PN-ABL-524

AGRICULTURAL RESEARCH PROJECT (386-0470)

SUBPROJECT: STRENGTHENING AGROMETEOROLOGICAL RESEARCH TO ENHANCE CROP PRODUCTION

CONSULTANCY REPORT: WORKSHOP ON DELINEATION OF AGROECOLOGICAL ENVIRONMENTS AND ON GEOGRAPHICAL INFORMATION SYSTEM SOFTWARE

WM. A. DUGAS and PAUL T. DYKE
CONSULTANTS
WINROCK INTERNATIONAL
1611 N. KENT ST.
ARLINGTON, VA 22209 U.S.A.

MAILING ADDRESS:
BLACKLAND RESEARCH CENTER
TEXAS AGRICULTURAL EXPERIMENT STATION
808 E. BLACKLAND RD.
TEMPLE, TX 76502 U.S.A.

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List of Terms

AICRPAM	All India Coordinated Research Program in Agricultural Meteorology
ARP	Agricultural Research Project
CRIDA	Central Research Institute of Dryland Agriculture
GIS	Geographical Information System
ICAR	Indian Council of Agricultural Research
ICRISAT	International Center for Research in the Semi-Arid Tropics
USAID	U.S. Agency for International Development
WMO	World Meteorological Organization

Executive Summary

This report summarizes activities associated with a workshop on delineation of agroecological environments and GIS software held at CRIDA and ICRISAT, Hyderabad, in December, 1991. Workshop goals were to develop an understanding of the basics of microcomputers, create input weather and soils data sets for simulation models, and develop familiarity with simulation models and GIS software.

The workshop was an outstanding success. Workshop participants were eager and prepared to learn the material, and facilities and logistical support provided by CRIDA and ICRISAT were excellent. Participants positively evaluated the workshop. Leaders were pleased with the enthusiasm and response of participants.

Workshop participants acquired the following: software and documentation of several simulation models, computer-readable weather data for locations in India, parameters for generating daily weather for more than 100 locations in India, and lecture notes for subjects covered in the workshop.

The opportunity now exists to develop linkages between Indian and U.S. scientists for cooperative research, especially for simulation model validation and calibration and for application of models to Indian problems. To accomplish this, we recommend USAID support travel by U.S. scientists to India to organize this collaborative research, and support an international symposium planned in India in late-1992. This symposium would be an excellent conclusion to this subproject and would facilitate scientist-to-scientist research interactions.

Introduction

This report summarizes activities associated with a workshop on delineation of agroecological environments and GIS software held in Hyderabad in December 1991. This workshop was one of a series associated with a subproject designed to strengthen research capabilities of ICAR scientists in agricultural meteorology by providing equipment, training, and technical assistance. This workshop was a part of the technical assistance.

Background

This subproject is part a larger ARP whose purpose is ". . . to strengthen the Indian Agricultural research system's ability to conduct research on priority problems. . .." It also directly supports the activities of the AICRPAM. The following objectives were established for the subproject:

A. Model interactions between weather and crops.

B. Develop 'response farming' procedures.

C. Develop crop yield forecasting models based on crop canopy spectral measurements.

D. Develop techniques using agrometeorological data for farm-level management decisions.

E. Assist in the development of the CRIDA.

This workshop supported objectives 1 and 4.

Objective

The workshop objective was to train Indian scientists on methods for delineating agroecological environments and on using GIS software.

Workshop Description

Workshop Schedule.

Workshop activities are presented in Appendix 3. Workshop participants (Appendix 5) were instrumental in deciding priorities. Several changes in emphases were made during the

workshop as a result of interaction with participants.

Workshop participants completed a pre-workshop questionnaire (Appendix 7) designed to assess their computer and simulation model capabilities. Eleven of these questionnaires were returned in early 1991, assuming the workshop was to be held in March 1991. Given the delay in the workshop, results were somewhat dated. Nevertheless, responses to the pre-workshop questionnaire (Appendix 8) were representative of workshop participants. Thus, planning by workshop leaders, based upon questionnaire results, was appropriate. We recommend continued use of a pre-workshop questionnaire. It will assist in assessing the capabilities of workshop participants and designing the workshop to meet needs of participants.

Workshop Evaluation.

The following goals were established for the workshop:

A. Understand basics of microcomputers.

B. Develop input data for simulation models, including measured and generated weather data sets and soils information.

C. Develop familiarity with GIS software.

Participants acquired the following as a result of attending the workshop:

A. Software and documentation for several simulation models (Appendix 4).

B. Computer-readable daily weather data for locations in India. Data contained necessary meteorological elements and were in the proper format for use by models.

C. Parameters for generating daily weather for more than 100 stations in India. These data can be used by models.

D. Model output, including several years of simulated yields and soil water levels throughout the growing season, for various crops.

E. Lecture notes for subjects covered in the workshop (Appendix 6).

Facilities.

Facilities and local logistical support provided by CRIDA and ICRISAT were excellent. Using both venues for workshops is recommended because both locations have positive aspects.

Workshop Evaluation.

Participants completed a post-workshop questionnaire (Appendix 7) evaluating the workshop. Results (Appendix 9) show the following:

A. Pre-Workshop Information

1. Only about 2/3 of participants received pre-workshop information. Several participants stated that the workshop would be improved with practicals using their own soils and weather data. Participants should be given advanced notice of workshop dates and the types of computer-readable data to be brought for practicals.

B. Administration/Logistics

1. Facilities and logistics were, in general, adequate. However, more computers are needed. With an attendance of ca. 21 and 6 computers (3 of which were 'slow' XTs), the lack of computers was a limitation. The housing at CRIDA was fine, but the extended travel time for participants from CRIDA to ICRISAT was a bit tiring.

C. Course Content

1. All objectives were adequately achieved. GIS was covered the least well.

2. The level of presentation was right.

3. Materials covered in the workshop were perceived to be useful, with GIS the least useful.

4. More exposure should be given to simulation models and GIS.

D. Course design

1. Scheduling and length of the course were adequate.

2. Lectures and discussions were most useful.

3. Handouts and manuals provided were perceived to be very useful.

E. Instructors

1. Both instructors were rated very high in all categories.

F. Overall Satisfaction

1. The course would be highly recommended to others.

2. Participants were confident in their ability to apply course materials, especially simulation models.

Problems Encountered and Solutions

A. Luggage. As instructed by Winrock, we packed teaching material (documentation, lecture notes, hand outs, software) in suitcases and brought them with us as personal baggage. Because of a short connection in Hong Kong, our luggage did not arrive with us in New Delhi. Then, because of difficulties with customs and airlines and because we were in Hyderabad and our luggage arrived in New Delhi, it was difficult to get our luggage (and, thus, teaching material) to us in a timely manner. We received our luggage late on Thurs. (5 Dec.). It was distributed to workshop participants on Fri. (6 Dec.), five days after arrival in India. For these first five days, some of the necessary teaching materials were not available to the participants. This could have seriously jeopardized workshop success. One workshop leader (WAD) spent a great deal of time during the first week attempting to acquire the luggage. This time was at the expense of interactions with workshop participants.

However, due to efforts by ICRISAT staff in Hyderabad, single copies of the necessary teaching materials were made available during the first week and sufficient progress was attained.

