beginning of the predictive period appears to be related to elevation and associated temperatures. Continuation of the analyses of long term sets will involve integrating temperatures and perhaps soil properties.

Current analyses suggest that relatively effective predictive models may be developed for a geographic locale. However, the differences in the dates when precipitation begins to effectively predict and the length of time in the window producing the best prediction suggests that universally applicable models may not be possible.

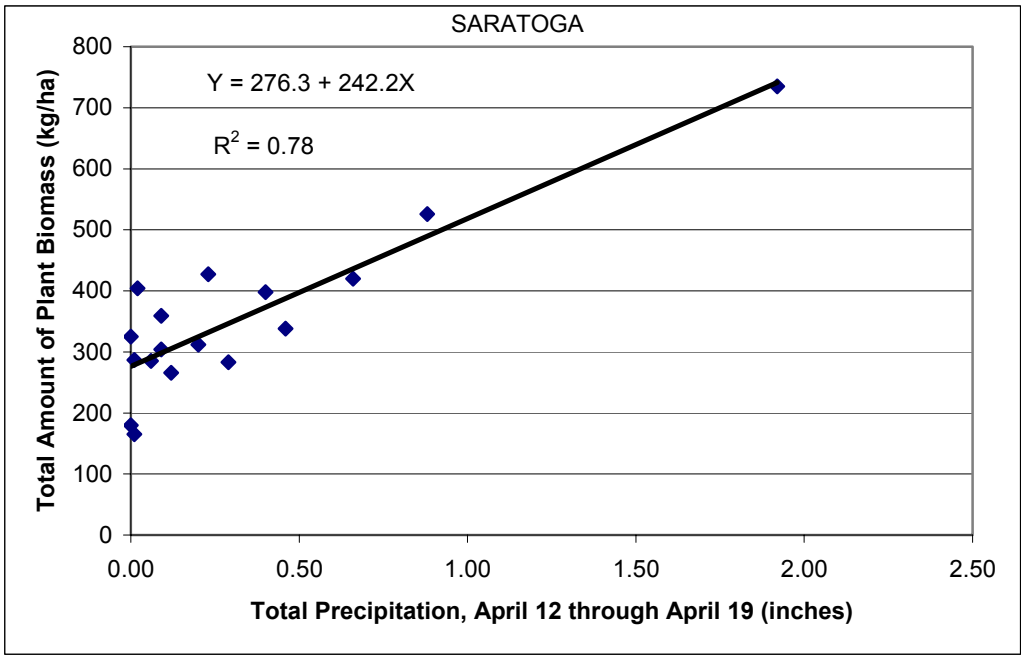

Figure 1. April 12-19 precipitation vs forage yields at Saratoga

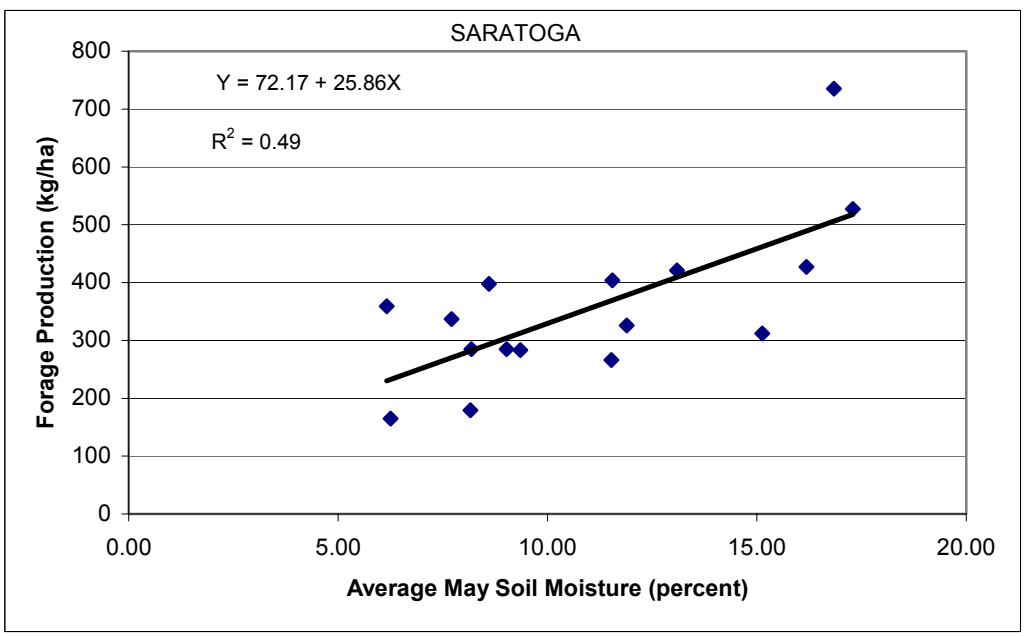

Figure 2. May soil moisture vs. forage production (no sage removed) for check plots, 1987-2002

