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Brief history of agricultural systems modeling

James W. Jones, John M. Antle, Bruno Basso, Kenneth Jay Boote, Richard T. Conant, Ian T Foster, H. Charles J. Godfray, Mario Herrero, Richard E. Howitt, Sander J. C. Janssen, B. A. Keating, Rafael MuozCarpena

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Author ORCID	0000-0002-3239-8960
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Abstract

Agricultural systems science generates knowledge that allows researchers to consider complex problems or take informed agricultural decisions. The rich history of this science exemplifies the diversity of systems and scales over which they operate and have been studied. Modeling, an essential tool in agricultural systems science, has been accomplished by scientists from a wide range of disciplines, who have contributed concepts and tools over more than six decades. As agricultural scientists now consider the "next generation" models, data, and knowledge products needed to meet the increasingly complex systems problems faced by society, it is important to take stock of this history and its lessons to ensure that we avoid re-invention and strive to consider all dimensions of associated challenges. To this end, we summarize here the history of agricultural systems modeling and identify lessons learned that can help guide the design and development of next generation of agricultural system tools and methods. A number of past events combined with overall technological progress in other fields have strongly contributed to the evolution of agricultural system modeling, including development of process-based bio-physical models of crops and livestock, statistical models based on historical observations, and economic optimization and simulation models at household and regional to global scales. Characteristics of agricultural systems models have varied widely depending on the systems involved, their scales, and the wide range of purposes that motivated their development and use by researchers in different disciplines. Recent trends in broader collaboration across institutions, across disciplines, and between the public and private sectors suggest that the stage is set for the major advances in agricultural systems science that are needed for the next generation of models, databases, knowledge products and decision support systems. The lessons from history should be considered to help avoid roadblocks and pitfalls as the community develops this next generation of agricultural systems models.

Keywords: agricultural systems modeling, statistical models, economic optimization model, model scale, interdi

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