USER EVALUATION OF EXPERIMENTAL LAND USE MAPS AND RELATED PRODUCTS FROM THE CENTRAL ATLANTIC TEST SITE

By

Herbert K. McGinty, III

U.S. Geological Survey

FINAL REPORT—VOLUME 12
CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE (CARETS) PROJECT

SPONSORED BY
National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771
and
U.S. Geological Survey
Reston, Virginia 22092
1975

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
CARETS--A Prototype Regional Environmental Information System (SR-125) (v. 12) User Evaluation of Experimental Land-Use Maps and Related Products from the Central Atlantic Test Site	9/30/75
	6. Performing Organization Code
7. Author(s) Herbert K. McGinty III	8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Geological Survey Geography Program Mail Stop 710 Reston, VA 22092	10. Work Unit No.
	11. Contract or Grant No. S-70243-AG
12. Sponsoring Agency Name and Address Frederick Gordon NASA Goddard Space Flight Center Greenbelt, MD 20771	13. Type of Report and Period Covered Type III Final Report 1975
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The user interaction and evaluation phase of the USGS/NASA Central Atlantic Regional Ecological Test Site was designed to obtain the input of local, regional, State, and Federal agency users of land-resource information into the development of a regional information system; to provide users with assistance and data resulting from CARETS research; and to have user organizations evaluate to what extent the CARETS products meet their needs.

The evaluation of CARETS land use and related products revealed that most user agencies interviewed, at all governmental levels, require more detailed data than that provided by the CARETS project. Few agencies found utility in the generalized ERTS Level I land-use maps. Level II data, though reported valuable by several users, was generally considered of secondary utility by most users. The products considered most useful by users at all levels were the high-altitude color-infrared photographs and the USGS orthophotoquads.

Recommendations resulting from the evaluation reflect the need to establish a flexible and reliable system for providing more detailed raw and processed land-resource information as well as the need to improve the methods of making information available to users.

17. Key Words Suggested by Author	18. Distribution Statement
Land-use planning Remote-sensor data User evaluation Central Atlantic region Land-use data	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Not Applicable	170	

Figure 2A. Technical Report Standard Title Page. This page provides the data elements required by DoD Form DD-1473, HEW Form OE-6000 (ERIC), and similar forms.

INT .2090-72

USER EVALUATION OF EXPERIMENTAL LAND-USE MAPS AND RELATED PRODUCTS FROM THE CENTRAL ATLANTIC TEST SITE

By Herbert K. McGinty III

U.S. Geological Survey
Reston, Virginia

September 1975

Volume 12 of Final Report for:

Goddard Space Flight Center
Greenbelt, Maryland 20771

Interagency Memorandum of Understanding No. S-70243-AG
Earth Resources Technology Satellite, Investigation SR-125 (IN-002)
"Central Atlantic Regional Ecological Test Site: A Prototype Regional Environmental Information System."

LIST OF FINAL REPORT VOLUMES

CARETS/LANDSAT INVESTIGATION SR-125 (IN-002)

Robert H. Alexander, 1975, Principal Investigator

Volume 1. CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM by Robert H. Alexander

2. NORFOLK AND ENVIRONS: A LAND USE PERSPECTIVE by Robert H. Alexander, Peter J. Buzzanell, Katherine A. Fitzpatrick, Harry F. Lins, Jr., and Herbert K. McGinty III

3. TOWARD A NATIONAL LAND USE INFORMATION SYSTEM by Edward A. Ackerman and Robert H. Alexander

4. GEOGRAPHIC INFORMATION SYSTEM DEVELOPMENTS ASSOCIATED WITH THE CARETS PROJECT by Robin G. Fegeas, Katherine A. Fitzpatrick Cheryl A. Hallam, and William B. Mitchell

5. INTERPRETATION, COMPILATION AND FIELD VERIFICATION PROCEDURES IN THE CARETS PROJECT by Robert H. Alexander, Peter W. DeForth, Katherine A. Fitzpatrick, Harry F. Lins, Jr., and Herbert K. McGinty III

