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Adaptation of Soil Conservation Practices under Uncertain Precipitation and Air Temperature Projections: Proposed Research

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Rationale: Winter wheat crops in the southern Great Plains have the potential of producing high soil erosion rates especially during the summer-fallow season. It is of concern to the conservation community that the current soil and water conservation efforts, based largely on climate observations and agronomic practices of the past century, may not keep pace with anticipated impacts of climatic change, especially under increased frequency of more extreme rainfall events. Changes in air temperature, precipitation, and frequency of extreme rainfall events are projected to stress agricultural soil and water resources over the next several decades. Challenges include an increase in production risks affecting crop yield and management and maintaining soil conservation within tolerable soil erosion limits. As such, it is critical to evaluate the impacts of future climate change on soil erosion to develop adaptive soil conservation strategies that maintain high crop yield. This knowledge will help maintain effective, competitive, sustainable, and environmentally responsible agricultural systems under changing climatic conditions.

Objective: Evaluate field-scale effects of future precipitation and air temperature projections on soil erosion and crop yield, and review adaptation options for soil conservation practices and associated winter wheat crop yields in central Oklahoma.

What we will do: We will use computer simulation of hydrologic processes, plant growth, and soil erosion to optimize the effectiveness of alternative conservation practices and agronomic crop management. To maximize crop yield it is necessary to assess anticipated future increases in soil erosion rates from winter wheat fields.

Proposed evaluation:

Soil erosion rates and crop yields under a variety of combinations of climate change scenarios, climate projections, tillage practices, and summer cover crops will be simulated.

The analyses will include the combination of the following climate and soil erosion models:

- 3 climate change scenarios: low, medium, and high greenhouse gas concentrations
- 15 different climate projections
- 4 tillage practices: conventional, conservation, minimum till, no-till
- winter wheat and two summer cover crop: fallow, sorghum, sudan grass

Synthetic daily weather, soil erosion, and crop yield will be simulated by SYNTOR and Water Erosion Prediction Project (WEPP) computer programs. Potential daily weather and soil erosion outcomes will be simulated to capture the uncertainty associated with future weather realizations. The soil erosion rates of each combination will be grouped and characterized by a statistical distribution. The distribution characteristics will be used to assess and rank the effectiveness of the various management combinations to maintain soil erosion at tolerable levels.

Expected outcomes:

This research will result in the following outcomes:

- Identify promising combinations of conservation tillage system(s) and summer cover crops to offset the anticipated increase in soil erosion rates due to climate change while maintaining high crop yield.
- Provide information on the uncertainty of achieving the desired reduction in projected soil erosions rates and maintaining current crop yields.
- Determine the long term sustainability of selected tillage-cover crop combination and crop yield.

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