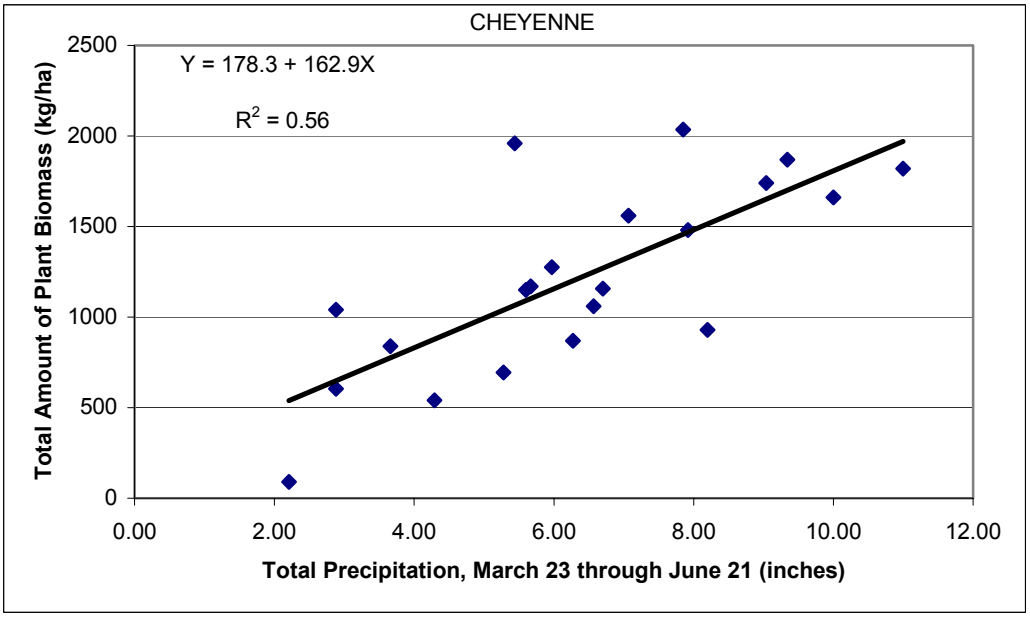

Figure 3. March 23 - June 21precipitation vs forage yields at Cheyenne

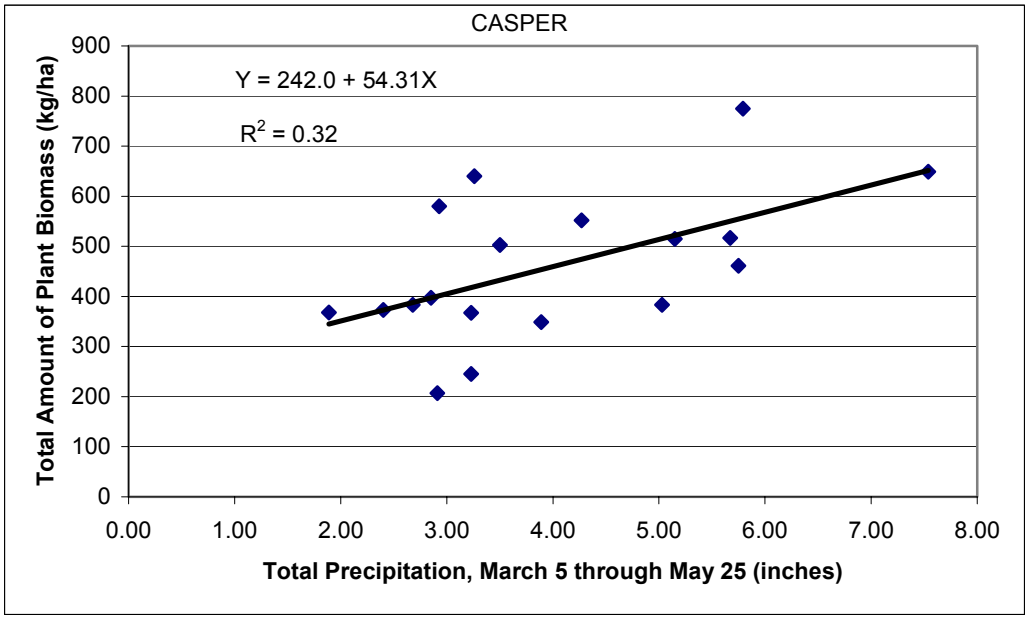

Figure 4. March 5 - May 25 precipitation vs forage yields at Casper