6. COST-ACCURACY-CONSISTENCY COMPARISONS OF LAND USE MAPS MADE FROM HIGH-ALTITUDE AIRCRAFT PHOTOGRAPHY AND ERTS IMAGERY by Katherine A. Fitzpatrick

7. LAND USE INFORMATION AND AIR QUALITY PLANNING: AN EXAMPLE OF ENVIRONMENTAL ANALYSIS USING A PILOT NATIONAL LAND USE INFORMATION SYSTEM by Wallace E. Reed and John E. Lewis

8. REMOTELY-SENSED LAND USE INFORMATION APPLIED TO IMPROVED ESTIMATES OF STREAMFLOW CHARACTERISTICS by Edward J. Pluhowski

9. SHORE ZONE LAND USE AND LAND COVER: CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE by R. Dolan, B. P. Hayden, C. L. Vincent

10. ENVIRONMENTAL PROBLEMS IN THE COASTAL AND WETLANDS ECOSYSTEMS OF VIRGINIA BEACH, VIRGINIA by Peter J. Buzzanell and Herbert K. McGinty III

11. POTENTIAL USEFULNESS OF CARETS DATA FOR ENVIRONMENTAL IMPACT ASSESSMENT by Peter J. Buzzanell

12. USER EVALUATION OF EXPERIMENTAL LAND USE MAPS AND RELATED PRODUCTS FROM THE CENTRAL ATLANTIC TEST SITE by Herbert K. McGinty III

13. UTILITY OF CARETS PRODUCTS TO LOCAL PLANNERS: AN EVALUATION by Stuart W. Bendelow and Franklin F. Goodyear (Metropolitan Washington Council of Governments)

Contents

Illustrations

Tables

USER EVALUATION OF EXPERIMENTAL LAND USE MAPS AND RELATED PRODUCTS FROM THE CENTRAL ATLANTIC TEST SITE

By Herbert K. McGinty, III

Abstract

The user interaction and evaluation phase of the USGS/NASA Central Atlantic Regional Ecological Test Site was designed to obtain the input of local, regional, State, and Federal agency users of land-resource information into the development of a regional information system; to provide users with assistance and data resulting from CARETS research; and to have user organizations evaluate to what extent the CARETS products meet their needs.

The evaluation of CARETS land-use and related products revealed that most user agencies interviewed, at all governmental levels, require more detailed data than that provided by the CARETS project. Few agencies found utility in the generalized ERTS Level I land-use maps. Level II data, though reported valuable by several users, was generally considered of secondary utility by most users. The products considered most useful by users at all levels were the high-altitude color-infrared photographs and the USGS orthophotoquads.

Recommendations resulting from the evaluation reflect the need to establish a flexible and reliable system for providing more detailed raw and processed land-resource information as well as the need to improve the methods of making information available to users.

INTRODUCTION

The Central Atlantic Regional Ecological Test Site (CARETS) project is a jointly sponsored USGS/NASA demonstration to test the hypothesis that data from the Earth Resources Technology Satellite (ERTS-1, later renamed LANDSAT-1) can be made an integral part of a regional land-resources information system, encompassing both inventory of the resource base and monitoring of change. The CARETS project has been carried out in cooperation with Federal, State, and local agencies having land-resource planning and management responsibilities in the region.

Investigators selected the boundaries of CARETS as shown in figure 1, after consultation with State and Federal agencies and upon consideration of the extent of urbanized land in the Chesapeake and Delaware Bay regions. They also considered the Army Corps of Engineers Chesapeake Bay study area, (U.S. Army Corps of Engineers, 1973), and the need for dividing the area into subunits compatible with census data and planning regions. The 74,712-km^2 (28,846-mi^2) CARETS area consists of 74 counties, 18 independent cities and the District of Columbia.