We recommend when consultants are going to India they be met at the airport by a Winrock individual in New Delhi. In our case, we were fortunate to be met by an ICRISAT employee who assisted us in organizing paper work and other matters related to our mishandled luggage. If Winrock personnel had been present at the airport, we believe we would have received our materials earlier. We were lucky to acquire the material within five days.

If consultants are bringing teaching material with them which may cause customs problems the following could be done:

1. Have Winrock personnel ensure airline connections are sufficiently long enough to increase the likelihood of proper luggage transfer. Our connection in Hong Kong was only 60 min. Our flight was 30 min. late in arriving in Hong Kong and therefore there was very little chance of our luggage making the transfer between airlines.

2. Winrock acquire the necessary letters and documents to facilitate easy passage through customs. In our case, the letter obtained from an ICAR Minister regarding workshop materials was instrumental in assuring our luggage, when finally received, could be cleared.

B. Materials. Although we brought three extra copies of documentation and software (20 in total), there were not sufficient copies to meet the number of workshop participants. An accurate count of the number of copies of materials required should be provided to consultants.

Recommendations

The opportunity now exists to integrate research activities of U.S. and Indian scientists involved in this subproject for cooperative research. Indian scientists are now, as a result of the training and instrumentation purchased in this subproject, making necessary environmental measurements, e.g. solar radiation, soil water, and leaf area in their field experiments, for model validation and calibration and are capable of analyzing the data with the computers. Indian scientists, however, still will require technical assistance to design, implement, and interpret research for these purposes and to fully and effectively utilize the instrumentation purchased and technical assistance delivered in association with this subproject. Simulation models could provide a focus for defining objectives and experimental methods for much of the research by subproject participants.

To facilitate the scientist-to-scientist interaction, we respectfully recommend USAID do the following:

A. Support travel by U.S. scientists involved in simulation model development and use to India to organize collaborative research with India scientists. U.S.-based modelers who should be contacted on this matter include:

1. Dr. C.A. Jones, Texas Agricultural Experiment Station, Blackland Research Center, Temple, TX. CERES-MAIZE.

2. Dr. J. Jones, University of Florida, Gainesville, FL. PNUTGRO, SOYGRO.

3. Dr. J.T. Ritchie, Michigan State University, East Lansing, MI. CERES-WHEAT, -RICE, -MILLET, -MAIZE.

4. Dr. Wes Rosenthal, Texas Agricultural Experiment Station, Blackland Research Center, Temple, TX. SORKAM, COTTAM.

5. Dr. J. Williams, USDA/ARS, Grassland, Soil and Water Research Laboratory, Temple, TX. EPIC, Weather Generator, SWRRB. This travel could be in conjunction with a final workshop for this subproject (see below).

B. Support an international symposium on "Agroclimatology and Sustainability" planned in India in late-1992. This symposium, jointly sponsored by ICAR, ICRISAT, and other international and national organizations, would be an excellent opportunity to bring leading international scientists to a conference whose theme and focus is directly related to the subproject objectives.

Indian scientists associated with this subproject would attend the symposium and are now poised to fully capitalize on this opportunity to interact with U.S. scientists. Interactions resulting from this symposium would enhance scientist-to-scientist research interactions.

C. Support a concluding workshop for this subproject in June 1992. This could be in conjunction with the last planned workshop (Crop Modeling). This workshop would be an excellent opportunity to evaluate progress of subproject participants in terms of subproject objectives. Several U.S. and ICRISAT

scientists should be invited to this workshop, including several individuals who provided technical assistance to this program.

D. Purchase additional equipment for this subproject:

1. A compact disc (CD) reader. Significant amounts of climatic and soils data, computer software, and bibliographic material are being and will be distributed on this media. This subproject should have access to one of these. For example, data and software exchange between CRIDA personnel or cooperating scientists within the subproject and with scientists at the Blackland Research Center will likely use CDs.

2. Photocopier and lazer printer. These materials would be useful during workshops to generate and copy materials. The lazer printer would also be useful to integrate with the GIS package left by consultants.

3. A few copies of a GIS software package. There are several in this group who have an interest and who have capabilities of using GIS. A couple of copies of an inexpensive software package (e.g. IDRISI) should be purchased for use by subproject participants.

Conclusions

This workshop was an outstanding success. The following was accomplished:

A Indian scientists who had been made aware of the utility of microcomputers and crop and hydrologic simulation models and who had a strong desire to use both of these were provided an opportunity to significantly increase their experiences and familiarity with each.

B. Participants were given personal help in understanding model processes, inputs, and outputs by individuals directly involved in model development and/or applications.

C. Participants used the models to evaluate strategic and tactical farm management decisions.

D. Participants became aware of the basics of GIS and how it can be used for analysis and delineation of agroecological

environments.

E. Participants became more expert at using microcomputers and associated related useful software (e.g. spreadsheets).

F. Participants were provided with timely and useful documentation. This was a major highlight of the workshop. This material could be integrated into university course materials. Future consultants should be encouraged to bring sufficient copies of relevant published materials (especially software, books, user's guides, symposium proceedings, etc.) for distribution to workshop participants. There is a great need and desire for this material which often is difficult to obtain in India.

Appendices

1. Terms of Reference

Conduct a training workshop on Delineation of Agroecological Environments and on Geographical Information Systems Software in Hyderabad from 2 to 14 December 1991.

2. Acknowledgements

We acknowledge the following individuals for their assistance in conducting this workshop:

Abrol, I.P. (D.D.G., ICAR, Delhi)
Aiyer, R.S. (ICRISAT, Hyderabad)
Bhatia, P.C. (Princ. Sci., ICAR, Delhi)
Bhatt, S. (Winrock, Wash, D.C.)
Katyal, J.C. (Director, CRIDA, Hyderabad)
McClung, A. Colin (Winrock, Wash., D.C.)
Ramana Rao, B.V. (Project Coord., ICAR, Hyderabad)
Singh, M. (Sen. Sci., Winrock, Delhi)
Singh, S. (USAID, Delhi, India)
Srinivasan, P.S. (Adm. Spec., Winrock, Delhi)
Virmani, S. (Sen. Sci., ICRISAT, Hyderabad)

Mr. Ramana Rao was especially helpful in development and implementation of this workshop. Dr. S.M. Virmani was instrumental in assuring that the proper facilities were made available to us at ICRISAT, was instrumental, along with Mr. Aiyer, in assuring our luggage was received, provided software and documentation for teaching materials during the first week, and made presentations on his research at the workshop. Without his efforts this successful workshop would not have been possible. His involvement in this subproject should be encouraged and maintained.

