**El Reno Key Papers**

Garbrecht, J. D., Nearing, M. A., Steiner, J. L., Zhang, X. J., & Nichols, M. H. (2015). Can conservation trump impacts of climate change on soil erosion? An assessment from winter wheat cropland in the Southern Great Plains of the United States. *Weather and Climate Extremes, 10*, 32-39. doi:10.1016/j.wace.2015.06.002

ABSTRACT: With the need to increase crop production to meet the needs of a growing population, protecting the productivity of our soil resource is essential. However, conservationists are concerned that conservation practices that were effective in the past may no longer be effective in the future under projected climate change. In winter wheat cropland in the Southern Great Plains of the U.S., increased precipitation in- tensity and increased aridity associated with warmer temperatures may pose increased risks of soil erosion from vulnerable soils and landscapes. This investigation was undertaken to determine which conservation practices would be necessary and sufﬁcient to hold annual soil erosion by water under a high greenhouse gas emission scenario at or below the present soil erosion levels. Advances in and beneﬁts of agricultural soil and water conservation over the last century in the United States are brieﬂy reviewed, and challenges and climate uncertainties confronting resource conservation in this century are addressed. The Water Erosion Prediction Project (WEPP) computer model was used to estimate future soil erosion by water from winter wheat cropland in Central Oklahoma and for 10 projected climates and 7 alternative conservation practices. A comparison with soil erosion values under current climate con- ditions and conventional tillage operations showed that, on average, a switch from conventional to conservation tillage would be sufﬁcient to offset the average increase in soil erosion by water under most projected climates. More effective conservation practices, such as conservation tillage with a summer cover crop would be required to control soil erosion associated with the most severe climate projections. It was concluded that a broad range of conservation tools are available to agriculture to offset projected future increases in soil erosion by water even under assumed worst case climate change scenarios in Central Oklahoma. The problem is not one of a lack of effective conservation tools, but one of adoption and implementation. Increasing the implementation of today’s conservation programs to address current soil erosion problems associated with the large year-to-year climate variability in the Southern Great Plains would greatly contribute towards mitigation of projected future increases in soil erosion due to climate change

Marek, G. W., Gowda, P. H., Evett, S. R., Baumhardt, R. L., Brauer, D. K., Howell, T. A., Srinivasan, R. (2016). Estimating evapotranspiration for dryland cropping systems in the semiarid Texas high plains using SWAT. *Journal of the American Water Resources Association, 52*(2), 298-314. doi:10.1111/1752-1688.12383

ABSTRACT: The Soil and Water Assessment Tool (SWAT) is one of the most widely used watershed models for simulating hydrology in response to agricultural management practices. However, limited studies have been performed to evaluate the SWAT model’s ability to estimate daily and monthly evapotranspiration (ET) in semiarid regions. ET values were simulated using ArcSWAT 2012 for a lysimeter field managed under dryland conditions at the USDA-ARS Conservation and Production Research Laboratory at Bushland, Texas, and compared with measured lysimeter values from 2000 to 2010. Two scenarios were performed to compare SWAT’s performance: (1) use of default plant leaf area index (LAI) values in the embedded plant database and (2) adjusted LAI values. Scenario 1 resulted in an “unsatisfactory” Nash-Sutcliffe efficiency (NSE) of 0.42 and 0.38 for the calibration and validation periods, respectively. Scenario 2 resulted in a “satisfactory” NSE value for the calibration period while achieving a “good” NSE of 0.70 for the validation period. SWAT generally underestimated ET at both the daily and monthly levels. Overestimation during fallow years may be due to the limitations of the pothole function used to simulate furrow diking. Users should be aware of potential errors associated with using default LAI parameters. Inaccuracies in ET estimation may also stem from errors in the plant stress functions, particularly when evaluating water management practices for dryland watersheds.

Moriasi, D. N., Gitau, M. W., Pai, N., & Daggupati, P. (2015). Hydrologic and water quality models: Performance measures and evaluation criteria. *Transactions of the ASABE, 58*(6), 1763-1785. doi:10.13031/trans.58.10715

