

# ***GLEAMS***

Groundwater Loading Effects of  
Agricultural Management Systems

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ABSTRACT

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This publication describes an improved mathematical model to assess the effects of climate-soil-management interactions on edge-of-field and bottom-of-root-zone water quality loadings. **GLEAMS** is an extension of **CREAMS** with an enhanced hydrology component, a component for vertical flux of pesticides, and a comprehensive plant nutrient component. Parameter editors are available for user convenience in micro-computer applications. The publication is presented in three parts: Part I, model documentation; Part II, model validation; and Part III, user manual.

Keywords: hydrology, erosion, sediment transport, plant nutrients, nutrient cycling, pesticide transport, agricultural management, mathematical model, nonpoint source pollution.

## PREFACE

This publication represents not only the efforts of the present authors, but the combined efforts of those 45 scientists and programmers contributing to the **CREAMS** model as well. It represents the continuation of work that began with a workshop at Arlington, Texas nearly 16 years ago. **CREAMS** resulted from a crash effort to develop a tool that could be used by the USDA-Soil Conservation Service and others to assess the impact of alternate management systems on non-point source pollution. Through technology transfer, model strengths and weaknesses were identified, and in 1983, work began on a component to consider vertical flux of pesticides and what became **GLEAMS**. Now, the plant nutrient component has been added.

Since **GLEAMS** is a continuation of **CREAMS**, much of the material describing model concepts in that document (USDA-ARS Conservation Research Report No. 26) is still valid. It was not considered necessary or desirable to reproduce the applicable material here. Modifications and new components that have not been documented elsewhere are included here.

Micro-basing **CREAMS** and the simultaneous development of **GLEAMS** on a personal computer made it possible to generate parameter editors and data bases to enhance the utility of **GLEAMS**. The tremendous advances in the world of PC's not only enabled these potentials, model users have almost unbelievable computing power and speed on their desk top.

There are three parts of the publication: Part I is model documentation; Part II is nutrient component validation; and Part III is the user manual. The user manual written to supplement the parameter editors. All parameters are described and their availability is given to aid the user in parameterization.

The nutrient component was developed under cooperative agreement between the USDA-ARS-Southeast Watershed Research Lab, Tifton, Georgia, and the Biological and Agricultural Engineering Department, University of Georgia-Coastal Plain Experiment Station, Tifton, Georgia. Although model distribution, support, and maintenance was transferred to the USDA-ARS-Grassland, Soil and Water Research Lab, Temple, Texas, earlier this year, this publication was printed by UGA-CPES-BAED at Tifton to fulfill the project.

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## ACKNOWLEDGEMENTS

Several people have contributed to the final development of **GLEAMS** in its present form. Since it is an extension of **CREAMS**, numerous people should be acknowledged for their overall assistance. All those people contributing to **CREAMS** are recognized, but most especially the lead scientists and programmers: Drs. J. R. Williams, R. E. Smith, A. D. Nicks, G. R. Foster, M. H. Frere, and R. A. Leonard, and Mr. J. D. Nowlin. These were the principal leaders, and the ultimate success of both models is attributed to them. Little could have been accomplished without the great support of Drs. K. G. Renard, D. B. Beasley, E. D. Threadgill, and Mr. L. E. Asmussen.

Technology transfer was all important in obtaining confidence in the model and modelers. Several USDA-SCS and other specialists worked patiently to help achieve the goals of technical exchange, model implementation, and provide feedback that was necessary in the further development of **GLEAMS**. Those of long standing support and helped determine user requirements include: John Burt, Tom Dumper, Dave Moffitt, Jim Krider, Mook Allen, Joe Del Vecchio, Don Stettler, Ray Riley, Denise Ford, Frank Geter, and Joe Bagdon. Other contributors include Dr. Don Goss and Ray Griggs, TAES, Temple, Texas, and Dr. George Oliver of Dow-Elanco.

Mr. David Still is recognized for early programming and initial micro-basing of **GLEAMS**. Jim Ascough is acknowledged for his programming the streamlined erosion overland flow profile description. Dr. Guye Willis' expertise in foliar pesticide characterization was extremely helpful in development of the pesticide data base. Dr. Stanley Wilkinson made some excellent data available for testing the animal waste component. Lynne Hester provided valuable assistance in data assembly for validation. H. L. Batten made several AUTOCAD plots of figures for the publication. Calvin Perry provided untold computer and word processing help. Anne Rice's cooperation has made it possible to get the document printed.

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