Overview of ESD's History in Modeling
(Applied and Theoretical Research)

Early radiological research on ecosystems provided a unique opportunity for the development of ecosystem and trophic models developed by Bob O'Neill, Don DeAngelis, Steve Bartlett, Mac Post and others in the 1970's. These efforts continue with terrestrial ecosystem models, such as LoTEC and GTEC, used to forecast the effects of global climate change (http://www.esd.ornl.gov/~wmp/GTEC/pgtec.html). Applied risk assessment models were built on the foundations of these models, adding the physiology of contaminant stressors. Researchers involved in these efforts were Steve Bartell, Glenn Suter, and Larry Barnthouse, and quantitative research in risk assessment continues at ORNL.

In the next generation, pioneering efforts branched into two directions. In one, ORNL researchers Bob O'Neill, Bob Gardner, Monica Turner, Tony King, Virginia Dale, Carolyn Hunsaker, and Bill Hargrove pioneered the development of landscape ecology, which is an excellent example of a research area in which theory came before field research. A considerable body of literature accumulated in the 1980's and 1990's (http://www.esd.ornl.gov/research/ecol_management/images/landscape_ecology_refs.pdf). Research in landscape ecology is being continued using spatially structured and spatially explicit population models in both terrestrial and aquatic settings.

In the other, the individual-based approach to population and community modeling was launched with Hank Shugart's FORET model for forest communities and fish population models developed by Don DeAngelis. One landmark event was a conference on Individual-based modeling (IBM) held in Knoxville, which led to the publication in 1992 of "Individual Based Models and Approaches in Ecology" edited by DeAngelis, Huston, and Gross (Univ. of Tennessee). During the 1990's, the Electric Power Research Institute funded a significant effort to apply IBMs as a management tool to quantify the impacts of hydropower production on fish populations. This program, headed at ORNL by Webb Van Winkle, involved researchers, Don DeAngelis, Kenny Rose, Kirk Winemiller, Jeff Tyler, Yetta Jager and others. During the 2000's, we have used these models as a conservation biology tool, where they provide a unique advantage in population genetic research.