ABSTRACT. Performance measures (PMs) and corresponding performance evaluation criteria (PEC) are important aspects of calibrating and validating hydrologic and water quality models and should be updated with advances in modeling science. We synthesized PMs and PEC from a previous special collection, performed a meta-analysis of performance data reported in recent peer-reviewed literature for three widely published watershed-scale models (SWAT, HSPF, WARMF), and one field-scale model (ADAPT), and provided guidelines for model performance evaluation. Based on the synthesis, meta-analysis, and personal modeling experiences, we recommend coefficient of determination (R2; in conjunction with gradient and intercept of the corresponding regression line), Nash Sutcliffe efficiency (NSE), index of agreement (d), root mean square error (RMSE; alongside the ratio of RMSE and standard deviation of measured data, RSR), percent bias (PBIAS), and several graphical PMs to evaluate model performance. We recommend that model performance can be judged “satisfactory” for flow simulations if monthly R2 > 0.70 and d > 0.75 for field-scale models, and daily, monthly, or annual R2 > 0.60, NSE > 0.50, and PBIAS ≤ ±15% for watershed-scale models. Model performance at the watershed scale can be evaluated as “satisfactory” if monthly R2 > 0.40 and NSE > 0.45 and daily, monthly, or annual PBIAS ≤ ±20% for sediment; monthly R2 > 0.40 and NSE > 0.35 and daily, monthly, or annual PBIAS ≤ ±30% for phosphorus (P); and monthly R2 > 0.30 and NSE > 0.35 and daily, monthly, or annual PBIAS ≤ ±30% for nitrogen (N). For RSR, we recommend that previously published PEC be used as detailed in this article. We also recommend that these PEC be used primarily for the four models for which there were adequate data, and used only with caution for other models. These PEC can be adjusted within acceptable bounds based on additional considerations, such as quality and quantity of available measured data, spatial and temporal scales, and project scope and magnitude, and updated based on the framework presented herein. This initial meta-analysis sets the stage for more comprehensive meta-analysis to revise PEC as new PMs and more data become available.

Steiner, J. L., Engle, D. M., Xiao, X., Saleh, A., Tomlinson, P., Rice, C. W., Devlin, D. (2014). Knowledge and tools to enhance resilience of beef grazing systems for sustainable animal protein production. *Ann N Y Acad Sci, 1328*, 10-17. doi:10.1111/nyas.12572

ABSTRACT: Ruminant livestock provides meat and dairy products that sustain health and livelihood for much of the world’s population. Grazing lands that support ruminant livestock provide numerous ecosystem services, including provision of food, water, and genetic resources; climate and water regulation; support of soil formation; nutrient cycling; and cultural services. In the U.S. southern Great Plains, beef production on pastures, rangelands, and hay is a major economic activity. The region’s climate is characterized by extremes of heat and cold and extremes of drought and flooding. Grazing lands occupy a large portion of the region’s land, significantly affecting carbon, nitrogen, and water budgets. To understand vulnerabilities and enhance resilience of beef production, a multi-institutional Coordinated Agricultural Project (CAP), the “grazing CAP,” was established. Integrative research and extension spanning biophysical, socioeconomic, and agricultural disciplines address management effects on productivity and environmental footprints of production systems. Knowledge and tools being developed will allow farmers and ranchers to evaluate risks and increase resilience to dynamic conditions. The knowledge and tools developed will also have relevance to grazing lands in semiarid and subhumid regions of the world.

Steiner, J. L., Starks, P. J., Garbrecht, J. D., Moriasi, D. N., Zhang, X., Schneider, J. M., Osei, E. (2014). Long-term environmental research: The Upper Washita River experimental watersheds, Oklahoma, USA. *Journal of Environmental Quality, 43*(4), 1227-1238. doi:10.2134/jeq2014.05.0229

ABSTRACT: Water is central to life and earth processes, connecting physical, biological, chemical, ecological, and economic forces across the landscape. The vast scope of hydrologic sciences requires research efforts worldwide and across a wide range of disciplines. While hydrologic processes and scientific investigations related to sustainable agricultural systems are based on universal principles, research to understand processes and evaluate management practices is often site-specific to achieve a critical mass of expertise and research infrastructure to address spatially, temporally, and ecologically complex systems. In the face of dynamic climate, market, and policy environments, long-term research is required to understand and predict risks and possible outcomes of alternative scenarios. This special section describes the USDA–ARS’s long-term research (1961 to present) in the Upper Washita River basin of Oklahoma. Data papers document datasets in detail (weather, hydrology, physiography, land cover, and sediment and nutrient water quality), and associated research papers present analyses based on those data. This living history of research is presented to engage collaborative scientists across institutions and disciplines to further explore complex, interactive processes and systems. Application of scientific understanding to resolve pressing challenges to agriculture while enhancing resilience of linked land and human systems will require complex research approaches. Research areas that this watershed research program continues to address include: resilience to current and future climate pressures; sources, fate, and transport of contaminants at a watershed scale; linked atmospheric–surface–subsurface hydrologic processes; high spatiotemporal resolution analyses of linked hydrologic processes; and multiple-objective decision making across linked farm to watershed scales.