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SOIL CONSERVATION SERVICE

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Model and Software

Packages Used By SCS

This technical note provides a synopsis of selected computer models and software that has been or is currently in use by NRCS. This technical note was initially compiled by staff at the former South National Technical Center and listed the individuals assigned the oversight responsibility for the model or software. This updated technical note only references the software.

The software and or models are:

- A. AGNPS
- B. CARE
- C. CREAMS
- D. ECON 2
- E. EGEM
- F. EPIC
- G. ERHYM - II
- H. GLEAMS
- I. ICE
- J. LDAMG
- K. SPUR
- L. SWRRB
- M. URB-1
- N. USLE
- O. VAGPR
- P. WATERS
- Q. WEPP

AGNPS - Agricultural Nonpoint Source Pollution Program

The model predicts runoff volume and peak rate, eroded and delivered sediment, nitrogen, phosphorus, and chemical oxygen demand concentration in the runoff, and the sediment for single storm events for all points in the watershed. It provides basic information about water quality used to classify nonpoint source pollution in agricultural watersheds. The output can be used to objectively rate watersheds against each other. It was developed by USDA-ARS for watersheds of 2.5 to 8000 acres using a PC, or 500 to 23,000 acres using a minicomputer. The version 1.1 was expected to be updated to Version 2.0 in June 1989. The 2.0 Version would require a graphics card with VGA capabilities for the graphics portion to display a 400,000 acre watershed. The software will have an EGA option to display watersheds in that mode up to about 12,000. A continuous simulation model is being developed (probably to be released as version 3.0) and is targeted for release as version 3.0) and is targeted for release in late summer of 1989.

CARE - Cost and Return Estimator

The CARE Program is designed to generate costs and returns for crop enterprises. CARE consists of a complete budget generator and a full-screen editor called Quickbudget. The budget generator uses databases that store information on farming activities. Farming activities are then assembled by a user to encompass variations in ownership, usage patterns, and machinery complements to prepare complete Cost and Return estimates for various farm enterprises. Quickbudget allows the user to select a previously prepared generator budget summary and edit only the summary on the screen. The revised budget summary can then be saved and/or printed. CARE is for field offices with land users.

CREAMS - Chemicals, Runoff And Erosion From Agricultural Management Systems

CREAMS is a continuous simulation, field-scale computer model. The model is divided into three components: hydrology, erosion/sediment yield, and chemicals (nutrients and pesticides). Each component operates independently. CREAMS predicts the delivery of runoff, sediment, pesticides, and nutrients from a drainage area within a field. It also provides an estimate of the effect these factors have on nonpoint source water pollution and can be used to rank different management systems. The CREAMS model was developed by scientists of the ARS and is applicable for a field having

- (1)-a single land use;
- (2) relatively homogeneous soils;
- (3) spatially uniform rainfall, and
- (4) a single management system, such as terraces.

Normally, a field is less than 100 acres Overall, CREAMS is not a user friendly model. The erosion/sediment component is data intensive, but the hydrology component is very useful in certain circumstances. Version 1.8/PC is currently available for use on a PC.

ECON2 - Economics

The Economics - Floodwater damage computer application program (ECON2) will compute average annual damages to crops and pasture, other agriculture items, roads and bridges, urban improvements, etc. The frequency methods or the historical methods of analysis may be used. The evaluation may be based on hydrological cross section and flow frequency data as input. The SCS developed this program which is used for evaluations of floodwater control alternatives. The identifying version number for this program is the most recent revision date which is 11/30/83. The present version of the program is operational. The program must be executed on the National Computer Center mainframe computer. A Lotus 123 template is available in each state for data input so that data may be input on a personal computer for transmittal to the national computer.

EGEM - Ephemeral Gully Erosion Model

EGEM is under development by the Hydrology Unit of SCS at NHQ in Washington, D.C. It requires input of about 15 variables, which are easily obtained by field personnel after some minimal training. It provides estimates of average annual erosion, or erosion by a single storm, depending upon the input selected by the user. It also provides estimates of the width, depth and area voided by an ephemeral gully, the depreciated area surrounding the ephemeral gully, and volume of runoff and peak discharge. Revisions under way include providing capability for applying EGEM to branching networks of gullies--it presently applies to only one channel at a time. Methods for extrapolating computations to field-sized areas may be included in future versions. Efforts will be made to simplify input required of the user by allowing the model to contain additional default values or compute certain input internally which will be transparent to the user.