The CARETS "Concept Diagram," in figure 2 presents the basic components of the CARETS project. Investigators used data and data products from remote-sensor sources to extract land-use information, which is produced in the form of maps, measured and summarized by computer, and made available to users. The CARETS project has also investigated the applications of land-use information, and other data sets (geologic, hydrologic, political boundary, and socioeconomic), for environmental impact analysis and other regional planning and management applications. These analyses were also presented to users for

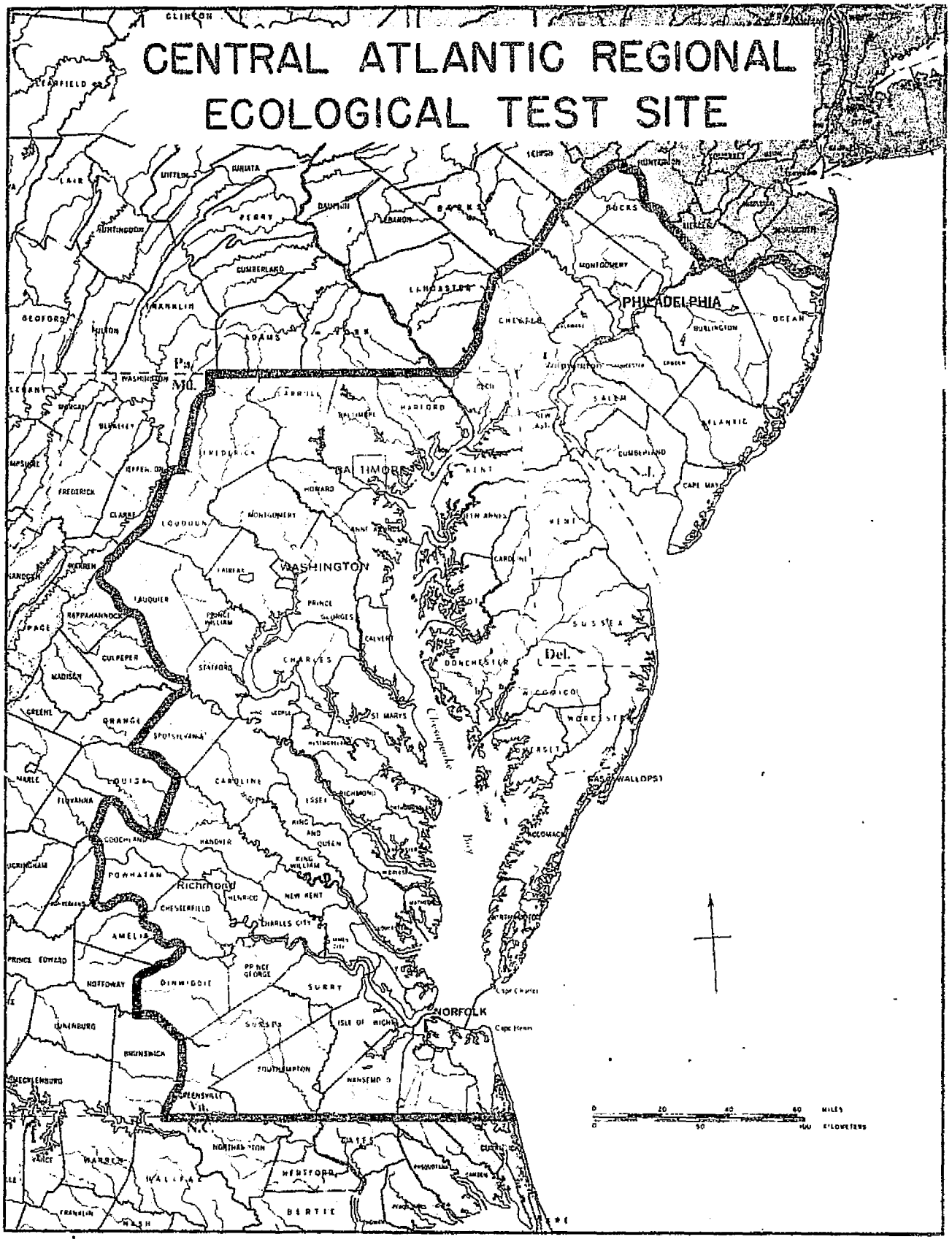


Figure 1

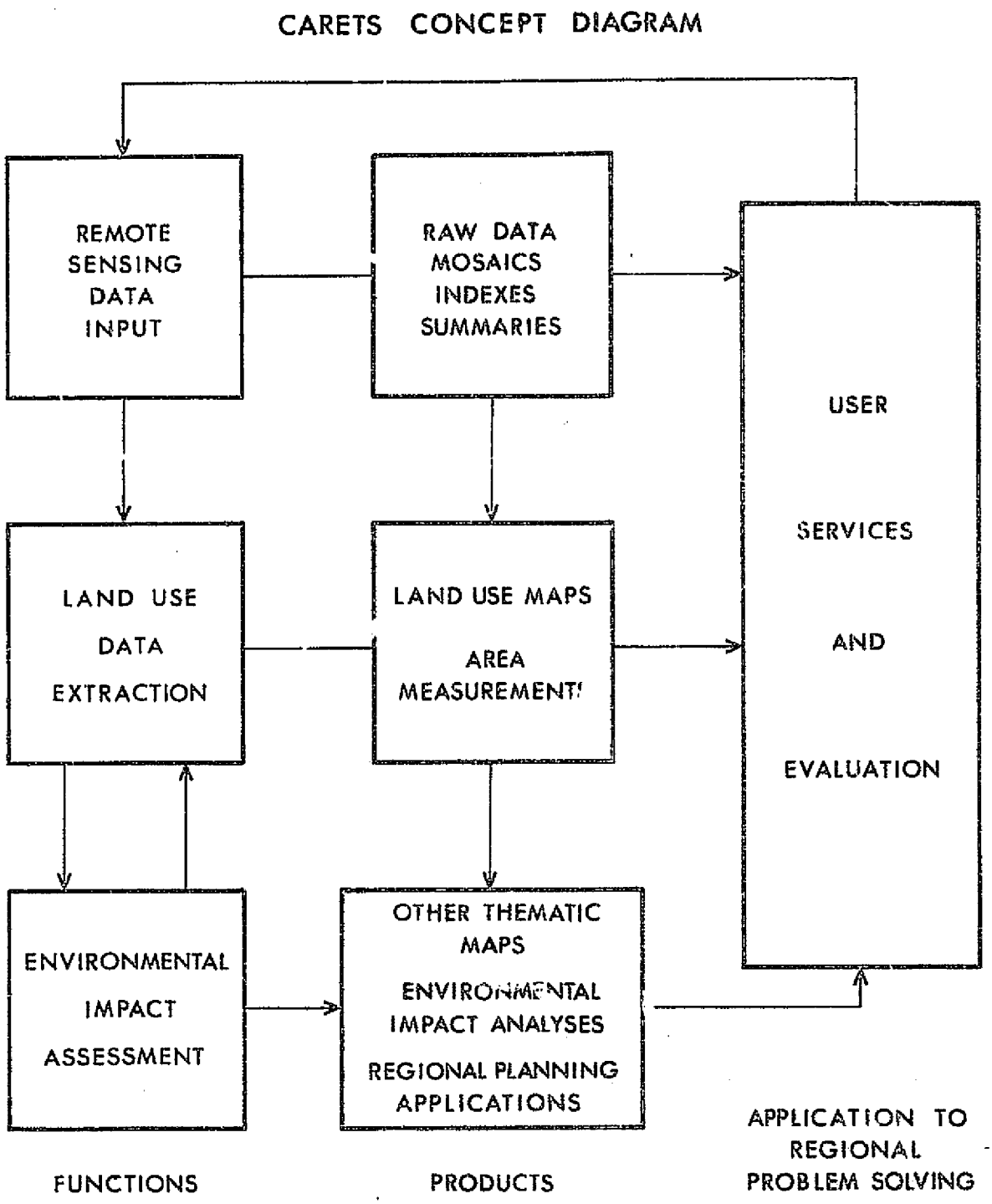

CARETS CONCEPT DIAGRAM
REMOTE SENSING DATA INPUT
RAW DATA MOSAICS INDEXES SUMMARIES
USER SERVICES AND EVALUATION
LAND USE DATA EXTRACTION
LAND USE MAPS AREA MEASUREMENT
ENVIRONMENTAL IMPACT ASSESSMENT
OTHER THEMATIC MAPS
ENVIRONMENTAL IMPACT ANALYSES
REGIONAL PLANNING APPLICATIONS
FUNCTIONS
PRODUCTS
APPLICATION TO REGIONAL PROBLEM SOLVING

Figure 2

evaluation and use in problem solving. User feedback, in turn, affected the type of data collected and products produced in later phases of the information system.

The CARETS project has included mapping of the region's land use at a scale of 1:100,000 from high-altitude aircraft photography and at a scale of 1:250,000 using ERTS imagery. The land-use classification scheme used in this mapping, an earlier version of that presented in USGS Circular 671, is given in outline form in table 1 (Anderson and others, 1972).

