The following is a summary of the FY2005 progress report for the 2004-2009 research project entitled:

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

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What major problem or issue is being resolved and how are you resolving it? How serious is the problem? What does it matter?

Agricultural production, conservation efforts, and sustainable utilization of natural resources are sensitive to climatic variations. Particularly in the Southern Great Plains, year-to-year variations in precipitation are pronounced, and persistent dry or wet conditions often result in environmental impacts and agricultural losses on the order of several billion dollars. Losses affect farmers and ranchers, the economic well-being of rural communities, the consumer through volatile prices and irregular supplies, and the natural resource base through excessive erosion, nutrient movement, and floods. The unpredictability of climate and weather limits our ability to optimize agricultural production under favorable climatic conditions, and to mitigate environmental impacts under adverse conditions. Farm planning and management decisions generally are reactive and conservative, and opportunities for diversification, greater profits, and enhanced environmental stewardship are missed.

The overall objective of this project is to produce new tools, develop decision information, and demonstrate applications of knowledge of climate variability and seasonal climate forecasts in agricultural production and resource conservation to benefit ranchers, farmers, and resource managers. Specific objectives are:

1) characterize and quantify multi-year regional climate variations and NOAA's seasonal climate forecasts at scales relevant for impact assessment and decision making in agricultural and conservation management;

2) integrate multi-year climate variations and seasonal forecast information into planning and management of agricultural enterprises and natural resources.

The primary users of this research are resource managers, producers and service organizations of the agricultural infrastructure, such as crop insurance suppliers, emergency and risk management agencies, and fertilizer, seed and chemical companies, all of which could potentially benefit from forecasts of the next season's demands, production, and yields. Models and methodologies developed by this research will also be valuable to scientists and engineers in federal, state and private institutions, consultants, and action agencies involved in various aspects of climate impacts on agricultural production and environments.

The problem is very serious because climatic variations drive and impact nearly every sector of the agricultural production system and result in significant annual losses that affect farmers and ranchers, the economic well-being of rural communities, and the natural resource base through soil erosion, nutrient movement, water shortages, and floods. This research matters because it can deliver critical, risk-based planning tools for farmers, ranchers, agri-businesses, and natural resources managers that help mitigate the negative impact of climate variability and derive benefits from the positive aspects.

What was the single most significant accomplishment for FY2004?

Utility of NOAA's seasonal air temperature forecast:

Utility measures of NOAA's seasonal air temperature forecasts are used to determine geographic regions for and seasons during which seasonal air temperature forecasts have greater potential for agricultural and water resource management applications. Application-oriented utility measures for NOAA's seasonal air temperature forecasts were not available to agricultural producers and water resource managers to help determine forecast application potential. Utility measures were developed and evaluated by scientists at the Grazinglands Research Laboratory, El Reno, Oklahoma, and national maps that display the spatial variation of the utility measures were produced for each of the four seasons of the year. The utility maps will lead to greater interest and more effective applications of the seasonal air temperature forecasts in regions where the utility measures have been shown to have higher value.

List other significant accomplishments, if any.

Seasonal air temperature forecasts accessible for agricultural applications:

A methodology that extends the application potential of NOAA's seasonal air temperature forecasts to include a broader range of agricultural and water resource management applications was developed. The overlapping nature of NOAA's seasonal forecasts led to ambiguities in forecast interpretation, and the 3-month forecasts period was often too long for effective and practical applications in agriculture and water resource management. A methodology to disaggregate NOAA's 3-month overlapping seasonal temperature forecasts into non-overlapping 1-month forecasts was developed at the Grazinglands Research Laboratory, El Reno, Oklahoma. The disaggregated precipitation forecasts are in a form more suitable for applications in agriculture and water resource management, and will lead to a broader use of the forecasts.