EPIC - Erosion-Productivity Impact Calculator

EPIC is a comprehensive model developed to determine the relationship between soil erosion and soil productivity. It continuously simulates the processes involved using a daily time step and readily available inputs. Since erosion can be a relatively slow process, the model is capable of simulating hundreds of years if necessary. EPIC is generally applicable, computationally efficient, and capable of computing the effects of management changes on outputs. EPIC is composed of (a) physically based components for simulating erosion, plant growth, and related processes, and (b) economic components for assessing the cost of erosion, determining optimal management strategies, etc. The physical components of EPIC include hydrology, weather simulation, erosion-sedimentation, nutrient cycling, plant growth, tillage and soil temperature. Version 3438 of EPIC is currently available for use on PC's.

ERHYM-II

ERHYM-II is a range site scale model which provides daily simulation of soil water evaporation, transpiration, runoff, and soil water routing. Herbage yield is computed annually at peak standing crop. The model uses daily climatic data to simulate ongoing processes, or it can use long-term weather records to simulate runoff and herbage production under a range of climatic conditions and management practices. The model is process orientated and should work reasonably well when the parameters are adequately defined and weather records are available. Currently, the model is not very user friendly--that is, it is not easily understood concerning what data is needed and how to enter the data. ARS developed this model and planed to release a new version by May 1989. The model is easy to operate after one knows what data is needed. Getting complete weather data for a particular location is not easy, but hopefully, the SCS will soon have sufficient weather data available. Texas A&M University is currently validating the model and making

changes in the way the model works. It appears that the revised version will result from Texas A&M efforts to make the model very usable for SCS work.

GLEAMS - Groundwater Loading Effects Of Agricultural Management Systems

GLEAMS is a mathematical model developed by ARS for field- sized areas to evaluate the effects of agricultural management systems on the movement of agricultural chemicals within and through the plant root zone. GLEAMS was developed from CREAMS by modifying the hydrology, plant nutrient, and pesticide components to consider movement of water and chemicals within and through the root zone, and to improve the model representations of management practices. Long-term simulation up to 50 years was also added. Output from the model for erosion and hydrology are similar to CREAMS output. Up to 10 pesticides can be routed through up to 12 layers contained within up to 5 soil horizons. The current version will not handle nutrients. Version 2.0, anticipated this year, will predict nitrogen and phosphorous movement through the root zone. The current version differs significantly from the previous version. Front end files developed for this version will not run on older versions. A new front end program supplied with the model is extremely helpful in developing the parameter files for GLEAMS. Input format and sequencing are managed by the front end software, and parameter selection is aided by "help" tables. This information was modified from "GLEAMS: Groundwater Loading Effects of Agricultural Management Systems," R.A. Leonard, W.G. Knisel, and D.A. Still, Vol. 30(5), Sept.-Oct., 1987, Transactions of the ASAE.

ICE - Interactive Conservation Evaluation

ICE is designed to provide a computerized evaluation process to assist land users in evaluating and selecting alternative soil conservation measures. The program compares with and without conservation practice alternatives for both sheet and rill, and ephemeral gully erosion. Sheet and rill erosion is evaluated using the USLE, techniques which are related to yield impacts with a modified Pierce-Larson Equation. The Ephemeral Gully Analysis evaluates the economic impact on measured gullies with user specified yield changes between the with and without situations. ICE is for field office use with land users. Version 6.3 was released in the June 1989.

LDAMG - Land Damage Analysis Program

The Land Damage Analysis Program will compute average annual damages due to sediment, scour and swamping. The program input requirements are the same economic and geologic data needed for manual calculations. The SCS developed this program which is used for evaluations of beneficial effects of land treatment and structural measures simultaneously. There are no identifying version numbers for this program. The present version of the program is operational. The programs must be executed on the National

Computer Center mainframe computer. A Lotus 123 template is available in each state for data input so that data may be input on a personal computer for transmittal to the national computer. Conversion of the program to a personal computer version will be completed as soon as possible.