3. Itinerary and Persons Visited

29 Nov. 1991:	Travel from Killeen, Texas to Hyderabad, India.
30 Nov. 1991:	Continue travel status.
1 Dec. 1991:	Continue travel status. Visit with Mr. Ramana Rao and Dr. S. Virmani regarding workshop plans. Prepare lectures for following day.
2 Dec. 1991:	Attend opening session of workshop at CRIDA in a.m. led by Drs. Katyal and Virmani. Present lectures on microcomputers and spreadsheets in p.m. See attached copy of lecture notes for topics covered.
3 Dec. 1991:	Continue workshop. Present lecture and practicals on CERES-MAIZE. See lecture notes. Participants loaded models and input data sets onto computers, and ran the models on Indian data sets.
4 Dec. 1991:	Continue workshop. Present lecture and practicals on CERES-WHEAT. See lecture notes. Participants loaded models and input data sets onto computers, and ran the models on Indian data sets.
5 Dec. 1991:	Present lecture material on SWRRB. Participants loaded software onto computers, discussed model inputs, and examined model outputs. See lecture notes. A brief presentation for and discussion with Dr. J.S.P. Yadav (USAID) took place.
6 Dec. 1991:	Handed out and discussed teaching materials (documentation and software) which arrived with luggage yesterday. Discussed EPIC inputs, algorithms, and outputs. See lecture notes. Made simulation runs with EPIC for Indian soils, weather, and cropping systems. Discussed workshop and subproject progress and plans with Dr. Yadav.
7 Dec. 1991:	Worked on final report and prepared material for second week of workshop.
8 Dec. 1991:	Holiday.
9 Dec. 1991:	Attend meetings of workshop held at CRIDA.

Discuss workshop progress, and made a mid-week assessment and plans for the next week. Discussed SORKAM inputs, algorithms, and outputs. See lecture notes. Attend guest lectures (Appendix 9) of scientists invited by CRIDA on GIS and on Sustainability and Dryland Agriculture.

10 Dec. 1991: Conduct practicals on weather generator. Present lecture on GIS software. Do GIS computer exercises. Visit in p.m. with scientists in Economics section of ICRISAT/Resource Management Section.

11 Dec. 1991: Continue exercises using simulation models with computers. Present lecture on use of DMSOILS software for calculating plant available water from soil properties.

12 Dec. 1991: Continue exercises using simulation models with computers. Work on final report. Discuss outputs in detail. Determine gaps in documentation and software. Hand out questionnaires to workshop participants.

13 Dec. 1991: Clean data and programs off computers on loan from ICRISAT. Hear presentation of GIS research by ICRISAT scientists (Appendix 9). Collect completed questionnaires.

14 Dec. 1991: Attend final session of conference held at CRIDA summarizing workshop. Make a presentation of my overall assessment of workshop. Hear presentations of research by participants. Travel to New Delhi by plane.

15 Dec. 1991: Work on final report.

16 Dec. 1991: Present final report to Winrock. Visit with personnel from USAID (Dr. S. Sing), ICAR (Dr. Abrol), and Winrock (Dr. M. Singh).

17 Dec. 1991:

4. Materials Provided to Participants

I. Books.

A. Jones, C. A. and J. R. Kiniry (eds.). 1986. CERES-MAIZE: A simulation model of maize growth and development. Texas A&M University Press, College Station, 194 pp.

B. Godwin, D., J. T. Ritchie, U. Singh, and L. Hunt. 1990. A User's Guide to CERES-WHEAT. V2.1, 2nd Ed., Mich. State Univ., Int. Fert. Dev. Center, I.B.S.N.A.T.

C. Rosenthal, W. D., R. L. Vanderlip, B. S. Jackson, and G. F. Arkin. 1989. SORKAM: A grain sorghum crop growth model. Texas A&M MP 1669.

D. Sharpley, A.N. and J.R. Williams. 1990. EPIC-Erosion/Productivity Impact Calculator. 1. Model documentation. USDA Technical Bulletin No. 1768. 235 pp.

E. Williams, J.R., P.T. Dyke, W.W. Fuchs, V.W. Benson, O.W. Rice, and E.D. Taylor. 1990. EPIC-Erosion/Productivity Impact Calculator. 2. User Manual. A.N. Sharpley and J.R. Williams (eds.). USDA Technical Bulletin No. 1768. 127 pp.

F. Arnold, J.G., J.R. Williams, A.D. Nicks, and N.B. Sammons. 1990. SWRRB, A basic scale simulation model for soil and water resources management. Texas A&M Univ. Press, College Station, TX.

II. Miscellaneous written materials.

A. Components of a PC.

B. Microsoft DOS Tutorial.

C. Lotus 123 menu structures.

D. Class notes (Appendix 6)

E. GIS Overview

F. SCS Soil Parameters Preparation Program for DRAINMOD. DMSOILS User's Guide

G. EPIC Model order form to register participants as model users to receive model updates and EPIC Installation Guide (29/10/91).

H. Operation of UTIL.

I. WXGEN User's Guide.

J. WXPARM User's Guide.

K. EPIC Supplemental Notes.

L. SWRRBWQ Supplemental Notes.

III. Software.

A. DMSOILS. Algorithms for calculating plant available soil water from soil properties.

B. CERES-MAIZE.

C. CERES-WHEAT.

D. EPIC.

E. SWRRB.

F. WMO Data. Weather generator parameters for stations around the world.

G. IDRISI. GIS software package. One copy given to CRIDA.

5. Workshop Participants

NAME	AFFILIATION	INTERESTS
Sukumar Dash	RMP/GIS, ICRISAT	Hydrological model, GIS
Dr. A.A. Dason	ARS Kovilpatti, T.N.	Cotton, pearl millet, sorghum, hydrology, EPIC, SWRRB, WXGEN
C.S. Harindranath	NBSS&LUP, Bangalore	Finger millet, coconut, sorghum, hydrologic modelling, soil moisture
S.S. Hundal	P.A.U., Ludhiana	Modeling wheat groundnut, water balance, evapotranspiration, GIS
S.A. Khan	B.C.K.V., Mohanpur	Modelling, mustard, rice, barley
P. Vijay Kumar	CRIDA	Castor, pulses, hydrologic studies, weather generator, EPIC
D. Midya	RMP/AGRO, ICRISAT	Sorghum, GIS
N.S. Murty	G.B.P. Univ. of Agric. Tech., Ranichauri	Potato, finger millet, wheat & plum, GIS, modelling, hydrology

Dr. S.T. Nagaraj	Univ. of Agric. Sciences, Banagalore, Karnataka State	Finger millet, pigeonpea, peanut, maize
Dr. C.B. Patil	Solapur, Maharashtra	Winter sorghum, Pearl millet, cropping system
K.S. Prasad	RMP/GIS, ICRISAT	GIS
Y.S. Rama Krishna	CAZRI, Jodhpur	Modeling, GIS, pearl millet, mustard,
Dr. A.Y. Rao	A.R.I. R'nagar, A.P. Agric. Univ., A.P.	Groundnut, Rice, Cropping systems
Dr. D. Gangadhar Rao	CRIDA	Sorghum, Groundnut
P. Mohan Rao	RMP/GIS, ICRISAT	GIS
U.M.B. Rao	CRIDA	Hydrological models, castor
Dr. M.N. Reddy	CRIDA	Sorghum, EPIC, GIS, weather generator
Dr. A. Sarker	PDCSR, Modipusam, Meerut	Rice, wheat, maize, potato, cropping systems
A.S.R.A.S. Sastri	Indira Gandhi Agric. Univ., Raipur, M.P.	Modeling, GIS, drought management, rainfed rice, soybean, peanut