An integral part of the CARETS project has been interaction with the user community of the region. The purpose of this interaction has been threefold: (1) to obtain user input into the design of the project, specifically information on desired data and data products; (2) to provide services and information to users interested in the CARETS project and its products; and (3) to obtain user evaluation of the CARETS products.

This report of CARETS user interaction and evaluation is divided into three sections. The first reviews recent research into user needs for land-resource information. The second discusses user interaction within the CARETS project, including the initial user conferences and user services through the CARETS information center. The final and major section discusses the methodology, results, and recommendations of the CARETS user evaluation study.

RECENT RESEARCH INTO USER NEEDS FOR LAND-RESOURCE INFORMATION

Recently, the USGS and other data-collecting agencies have been concerned with the users of land-resource information and how well the

Table 1--Land-Use Categories in the Central Atlantic Regional Ecological Test Site Data Base

Level I Categories and Map Notation Used	Level II Categories and Map Notation Used
1 - Urban & Built-Up	11-Residential 12-Commercial and services 13-Industrial 14-Extractive 15-Transportation, communications, and utilities 16-Institutional 17-Strip and clustered settlement 18-Mixed 19-Open and other
2 - Agricultural	21-Cropland and pasture 22-Orchards, groves, bush fruits, vineyards, and horticultural areas 23-Feeding operations 24-Other
4 - Forest Land	41-Heavy crown cover (over 40%) 42-Light crown cover (10% to 40%)
5 - Water	51-Streams and waterways 52-Lakes 53-Reservoirs 54-Bays and estuaries 55-Other
6 - Nonforested Wetland	61-Vegetated 62-Bare
7 - Barren Land	72-Sand other than beaches 73-Bare exposed rock 74-Beaches 75-Other

available information meets user needs. Of particular concern are those user agencies who are in a position to make decisions about changes in land use, either in the management of territory under their jurisdictions or in the planning for future uses of the land. Awareness that environmental quality is often directly dependent on the kinds of decisions made by these user agencies has guided a search for better and more timely information, on the assumption that better information will lead to better decisions.

In the summer of 1972, the Environmental Systems and Resources Division of the National Science Foundation's RANN (Research Applied to National Needs) program conducted a 2-week workshop/conference where researchers and planning practitioners met to discuss the "most pressing environmental/land-use planning problems and potentialities" (McAllister, 1973, p. iii). The report of the working committee on data stressed the need to increase the utility of data to users and listed three primary tasks of most planners concerned with the physical environment: research, plan preparation, and decision implementation. Research tasks require the greatest allowable data retrieval and processing time; the task of preparing plans allows for less retrieval and processing time; and the task of implementing decisions requires the most recent data (McAllister, 1973, p. 302).

