Appendix 1: Study variables

Three influential agroecosystem variables were chosen as the targets for the shock scenario-based resilience assessment in this study. Farm Income (FI) was the first variable that was analyzed. Farm income is directly related to crop yield, which is strongly affected by soil salinity and water stress. Net income per study system polygon (215) was calculated in terms of seasonal gross margin and estimated by the difference in farm expenditures and revenue. Farm Income is a stock variable in the farm economics submodule of the GBSDM and is involved in numerous complex linkages and feedbacks between other variables throughout the coupled model. The second variable of interest in this study was Crop Revenue (CR) and was measured as the cropped income produced by each set of two crops per seasonal growing period (four different crop types in total for one year). Total crop revenue is a function of cropped area, seasonal yield, and market rates; this variable allowed the research team to distinguish between fluctuations in agricultural resilience due to increased expenditures or decreased profits. The final variable of interest examined in this study was Water-table Depth (WTD). Water-table depth is a key indicator of seasonal weather patterns, climatic trends, and anthropogenic influences on the landscape. Low water-table depth can lead to decreased soil health, crop revenue and farm income losses, and may contribute to increased social tensions between local farmers based on unequal distribution of finite water resources. Conversely, very high water-table depth may lead to flooding and soil saturation and may contribute to excess mineral and contaminant leaching to and from the soil.

There are several reasons for the selection of these three specific study variables: first, an effort was made to represent both the socio-environmental capabilities of the coupled model (e.g. farm income, crop revenue) as well as the biophysical contributions (e.g. water-table depth). Second, the capacity of the coupled model to incorporate the dynamic feedbacks between the socioeconomic and environmental variables is what makes this resilience modelling strategy particularly unique; the use of complexly interrelated variables further elucidates the connections of all adjacent variables in the watershed system. Finally, the implications of a resilient response from one or all of the study variables are interesting, unique, and informative; for example, if farm income were to exhibit high resilience under a shock scenario that devastates the normal ‘functionality’ of water table depth, we would gain new insights and understanding of the dynamic relationship between agricultural productivity, vulnerability, and water access.