Diwan Singh	Agric. Met., H.A.U., Hissar	Mustard, soil water balance, hydrological studies, climatic characterization.
Piara Singh	ICRISAT	Modeling, hydrology
R.D. Singh	ICAR, Res. Complex for NEH Region, Barapani, Shillong	Mustard, soybean, maize, rice, hydrologic modeling
S.R. Singh	NBSS&LUP, Nagpur	Finger millet, sorghum, hydrologic modelling, soil moisture
N.N. Srivastava	CRIDA	Sorghum, pearl millet, castor, weather generator
S.K. Tomar	N.D.U.A.T., Kumarganj, Faizabad	Wheat intercropped with Rabi pulses
U.S. Victor	CRIDA	Modeling, GIS, hydrology, sorghum, castor, pearl millet, groundnut
K.P.R. Vittal	CRIDA	EPIC, GIS, soil productivity

6. Lecture Notes

MICROCOMPUTER BASICS

I. PROCESSORS
- A. TYPES
  - 1. 8088
  - 2. 80286
  - 3. 80386
  - 4. 80486
- B. SOFTWARE REQUIREMENTS
- C. PROCESSING SPEED (8-33 MHz)

II. KEYBOARD
- A. NUM KEY PAD
- B. ARROW KEYS
- C. 'BREAK'
- D. WARM AND COLD BOOT

III. MEMORY
- A. BYTE
  - 1. 8-BIT GROUP
  - 2. 1 KB = 1024 BYTES
- B. WORD SIZE (8, 16, OR 32 BIT)
- C. RAM
  - 1. PROGRAM AND DATA STORAGE
  - 2. 640 K 'CEILING'
  - 3. SOLID STATE
  - 4. TEMPORARY STORAGE
- D. ROM
  - 1. DIAGNOSTICS
  - 2. PERMANENT
- E. EXTENDED VS. EXPANDED
- F. 'HIGH'

IV. DISK DRIVES
- A. FLOPPIES
  - 1. SIZE
  - 2. DENSITY
  - 3. DISKS
    - a. WRITE-PROTECT
    - b. CARE
    - c. SYSTEM
  - 4. ORGANIZATION
- B. HARD DISKS
  - 1. SIZE
  - 2. FORMATTING

VI. OPERATING SYSTEMS
- A. MS-DOS
- B. OS2
- C. MAC
- D. UNIX

VII. MONITORS/GRAPHICS ADAPTERS
- A. CGA
- B. VGA
- C. VGA+

VIII. PRINTERS
- A. DOT MATRIX
- B. LAZER
- C. POSTSCRIPT

IX. DRIVERS

Device drivers are programs that let the operating system recognize devices that are not a part of the computer (for example, a modem, printer, or mouse). Some device drivers are already installed with MS-DOS. Other device drivers, called installable device drivers, can be installed as you need them.

X. PERIPHERALS
- A. SLIDE MAKERS (IMAGE PROCESSORS)
- B. MODEMS
  - 1. BAUD RATE
  - 2. COMMUNICATION PROTOCOL
- C. LOCAL AREA NETWORKS
  - 1. SERVERS
  - 2. NODES
- D. DIGITIZERS (GIS)
- E. PLOTTERS
- F. MATH CO-PROCESSOR
  - 1. SPECIFIC TO PROCESSING SPEED AND PROCESSOR
- G. FAX CARDS
- H. MOUSE
- I. TAPE DRIVES (BACK UP)
- J. EXPANSION CARDS
- K. CD ROMS
- L. SERIAL AND PARALLEL PORTS

XI. DIRECTORIES
- A. ROOT DIRECTORY
- B. SUBDIRECTORIES
- C. BOOTING FROM HARD DISK
  - 1. CONFIG.SYS
    - a. FILES
    - b. BUFFERS
  - 2. AUTOEXEC.BAT
    - a. PATH
    - b. PROMPTS (PG)
- D. FILES TYPES
  - 1. EXECUTABLE
  - 2. DATA (ASCII)
  - 3. COMPRESSED FROM APPLICATIONS (ZIPPED)
  - 4. BATCH

XII. TEXT EDITORS
- A. EDLIN
- B. WORD PROCESSORS
  - 1. PROGRAM EDITORS

XIII. SOFTWARE
- A. WORDPROCESSING (WORD PERFECT)
- B. SPREADSHEETS (LOTUS, QUATTRO, EXCEL)
- C. SHELLS (NORTON, MAGELLAN, OFFICE, WINDOWS)
- D. APPLICATIONS

E. LANGUAGES
   1. FORTRAN
   2. PASCAL
   3. C
   4. BASIC
F. GRAPHICS (FREELANCE GRAPHICS)
G. CAD
H. COMMUNICATIONS (KERMIT, CROSSTALK)

SPREADSHEETS

I. INTRODUCTION (LOTUS)
- A. WHAT IS SPREADSHEET
  - 1. STRUCTURE FOR NUMERIC CALCULATIONS
  - 2. COLUMNS, ROWS, VALUES
- B. SPREADSHEET AND BORDER AREA
  - 1. CELL ADDRESSES
  - 2. MODE INDICATOR
  - 3. CELL
  - 4. CELL POINTER
  - 5. STATUS LINE
  - 6. MULTIPLE WORKSHEETS (V. 3.0+)
- C. VERSIONS (2, 2.1, 3, 3.1, 123 FOR WINDOWS)
  - 1. REQUIREMENTS
    - a. RAM MEMORY
    - b. PROCESSORS
    - c. PRINTERS
    - d. DISK SPACE
- D. CONFIGURATION FILES
  - 1. PRINTERS
  - 2. GRAPHICS CARD
  - 3. MONITOR
- E. STARTING AND ENDING

II. WORKSHEET BASICS
- A. MOVEMENT
  - 1. ARROW KEYS
  - 2. F5
  - 3. HOME
  - 4. PAGE KEYS
  - 5. SCROLL LOCK
  - 6. END
  - 7. ESC
- B. FUNCTION KEYS
- C. CELL ENTRY
  - 1. KEYBOARD
    - a. KINDS
      - (1) NUMBERS
      - (2) FORMULAS
      - (3) LABELS (',",^,\)
    - b. EDITING (F2)
    - c. RECALCULATION IN EDIT (F9)
  - 2. COPY/MOVE
  - 3. FROM FILE
    - a. IMPORT
    - b. COMBINE
- D. MENUS
  - 1. HIERARCHICAL
  - 2. MOVING 'UP' AND 'DOWN'
  - 3. SELECTING CHOICE
- E. CELL RANGES
  - 1. ENTERING
  - 2. SPECIFYING W/ MOVEMENT

- 3. REMOVING ANCHOR W/ "ESC"
- 4. NAMING

F. FORMULAS
- 1. + KEY
- 2. ADDRESSING
  - a. ABSOLUTE
  - b. RELATIVE
- 3. OPERATORS
  - a. PRIORITY

G. @ FUNCTIONS (SEE TABLE 10.1)

H. MACROS

III. MAIN MENU (SEE FIG. 3.1)

A. WORKSHEET
- 1. INSERTING/DELETING COLUMNS, ROWS

B. RANGE
- 1. ERASE
- 2. NAME

C. COPY

D. MOVE

E. FILE COMMANDS
- 1. EXTENSIONS
- 2. DEFAULT DIRECTORIES
- 3. RETRIEVE
- 4. SAVE
- 5. COMBINE
- 6. EXTRACT
- 7. IMPORT (ASCII)

