The following is a summary of the FY2007 progress report for the 2004-2009 research project entitled:

INTEGRATION OF CLIMATE VARIABILITY AND FORECASTS INTO RISK-BASED MANAGEMENT TOOLS FOR AGRICULTURAL PRODUCTION AND RESOURCE CONSERVATION

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Project Objectives:

(a) Evaluate the utility of climate variations and forecasts for agriculture and resources conservation applications.
(b) Develop risk-based decision tools that take into consideration climate variations and forecasts for practical decision applications in agriculture and natural resource management.
(c) Demonstrate climate-related decision and application opportunities for a livestock grazing enterprise and a reservoir water-level management plan.

The guiding principle underlying this project is the bridging of the gap between emerging climate knowledge and application of climate information to problem-solving by developing decision tools for real-life applications that meet the requirements of producers and resource managers.

Approach:

Decadal-scale climate variations are identified by a trend analysis of historical climate data published by NOAA's National Climate Data Center, and the utility of seasonal climate forecasts by NOAA's Climate Prediction Center are evaluated in terms of forecasted and observed departure from average conditions. Statistical characteristics of climate variations and forecasts are quantified in terms of basic distribution statistics and probability of exceedance curves (POE). Associated weather outcomes are developed using a weather generator, which will drive selected crop and hydrologic models that simulate climatic impacts on forage production and natural resources. Collaborating producers will capture their decision process using a journaling approach which will identify critical decision variables for which POE curves will be developed. The POE curves will reflect the risk and uncertainty of forecasted impacts and represent the basic decision information for decision makers. Two case studies, the management of a fall forage-grazing system in central Oklahoma and water-level regulation for Lake Texoma reservoir, will be used to demonstrate the management potential offered by climate variations and forecasts.

Accomplishments:

Multi-year precipitation variations impact water resources management and conservation needs:
The existence and impact of multi-year precipitation variations on soil erosion, sediment transport, and watershed sediment yield is often overlooked in water resources and conservation investigations, which, in turn, can lead to inaccurate assessment of water availability, downstream sedimentation problems, and needed remedial soil and water conservation efforts. Researchers at the Grazinglands Research Laboratory, El Reno, OK, demonstrated the magnitude and amplification of the impact of multi-year precipitation variations on watershed runoff and sediment yield agricultural watershed in Oklahoma. Consideration of multi-year precipitation variations and associated impacts on watershed runoff and sediment yield reduces risk in water resources management and improves assessment of conservation needs to mitigate water quality and sedimentation problems in downstream water bodies.

Utility of seasonal climate forecasts quantified for agricultural applications:
Seasonal climate forecast issued by NOAA's Climate Prediction Center appear to offer an opportunity to reduce risks in agricultural management, but the practical utility of the forecasts was unknown. Scientists from the Grazinglands Research Laboratory in El Reno, OK, developed and applied three utility measures across the contiguous U.S. for seasonal forecasts issued from 1997 through early 2005. Results delineate regions of the contiguous U.S. where seasonal forecasts appear to currently offer opportunities for incorporation of climate forecast-derived information in agricultural decision support systems. Forecasts for warmer than average conditions have good utility over most of the U. S., while forecasts for cooler than average do not. Forecasts for precipitation have modest utility only in the Desert Southwest, southern and eastern Texas, the Gulf Coast, Florida, and parts of the Pacific Northwest. Potential impacts of climate forecast-derived agronomic guidance include improved ability to manage risk, to improve profits during favorable climate conditions, and to reduce losses during unfavorable climatic conditions.

Seasonal climate forecast dependability reduced by downscaling to farm level:
In order to develop agricultural decision support information based on seasonal climate forecasts, forecasts must first be downscaled to a farm level and into one-month forecasts. The open question was how much forecast dependability would be lost as a result of downscaling, and whether enough dependability remained to justify use of the climate forecasts. Scientists from the Grazinglands Research Laboratory in El Reno, OK, determined that downscaled temperature forecasts retain 76% of their dependability, while precipitation forecasts retain 66% of their dependability. This accomplishment quantifies our ability to translate current climate forecasts into statements of risks for local applications within the contiguous United States, and to offer an opportunity to tune agronomic guidance to minimize climate-related risks and optimize agricultural resource management.

Newly developed wheat grazing model tested:
Winter-wheat grazing supports a multi-million dollar beef industry in the Southern Great Plains, but most research and model applications have focused on wheat grain production. An integrated wheat-growth and -grazing model was developed to identify management opportunities and the potential for higher economic returns by leveraging recent seasonal climate forecast products of NOAA and other climate variability information. The model was extensively evaluated and validated using winter wheat clipping/regrowth and cattle grazing data from long-term wheat experiments conducted at several locations by Oklahoma State University. The extensive model evaluation and validation cleared the way to produce a reliable decision support tool for management of dual-purpose winter-wheat enterprises. Application of this new decision support model can help identify potential management practices that lead to increased economic returns for the beef-wheat production enterprise.

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