SPUR - Simulation Of Production And Utilization of Rangeland

The SPUR model is a comprehensive rangeland simulation model developed to provide information that may be used to manage rangelands for various uses and products. It is composed of five basic components:

- (1) climate;
- (2) hydrology;
- (3) plants;
- (4) animal, and

(5) economic. The model is driven by weather and soil data and simulates daily plant growth, uses forage preference, location, and abundance to control plant utilization. Animal growth is simulated on a steer- equivalent basis, and net gain is used to calculate economic benefits. The hydrology component calculates upland surface runoff volumes, peak flow, snowmelt and streamflow. It also estimates upland and channel sediment yields. The SPUR model has not been validated for all components at a single location. The SCS is currently involved in getting the model validated so that it may be used to assist in the calculation of water yield from rangeland with various treatments applied. The model is not currently user friendly. It uses USLE hydrology, which is not very functional on rangeland, and the dynamic plant growth model needs improvement. It is hoped that SCS interest in this model continues, and that changes needed by the model will be made so that water yields can be predicted from rangeland or watershed-size areas

SWRRB - Simulator For Water @urces In Rural B@

SV,TRRB predicts effects of management decisions on water and sediment yields on large, ungaged, rural watersheds. It is not identified by a version number, but the current version is dated March 1989. The model is being developed-by ARS scientists. It simulates weather, surface runoff, return flow, percolation, ET, transmission losses, pond and reservoir storage, crop growth, and irrigation. It provides estimates of water and sediment yield from a watershed by hydrologic routing techniques. Plans are being made for a user friendly interface for data entry, called ENTERACT. It should be available within a few months. Capability for predicting pesticide and nutrient discharges from watersheds will be included in a future version of SV,TRRB.

SNTC contact: Peter Waldo, Geologist, Engineering Staff.

URBI-1-Urban Flood %mage Economic Evaluation

The Urban Floodwater Damage Economic Evaluation computer application program (URBI-1) will compute average annual damages for buildings and contents. The program requires input data of percent damage factors (COF-DAMG) by flood depth for buildings and contents of representative houses or other types of buildings. The frequency method of evaluation is used to compute damages by depths for each damage factor category. The program requires standard hydrological cross section and flow frequency data as input. The SCS developed this program which is used for evaluations of floodwater control alternatives. The identifying version number for this program is the most recent revision date which is 08/22/86. The present version of the program is operational. The program must be executed on the National Computer Center mainframe computer. A Lotus 123 template is available in each state for data input so that data may be input on a personal computer for transmittal to the national computer. Conversion of the program to a personal computer version will be completed as soon as possible.

SNTC contact: Tom Hodges, Head, ESSE Staff

USLE - Universal Soil Loss Equation

The USLE is an erosion model designed to compute longtime average annual soil losses from sheet and rill erosion under specified conditions. It is also useful for construction sites and other nonagricultural conditions, but it does not predict deposition and does not compute sediment yields from gully, streambank, and streamlined erosion. Walter H. Wischmeier, Agricultural Research Service (retired) was research leader of the group which developed the USLE. The procedure is published in Agricultural Handbook 537.

SNTC contact: Henry Bogusch, Agronomist, ESP Staff.-

VAGPR - Value of Agriculture Production

The Value of Agriculture Production (VAGPR) Program is designed to compute future without project returns for various crops and compare these with alternative conditions. The SCS developed this program which is useful for alternative intensification, irrigation, drainage and erosion benefit evaluations. There are no identifying version numbers for this program. The present version of the program is operational. The program must be executed on the National Computer Center mainframe computer. A Lotus 123 template is available in each state for data input so that data may be input on a personal computer for transmittal to the national computer. Conversion of the program to a personal computer version will be completed as soon as possible.

SNTC contact: Tom Hodges, Head, ESSE Staff

WEPP - Water Erosion Prediction Program

WEPP is a new generation water erosion prediction model. The first version, called the hillslope or profile version, is designed to replace USLE. It is an improved erosion prediction technology which is based on modern hydrologic and erosion science and is process oriented. The model and computer programs are versions which are presently being developed in phases. The second version is the watershed version that uses a representative landscape profile and considers concentrated flow areas within the application area. The third is the grid version. It computes sediment movement at all points and in all concentrated flow areas of a field. The project leader for development of WEPP is Leonard J. Lane of the Agricultural Research Service (ARS).

SNTC contact: Henry Bogusch, Agronomist, ESP Staff

WATERS - Watershed Evaluation @arch System

WATERS is a system of hydrologic and economic models applied to selected watersheds for the study of environmental and economic effects of resource management strategies. It is a combination of the Agricultural Nonpoint Source Pollution Model (AGN-PS) developed by ARS and a Linear Program prepared by Iowa State University. The user groups include resource planners and managers who need to assess management options for watersheds and individual land units. Erosion estimates, runoff, peak flow, sediment production, chemical transport, flooding potential and related data can be estimated by WATERS. It further allows a blending of economic and environmental information as a means to focus on achieving the desired resource management results.

SNTC contact: b&ke Woodson, Water Resource Specialist,