F. PRINT
- 1. RANGE
- 2. FORMAT
- 3. DESTINATION
- 4. FORMATTED/UNFORMATTED
- 5. PAGE LENGTH

G. GRAPH
- 1. TYPES
  - a. XY
  - b. BAR
  - c. LINE
- 2. RANGES (X AND Ys)
- 3. VIEW
- 4. SAVE
- 5. OPTIONS
  - a. LEGEND
  - b. FORMAT
  - c. TITLES
  - d. GRID
  - e. SCALE
- 6. NAMING
- 7. PRINTING
  - a. VERSION 2.1 VS 3

H. PRINT GRAPH (V 2.1)

HYDROLOGIC MODELS

I. INTRODUCTION
- A. HISTORICAL PERSPECTIVE
  - 1. CREAMS
- B. GSWRL/BRC ACTIVITIES

II. EXAMPLE MODELS
- A. EPIC (EROSION PRODUCTIVITY IMPACT CALCULATOR)
  - 1. HYDROLOGY
    - a. SURFACE RUNOFF
      - (1) VOLUME
      - (2) PEAK RUNOFF RATE
      - (3) LATERAL SUBSURFACE FLOW
      - (4) EVAPOTRANSPIRATION
        - (a) POTENTIAL ET
        - (b) SOIL AND PLANT EVAPORATION
        - (c) WATER TABLE
  - 2. WEATHER
    - a. GENERATOR
      - (1) PRECIPITATION
      - (2) AIR TEMPERATURE
      - (3) SOLAR RADIATION
      - (4) WIND
      - (5) RELATIVE HUMIDITY
  - 3. EROSION
    - a. WATER
      - (1) RAINFALL/RUNOFF
      - (2) IRRIGATION
    - b. WIND
  - 4. NUTRIENTS
    - a. NITROGEN
      - (1) NITRATE LOSS IN SURFACE RUNOFF
      - (2) DENITRIFICATION
      - (3) MINERALIZATION
      - (4) IMMOBILIZATION
    - b. PHOSPHORUS
      - (1) SOLUBLE LOSS
      - (2) SEDIMENT TRANSPORT
      - (3) MINERALIZATION
      - (4) IMMOBILIZATION
      - (5) CYCLING
  - 5. SOIL TEMPERATURE
  - 6. CROP GROWTH MODEL
    - a. POTENTIAL GROWTH
    - b. WATER USE
    - c. NUTRIENT UPTAKE
    - d. BIOMASS
      - (1) WATER STRESS
      - (2) TEMPERATURE STRESS
      - (3) NUTRIENT STRESS
    - e. GROWTH CONSTRAINTS
  - 7. TILLAGE
  - 8. PLANT ENVIRONMENTAL CONTROLS

a. DRAINAGE
b. FERTILIZATION
c. LIMING
d. PESTICIDES
e. FURROW DIKING

9. ECONOMICS

B. SWRRB (SIMULATOR FOR WATER RESOURCES IN RURAL BASINS)

1. ASPECTS
   a. PURPOSE: PREDICT EFFECT OF MGN'T DECISIONS
   b. PHYSICALLY BASED
   c. SIMULATE LONG PERIODS
   d. OPERATE ON SUBDIVIDED BASINS
2. MODEL COMPONENTS
   a. HYDROLOGY (WATER BALANCE EQN.)
      (1) RUN OFF (SCS CURVE #)
      (2) PERCOLATION
      (3) LATERAL FLOW
      (4) EVAPOTRANSPIRATION
      (5) SNOW MELT
      (6) TRANSMISSION LOSSES
   b. WEATHER
      (1) MEAS. OR SIMULATE TEMP. AND PCPN
      (2) SIMULATE RADIATION
   c. FLOOD ROUTING
   d. PONDS AND RESERVOIRS
   e. SEDIMENT YIELD
   f. SEDIMENT ROUTING
   g. SOIL TEMPERATURE
   h. CROP GROWTH
   i. TILLAGE AND RESIDUE
   j. IRRIGATION

GIS SOFTWARE

I. GIS INTRODUCTION
- A. DEFINITION
  - GIS ASSEMBLES, ANALYZES, AND STORES DATA (ATTRIBUTES) CORRESPONDING TO GEOGRAPHICAL AREAS, WITH THE SPATIAL LOCATIONS OF THE AREAS FORMING THE BASIS OF THE SYSTEM. NOT SIMPLE GRAPHICS/MAPPING SYSTEMS.
- B. HARDWARE
  - 1. INPUT
    - a. KEYBOARD
    - b. DIGITIZER (COORDINATE [X,Y] OR OPTICAL)
      - (1) PHOTOS
      - (2) MAPS
    - c. LIGHT PEN
    - d. VIDEO CAMERA
    - e. REMOTE SENSORS
  - 2. COMPUTER
    - a. LARGE RAM
    - b. STORAGE DEVICES
      - (1) HARD DISK
      - (2) MAGNETIC TAPE
      - (3) FLOPPY DISK
  - 3. OUTPUT
    - a. PRINTER
    - b. PEN PLOTTER
    - c. CRT
    - d. FILM WRITER

II. RASTER/VECTOR SYSTEMS
- A. RASTER (CELL BASED, E.G. IDRISI)
  - 1. RASTER=HORIZ. SCANNING PATTERN
  - 2. SMALL, INTERNAL UNIFORM CELLS IN GRID
  - 3. LEFT TO RIGHT, TOP TO BOTTOM
  - 4. NUMERIC VALUE FOR EACH CELL
  - 5. BETTER FOR ANALYSIS AND QUANTITATIVE
- B. VECTOR (ARC-INFO)
  - 1. SMALL LINE SEGMENTS W/ MAGNITUDE AND DIRECTION
  - 2. USE PLANT COORDINATES
  - 3. POINTS, LINES, AREAS
  - 4. HIGH PRECISION OF DISPLAY
  - 5. LOWER STORAGE REQUIREMENTS
  - 6. IDEAL FOR DISCRETE FEATURES

III. ISSUES
- A.. ALGORITHMS
  - 1. EACH MAP IS A 'DATA LAYER', E.G. SOILS
    - a. BOOLEAN LOGIC
      - (1) ADDITION
      - (2) SUBTRACTION
      - (3) MULTIPLICATION
      - (4) DIVISION
  - 2. INTERPOLATION
- B. REGISTRATION
- C. CELL SIZE

IV. LINKAGE WITH SIMULATION MODELS
    A. MODEL INPUTS ARE GEO-REFERENCED
V. SOFTWARE EXAMPLES
    A. EPPL
    B. IDRISI
    C. ARC-INFO
    D. GRASS

SINGLE CROP MODELS

I. TYPES
- A. REGRESSION
  - 1. SITE AND TIME SPECIFIC
  - 2. NOT NECESSARILY REFLECTING PROCESSES
- B. PROCESS-BASED
  - 1. COMPLICATED
  - 2. MANY INPUTS
  - 3. DIFFICULT TO VALIDATE

II. USES
- A. RESEARCH
  - 1. I.D. RESEARCH NEEDS
  - 2. ORGANIZE THOUGHTS
  - 3. MULTI-DISCIPLINARY RESEARCH
- B. EXTENSION
  - 1. STRATEGIC DECISIONS
    - a. PLANTING DATES
    - b. GENOTYPE SELECTION
    - c. PLANT POPULATION
  - 2. TACTICAL DECISIONS
    - a. INSECT CONTROL
    - b. IRRIGATION
    - c. FERTILIZER

