Sinkholes have been one of the major geohazards in karst terrain and pose a social, economic, and environmental risk. In Florida, sinkhole-related insurance claims between 2006 and 2010 amounted to $1.4 billion. Approximately 20% of the United States is underlain by karst terrain formed from the dissolution of soluble rocks and is susceptible to a sinkhole hazard. Particularly, Texas, Florida, Tennessee, Alabama, Missouri, Kentucky, and Pennsylvania are known as sinkhole states.

The scope of this study is to develop a sinkhole simulator that can assess the qualitative behavior of the hydrogeological mechanism of Florida's sinkhole formations. Two sinkhole simulators were developed, with the second simulator constructed to overcoming the limitations of the first. The first generation sinkhole simulator incorporated a falling head groundwater system and the sinkhole could only be observed once the ground surface was breeched. The second generation sinkhole simulator incorporated a constant head groundwater system which accurately depicts field conditions and the sinkhole was able to be observed during all stages of formation within this model. In both simulators multiple hydrogeological conditions were created and water level transducers were installed at various locations to monitor variations in the water table during the sinkhole process in order to investigate the soil-groundwater behavior.

Findings from this study include: 1) that groundwater recharge is a critical sinkhole triggering factor, 2) the groundwater table cone of depression increases as the raveled zone or void travels up through the overburden due to sinkhole formation, 3) the cover-subsidence sinkhole erosion mechanism involves a continuous flow of particles throughout the whole overburden resulting in near instantaneous surface subsidence during formation, whereas with the cover-collapse sinkhole erosion mechanism the flow of particles is from the interior surface of the void and ground subsidence only occurs immediately before surface collapse, and 4) a strong relationship between soil strength and type of sinkhole formed was observed.