World Meteorological Organization promotes use of seasonal climate forecasts:

A scientist of the Grazinglands Research Laboratory, El Reno, Oklahoma, was invited to be part of a team of experts that was convened by the World Meteorological Organization to confer on the application of seasonal climate forecast information in agricultural and water resource management applications. Seasonal climate forecast have been operationally issued for about 10 years, but the use of these forecasts in agricultural and water resource management applications has been limited. The team of experts identified gaps in the technology transfer process, discussed constraints to the adoption of seasonal climate forecasts in agriculture, and, at the request of the World Meteorological Organization, developed recommendations that will enhance agricultural applications of seasonal forecasts in developed and developing countries. The recommendations will be brought to the attention of institutions and organizations dealing

with development and application of seasonal climate forecasts, and implementation of recommendations will accelerate use and application of seasonal forecasts in agriculture and water resource management.

List any significant activities that support special target populations.
The research leader participated on a committee for the Southern Great Plains Agricultural Resources Coalition that focuses on improved production and marketing of agricultural products to enhance environmental sustainability of small farmers and rural communities in western Oklahoma.

What science and/or technologies have been transferred and to whom? When is the science and/or technology likely to become available to the end-user (industry, farmer, other scientists)? What are the constraints, if known, to the adoption and durability of the technology products?
The methodology for the time dissagregation of 3-month overlapping precipitation forecasts into 1-month non-overlapping forecasts was made available to users of seasonal climate forecasts by way of a field day report and journal publication, and by personal communication with the federal organization issuing operational seasonal climate forecasts. There are no constraints to the adoption of the methodology by the federal organization issuing seasonal climate forecasts. Constraints to the adoption of the methodology by farmers, water resource managers and other users of seasonal climate forecasts include computer access, retrieval and interpretation of technical information on the forecasts.

Recommendations that enhance agricultural applications of seasonal forecasts in developed and developing countries have been transferred to the World Meteorological Organization. Constraints to the adoption and use of seasonal forecast were primarily related to a misalignment of the scientific nature of the forecast products and the practical and application specific needs of the user community. Furthermore, in developing countries there is a lack of capacity in terms of institutional structures and communication lines to inform consultants, advisers, extension agents, and end users of methodologies and climate forecast interpretation.

List your most important publications in the popular press and presentations to organizations and articles written about your work.
Two invited presentation were given to the Mayor, Commissioners, City Engineers, and concerned citizens of the City of Shawnee on decade-long climate variations and their impact on water resources in Oklahoma.

An invited presentation was given to the Union City, Oklahoma Lion's Club on the utility of seasonal forecasts in Oklahoma.

Publication(s):

Schneider, J.M., Garbrecht, J.D., Unger, D.A. 2004. A heuristic method for time disaggregation of seasonal climate forecasts. Weather and Forcasting. 20:212-221.

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Garbrecht, J.D., Meinke, H., Sivakumar, M., Motha, R., Salinger, M. 2005. Seasonal climate forecasts and application by agriculture: a review and recommendations. Trans American Geophysical Union. 86:227-228.

Garbrecht, J.D., Schneider, J.M., Van Liew, M.W. 2005. Linking climate forecasts and watershed runoff prediction using a neural network approach. In: Moglen, G.E., editor. Proceedings of the American Society of Civil Engineers 2005 Watershed Management Conference. Managing Watersheds for Human and Natural Impacts, July 19-22, 2005, Williamsburg, Virginia. 2005 CDROM.

Zhang, X.J. 2004. CLIGEN non-precipitation parameters and their impact on WEPP crop simulation. Applied Engineering in Agriculture. 20(4):447-454.

Zhang, X.J. 2004. Calibration, refinement, and application of the WEPP model for simulating climatic impact on wheat production. Transactions of the American Society of Agricultural Engineers. 47(4):1075-1085.

Garbrecht, J.D., Van Liew, M.W., Brown, G.O. 2004. Trends in precipitation, streamflow and ET in the Great Plains. Journal of Hydrologic Engineering. 9(5):360-367.

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Garbrecht, J.D., Schneider, J.M. 2005. The emperor's new clothes: software, wetware, or nowhere? The thorny road to adoption: climate-product dissemination for agriculture in the United States. In: Proceedings of the World Meteorological Organization. p. 22-25.

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Zhang, X.J. 2005. Generating correlative storm variables for CLINGEN using a distribution-free approach. Transactions of the ASAE. 48(2):567-575.