III. PROCESS-BASED EXAMPLES
- A. CERES-MAIZE
  - 1. MAIN ASPECTS
    - a. DAILY TIME STEP
    - b. SIMULATE GROWTH, DEVELOPMENT, AND YIELD
    - c. USE READILY-AVAILABLE INPUTS
    - d. OPERATE ON IBM COMPATIBLE
  - 2. APPLICATIONS
    - a. WITHIN YEAR CROP MANAGEMENT
    - b. MULTI-YEAR
  - 3. PROCESSES
    - a. PHENOLOGICAL DEVELOPMENT
      - (1) 8 SEPARATE STAGES
    - b. GROWTH OF LEAVES, STEMS, AND ROOTS
    - c. BIOMASS ACCUMULATION
    - d. SOIL WATER BALANCE
    - e. SOIL NITROGEN TRANSFORMATIONS
  - 4. INPUTS
    - a. SOIL WATER
      - (1) SOIL ALBEDO
      - (2) STAGE 1 EVAP. COEFF.
      - (3) BULK DENSITY BY LAYER
      - (4) RUN OFF CURVE #
        - (a) EST. FROM HYDROLOGIC GROUP
      - (5) SOIL LAYER THICKNESSES
      - (6) SOIL WATER CONTENTS BY LAYER
        - (a) INITIAL
        - (b) UPPER AND LOWER LIMITS OR SOIL TEXTURE

(c) SATURATION
(7) ROOT DISTRIBUTION WEIGHTING FACTOR BY LAYER
b. GENETIC
(1) GDD FROM SEEDLING TO EMERGENCE (BASE = 8)
(2) PHOTOPERIOD SENSITIVITY COEFF.
(a) AFFECTS RATE OF FLORAL INITIATION
(b) USED WITH HOURS OF LIGHT.
(3) GDD SILKING TO PHYSIOL. MAT. (BASE = 8)
(4) POTENTIAL KERNEL NUMBER
(5) POTENTIAL KERNEL GROWTH RATE (mg/(kernel d)
c. CLIMATIC
(1) DAILY MAX AND MIN TEMP
(2) DAILY PCPN
(3) DAILY SOLAR RADIATION
(4) IRRIGATION TIMING AND AMOUNTS
d. MANAGEMENT
(1) SOWING DATE
(2) PLANT POPULATION
(3) SOWING DEPTH
(4) LATITUDE
5. OUTPUTS
a. GENERAL
(1) TITLE
(2) CULTIVAR INFORMATION
(3) GENETIC CONSTANTS
(4) SOIL CHARACTERISTICS
b. WATER
(1) IRRIGATION
(2) BALANCE BY GROWTH PERIOD
c. GROWTH AND DEVELOPMENT
(1) PREDICTED AND MEASURED DATES
(2) GRAIN AND BIOMASS
(3) YIELD COMPONENTS
(4) WATER STRESS INDICES BY PERIOD

B. SORKAM
1. MAIN ASPECTS
a. DAILY TIME STEP
b. SIMULATE GROWTH, DEVELOPMENT, AND YIELD
c. USE READILY-AVAILABLE INPUTS
d. OPERATE IN IBM COMPATIBLE
2. APPLICATIONS
a. WITHIN YEAR CROP MANAGEMENT
b. MULTI-YEAR
3. PROCESSES
a. EMERGENCE
b. PHENOLOGY
c. LEAF GROWTH
d. RADIATION ABSORPTION
e. DRY MATTER ACCUMULATION
f. DRY MATTER PARTITIONING

g. TILLER AND SEED NUMBER
h. SOIL WATER
i. EVAPOTRANSPIRATION
j. SOIL WATER STRESS
k. RUNOFF
l. FEEDBACK

4. INPUTS
   a. SOWING
      (1) SOWING DATE
      (2) SOWING DEPTH
      (3) ROW SPACING
      (4) PLANT POPULATION
      (5) MAX. ROOTING DEPTH
   b. CULTIVAR
      (1) MATURITY CODE
      (2) PHOTOPERIOD SENSITIVITY
      (3) TILLER INTERCEPT COEFF.
      (4) TILLER SLOPE COEFF.
      (5) SEED NUMBER COEFF.
      (6) # OF LEAVES
   c. IRRIGATION
   d. SOIL WATER
      (1) SOIL ALBEDO
      (2) STAGE 1 & 2 EVAP. COEFF.
      (3) DRAINAGE COEFF.
      (4) RUN OFF CURVE #
      (5) SOIL LAYER THICKNESSES
      (6) SOIL WATER CONTENTS
      (7) ROOT DISTRIBUTION WEIGHTING FACTOR
   e. CLIMATIC
      (1) DAILY MAX AND MIN TEMP
      (2) DAILY PCPN
      (3) DAILY SOLAR RADIATION
      (4) IRRIGATION AMOUNTS

C. CERES-WHEAT

1. ASPECTS
   a. PROCESS ORIENTED
   b. MANAGEMENT LEVEL
   c. DAILY TIME STEP
   d. MENU DRIVEN
2. PROCESSES
   a. PHENOLOGICAL DEVELOPMENT
      (1) AFFECTED BY GENOTYPE AND WEATHER
   b. GROWTH OF LEAVES, STEMS, AND ROOTS
   c. BIOMASS ACCUMULATION
      (1) AFFECTED BY PHENOLOGY
      (2) PARTITIONING BETWEEN VEG. AND REPROD.
   d. SOIL WATER BALANCE
   e. SOIL NITROGEN TRANSFORMATIONS, UPTAKE, AND PARTITIONING
3. INPUTS
   a. SOIL WATER

(1) SOIL
(2) STAGE 1 EVAP. COEFF.
(3) DRAINAGE COEFF.
(4) RUN OFF CURVE #
(5) SOIL LAYER THICKNESSES
(6) SOIL WATER CONTENTS
(a) INITIAL
(b) UPPER AND LOWER LIMITS
(c) SATURATION
(7) ROOT DISTRIBUTION WEIGHTING FACTOR

b. SOIL NUTRIENTS
(1) INITIAL NO_3 AND NH_4
(2) DATES, RATES, DEPTH, SOURCE

c. GENETIC
(1) VERNALIZATION SENSITIVITY (P1V)
(2) PHOTOPERIOD SENSITIVITY (P1D)
(3) DURATION OF GRAIN FILLING (P5)
(4) POTENTIAL KERNEL NUMBER (G1)
(5) POTENTIAL GRAIN FILLING RATE (G2)
(6) TILLER PRODUCTION (G3)

d. CLIMATIC
(1) DAILY MAX AND MIN TEMP
(2) DAILY PCPN
(3) DAILY SOLAR RADIATION
(4) IRRIGATION DATES & AMOUNTS

e. LOCATION
(1) LATITUDE

4. OUTPUTS (FILES)

a. SUMMARY
(1) CROP DEVELOPMENT
(2) BIOMASS
(3) LAI
(4) NITROGEN UPTAKE AND STATUS
(5) SOIL WATER STATUS
(6) WATER AND NITROGEN STRESS INDICES
(7) YIELD

b. PREDICTED AND OBSERVED VALUES

c. CROP GROWTH OUTPUT
(1) SUM OF THERMAL TIME
(2) BIOMASS
(3) TILLERS
(4) LAI
(5) BIOMASS BY ORGAN
(6) ROOTING DEPTH
(7) PARTITIONING FACTOR
(8) ROOT LENGTH DENSITY

d. WEATHER AND WATER BALANCE

e. NITROGEN BALANCE

5. OUTPUTS (GRAPHICS)

a. CROP

b. WEATHER AND SOIL

c. NITROGEN

d. HARVEST

6. INPUT FILES

a. STATION

(1) .WH4 (RESIDUE)

(a) ID
(b) TRT #
(c) STRAW RESIDUE
(d) DEPTH OF STRAW INCORP (cm)
(e) C/N RATIO OF STRAW (%)
(f) AMNT OR ROOT RESIDUE FOR EACH TRT

(2) WH5 (INITIAL SOIL WATER AND NUTRIENTS)

(a) TRT
(b) DEPTH (cm)
(c) INITIAL SOIL WATER
(d) INITIAL NITRATE
(e) INITIAL AMMONIUM
(f) pH

(3) WH6 (IRRIGATION)

(a) # OF EVENTS AND TRT NAME
(b) DATE
(c) AMOUNT (mm)

(4) WH7 (FERTILIZER)

(a) # OF TRT AND FILE
(b) DATE
(c) AMOUNT (kg/ha)
(d) DEPTH (cm)
(e) TYPE OF FERTILIZER

(5) WH8 (MANAGEMENT)

(a) NAME, #, TITLE,SOIL #, ?
(b) BEGIN SIMULATION, SOWING DATE, PL. POP, ?, SOWING DEPTH, NITRO/WATER TRIGGER, NITRO./WATER TRIGGER,?,?,?,?,?,

(6) WHA (MEASURED DATA)

(7) WHB (GRAPHING GROWTH)

(8) WHC (GRAPHING SOIL WATER)

(9) WHD (GRAPHING NITROGEN)

b. GLOBAL INPUTS

(1) SPROFILE.WH2 (SOILS)

(a) #, NAME
(b) ALBEDO, U, SWCON, CURVE #, ?,?,?,?,?,?,?,?
(c) DEPTH, LOWER LIMIT, UPPER LIMIT, SAT., BEGINNING SOIL WATER, ROOT WEIGHTING FACTOR, BULK DENSITY, ORGANIC CARBON, ?, ?, ?, ?.

(2) WHEXP.DIR

(a) CODE, NAME, WEATHER DATA FILE, SOIL FILE
(b) INPUT FILES (WH4..WH9)
(c) OUTPUT FILES (WHA, WHB, 'OUT' FILES

(3) WTH.DIR

(a) CODE, NAME, BEGINNING & ENDING DATE, FILENAME

(4) GENETICS.WH9

(a) #, VARIETY, GENETIC COEFFICIENTS

c. WEATHER

(1) CODE, LATITUDE

d. LABEL FILES

(1) GLABEL (GROWTH)

(2) GLABEL2 (WEATHER AND WATER)

(3) GLABEL3 (NUTRIENTS)

(4) GBALEL4 (PHENOLOGY, STRESS, YIELD)

7. Questionnaires

Pre-Workshop Questionnaire

Your Name:
Name and Address of Your Institution:
Your Present Position and Title:
Your Job Description:
1. Please describe your present work:
2. If there is any information about your present or future work-related responsibilities that you think will help make this course more useful to you, please explain below:

Your Academic Training:
1. What is the highest degree you have earned?
2. Date earned?
3. Name of Institution granting the degree?
4. Major:

Quantitative/Computer Experience:

1. Have you taken 1 or more courses at the post-graduate level in:
   Statistical Inference? _____ Yes _____ No
   Simulation Modelling? _____ Yes _____ No
   Experimental Design? _____ Yes _____ No
   Multiple Regression? _____ Yes _____ No
2. Have you previously had training in the mathematical modelling of biological or physical systems?
   _____ Yes _____ No
   If yes, please describe that training.
3. Have you had experience using and operating micro-computers (PC's)?
   _____Yes _____ No
   If yes, which of the following types of software programs have you used:
   Operating Systems:
   DOS ____Yes ____ No
   OS/2 ____ Yes ____ No
   Other (Please identify by name)?
   Applications Software (If yes, identify by name):
   Word processing? ____Yes ____ No
   Spreadsheet? ____Yes ____ No
   Statistical? ____Yes ____ No
   Database? ____Yes ____ No
   Other? ____Yes ____ No
   Languages:
   BASIC? ____Yes ____ No
   FORTRAN? ____Yes ____ No
   PASCAL? ____Yes ____ No
   Other (Please identify by name)?

Any other relevant comments:

Post-Workshop Questionnaire

PRE-WORKSHOP INFORMATION

Did you receive pre-workshop information? ____Yes ____ No

If Yes, how clear were the course objectives? (please circle the appropriate number)

Unclear				Very Clear
5	4	3	2	1

Comments?

COURSE ADMINISTRATION/LOGISTICS

Please indicate your satisfaction with the following support arrangements (please circle the appropriate number):

	Not at all Satisfied				Extremely Satisfied
Training Facilities?	5	4	3	2	1
Housing Accommodations?	5	4	3	2	1
Logistical Support?	5	4	3	2	1

Comments?

COURSE CONTENT

1. At the beginning of the course or during the course, did you discuss with the instructors how the course content would meet your specific needs?

   ____ Yes ____ No

2. Please indicate your achievement of each of the training objectives listed below (please circle the appropriate number):

	Not at all Achieved				Extremely well Achieved
Obj. 1: Understand the importance of using simulation models to delineate agroecological environments.	5	4	3	2	1
Obj. 2: Become familiar with the fundamentals of simulation models.	5	4	3	2	1
Obj. 3: Become familiar GIS software.	5	4	3	2	1

3. Was the level of presentation of the subject matter:

   _____ Too Simple? ____About Right? _____ Too Complex?

4. Rate the usefulness of each of the course topics in terms of being able to use the ideas, materials or skills in your work (please circle the appropriate number):

	Not Useful				Very Useful
Intro to PC's	5	4	3	2	1
Using spreadsheets on PC's	5	4	3	2	1
Intro to simulation modeling	5	4	3	2	1
GIS software	5	4	3	2	1
Practicals	5	4	3	2	1

5. For each of the following course topics, please indicate whether they should be expanded, shortened, omitted, or left as is:

	Expand	Shorten	Omit	Leave As Is

Intro to PC's	_____	_____	_____	_____
Using spreadsheets on PC's	_____	_____	_____	_____
Intro to simulation modeling	_____	_____	_____	_____
GIS software	_____	_____	_____	_____
Practicals	_____	_____	_____	_____

6. What topics would you recommend be added to the workshop?
7. Was the hardware you had access to sufficient? Please describe the hardware (processor, graphics adapter, printers, etc.)

COURSE DESIGN AND DELIVERY

1. During the course, was the daily schedule:
   _____ Too Short? _____ About Right? _____ Too Long?
2. Was the overall length of the course:
   _____ Too Short? _____ About Right? _____ Too Long?
3. Indicate how helpful you found each of the following teaching methods to be (please circle the appropriate number):

	Not at all Helpful				Extremely Helpful
Lecturers?	5	4	3	2	1
Large Group Discussions?	5	4	3	2	1
Small Group Discussions?	5	4	3	2	1
Exercises?	5	4	3	2	1
Individual consultations with instructors?	5	4	3	2	1

4. How useful were the following types of materials (please circle the appropriate number):

	Not at all Helpful				Extremely Helpful
Course Manual?	5	4	3	2	1
Handouts?	5	4	3	2	1
Written Assignments/Exercises?	5	4	3	2	1
Computer Assisted Information?	5	4	3	2	1

Comments on instructional materials?

INSTRUCTORS

1. Name of First Instructor: William A. Dugas
   Rate this instructor in the following areas (please circle the appropriate number):

	Poor				Excellent
Knowledge of Subject?	5	4	3	2	1
Presentation of Material?	5	4	3	2	1
Ability to Relate Material to Agroecological problems?	5	4	3	2	1
Encourages Participants to Discuss Material?	5	4	3	2	1

What, if anything, would you suggest this instructor do to improve?

2. Name of Second Instructor: Paul T. Dyke
   Rate this instructor in the following areas (please circle the appropriate number):

	Poor				Excellent
Knowledge of Subject?	5	4	3	2	1
Presentation of Material?	5	4	3	2	1
Ability to Relate Material to Agroecological problems?	5	4	3	2	1
Encourages Participants to Discuss Material?	5	4	3	2	1

What, if anything, would you suggest this instructor do to improve?

OVERALL WORKSHOP SATISFACTION

1. Would you recommend this course to other individuals with a background similar to yours?

   _____ Yes _____ No

   Please explain why or why not:

2. In general, how confident are you that you can apply the skills learned during this workshop to your research activities (please circle the appropriate number)?

   Not at all Confident — Extremely Confident

   5 4 3 2 1

3. Specifically, which topics do you feel you will be able to apply?

4. Please make any additional comments you would like to about this workshop.

8. Questionnaire Results

Pre-Workshop Questionnaire

EXPERIENCE/ COURSES	YES	NO
1A STATISTICAL INFERENCE	5	6
B SIMULATION MODELLING	1	10
C EXPERIMENTAL DESIGN	3	8
C MULTIPLE REGRESSION	4	7
2 MATH. MODEL OF BIOLOGICAL PHYSICAL SYSTEMS	4	7
3 MICRO-COMPUTERS	10	1
4A DOS	10	1

Post-Workshop Questionnaire

QUESTION AREA	RESPONSES
Receive pre-workshop information	Yes 13; No 8 (Participants should be given advanced noticed of workshop and materials to bring, e.g. data).
Course administration logistics	Training; Avg. = 1.9 Housing; Avg. = 2.0 Logistics; Avg. = 1.5 (Too few computers)
Course content	Achievement Del. Regions; Avg. = 1.5 Models; Avg. = 1.5 GIS; Avg. = 2.4 Presentation Level Too Short = 1 About Right = 17 Utility PCs; Avg. = 1.3 Spreadsheets; Avg. = 1.3 Models; Avg. = 1.5 GIS; Avg. = 2.0 Practicals; Avg. = 1.2 Topics PCs (Exp = 3; Shorten= 6; Omit = 4; As Is = 8) Sp. (Exp = 7; Shorten= 4; Omit = 1; As Is = 10) Models (Exp = 12; Shorten= 3; Omit = 1; As Is = 5) GIS (Exp = 16; Shorten= 3; Omit = 0; As Is = 2) Pract. (Exp = 16; Shorten= 0; Omit = 0; As Is = 5) New Topics Practicals with existing data GIS examples Hardware sufficient Sufficient = 7 Insufficient = 10

Course design and delivery	Daily schedule Too short = 0 About right = 19 Course length Too short = 3 About right = 17 Too long = 1 Methods Lecture; Avg.= 1.3 Discussions; Avg. = 1.2 Exercises; Avg. = 1.6 Consultations; Avg. = 1.3 Materials Manual; Avg. = 1.1 Handouts; Avg. = 1.2 Assignments; Avg. = 1.4 Comp. Info.; Avg. = 1.4
Instructors	WA Dugas Knowledge; Avg. = 1.2 Presentation; Avg. = 1.1 Relate; Avg. = 1.2 Encourage; Avg. = 1.2 PT Dyke Knowledge; Avg. = 1.2 Presentation; Avg. = 1.1 Relate; Avg. = 1.2 Encourage; Avg. = 1.2
Overall satisfaction	Recommend Yes = 19 No = 1 Apply skills; Avg. = 2.0 What apply Simulation models

9. Guest Lectures/Presentations

9 Dec. 1991 (CRIDA)

Dr. J.S. Kanwar, Retired D.D.G., ICRISAT, Hyderabad, "Agroecological Zones and Dryland Agriculture".

Dr. A. Mohammed, CESS Campus, Begumpet, Hyderabad, "Applications of GIS".

Mr. Dharmar, ROTL India, Ltd., Madras, "Demonstration of a GIS system".

13 Dec. 1991 (ICRISAT)

Dr. S. Virmani, Princ. Sci., ICRISAT, Hyderabad, "Demonstration of GIS research at ICRISAT".

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SUMMARY OF WORKSHOP ON DELINEATION OF AGROECOLOGICAL ENVIRONMENTS AND GEOGRAPHICAL INFORMATION SYSTEM SOFTWARE

16 DEC. 1991

WM. A. DUGAS and PAUL. T. DYKE

I. WORKSHOP GOALS
- A. MICROCOMP. BASICS/SPREADSHEETS
- B. CROP MODELS
- C. HYDROLOGIC MODELS
- D. GIS
- E. DELINEATION OF AGROCLIM. REGIONS

II. PRODUCTS DELIVERED TO WORKSHOP PARTICIPANTS
- A. SOFTWARE/DOCUMENTATION
  - 1. 3 SINGLE CROP MODELS
    - a. CERES-MAIZE
    - b. CERES-WHEAT
    - c. SORKAM
  - 2. CROPPING SYSTEM MODEL (EPIC)
  - 3. HYDROLOGIC MODEL (SWRRB)
  - 4. MODEL INPUT DATA SETS
    - a. SOILS
      - (1) MEASURED
      - (2) CALCULATED FROM SOIL PROPERTIES
    - b. WEATHER
      - (1) MEASURED
      - (2) GENERATED
  - 5. LECTURE NOTES
  - 6. HANDOUTS
    - a. MS-DOS
    - b. LOTUS
    - c. GIS OVERVIEW
- B. EXAMPLES OF MODEL USES
  - 1. STRATEGIC AND TACTICAL DECISIONS
  - 2. DELINEATING AGROCLIMATIC REGIONS
- C. GIS EXAMPLES
  - 1. INDIA/ICRISAT
  - 2. U.S./TEXAS A&M UNIV.

III. WORKSHOP EVALUATION
- A. VERY SUCCESSFUL
- B. GOOD FACILITIES
- C. LENGTH CORRECT
- D. PARTICIPANTS CAN APPLY TOOLS
- E. PARTICIPANTS TOOK HOME MATERIALS

IV. FUTURE
- A. SCIENTIST-TO-SCIENTIST INTERACTIONS
  - 1. USAID SUPPORT
  - 2. CLOSING WORKSHOP OF SUBPROJECT
    - a. EVALUATE PROGRESS
- B. 'SUSTAINABILITY' SYMPOSIUM
- C. ADDITIONAL EQUIPMENT