The Earth Resources Survey Benefit-Cost Study prepared for the U.S. Department of the Interior, Geological Survey presents a comprehensive analysis of user needs (Earth Satellite Corporation and Booz-Allen Applied Research Corporation, 1974). This study lists the application areas that can use high-altitude photography and ERTS data as: (1) State land-use planning and management, (2) certain types of site and route selection,

and (3) Federal land-use planning. The study also identifies a series of user needs and data characteristics to fulfill such needs.

New York State's Land Use and Natural Resource (LUNR) Inventory has recently conducted a study of the uses of land-resource information at the State level. From a questionnaire sent to users ordering LUNR Inventory products, researchers obtained an evaluation of products and their characteristics as well as information concerning the uses of the data and data acquisition problems. The study revealed that a majority of respondents used the LUNR Inventory products as intended and that 75 percent of the State's regional boards used the inventory products. Furthermore, users expressed a need to direct further attention to greater product accuracy. Unlike the CARETS user evaluation study, the LUNR Inventory study did not make effort to provide users with data products but derived its information solely from those who had acquired the data on their own initiative. The LUNR Inventory study was therefore primarily concerned with actual rather than potential uses (Crowder and others, 1974).

The Department of Environmental Science, University of Virginia, conducted initial research into the needs of potential users of remote-sensor data in the Central Atlantic region before the CARETS project formally began (Goodell and others, 1972). The major goals of this research were to identify the management and planning agencies with responsibilities within Virginia's coastal zone; to investigate their data bases for planning and managing resources; and to assess the potential of remote sensing as a complement to or supplement for this base.

The conclusions reached in the study, as listed below, suggest some of the results of the later CARETS user evaluation as well as problems that remain unresolved:

1) Remote sensing appears to offer a unique source of data that will supplement, complement, and be more current than some of the data now collected and used by government agencies, provided the data can be supplied in formats compatible with the existing decision-making process.

2) The applications of remote sensing appear to be highest in the inventory function of government, including the location of phenomena. Inventory is the initial focus of agency planning. The second highest application revolves around the regulatory function of government.

3) Those agencies having the highest potential application for remote sensing (not by rank) are:

Natural resources and economic development
Recreation and culture
Agriculture
Transportation
State planning
Regional planning districts
Local, city, and county planning agencies

4) Since few agencies presently have the capability of interpreting remote-sensor imagery, they can make little use of it unless a central processing center is created for data interpretation, generation, and dissemination.

5) The scales of resolution appearing to be necessary require sensing at several altitudes and focal lengths or both. Needs for repetitive coverage vary from as frequently as hourly or diurnally to annually or even less frequently.

As part of its role in the CARETS user evaluation study, the Metropolitan Washington Council of Governments (MWCOG) inventoried Washington metropolitan area local agency land-use planning decisions, which involved a review of minutes from local planning and zoning authorities between April and October 1973. The predominant issues addressed by all planning authorities were rezoning and site plan reviews. The inventory results revealed that the older urbanized areas were concerned with redevelopment; the developing suburban counties were concerned with the impact of development in relation to environmental quality, transportation, and site acquisition; and the jurisdictions on the rural/urban fringe were concerned basically with the issue of growth and comprehensive planning.

CARETS USER INTERACTION

Interaction between the CARETS investigators and the user community occurred throughout the project's duration on both a structured and informal basis. This interaction allowed users to be directly involved in the project, facilitated the dissemination of CARETS information and products, provided contacts for the user evaluation study, and permitted input from organizations not participating formally in the CARETS user evaluation study.

INITIAL USER CONFERENCE

On June 11, 1971, the U.S. Geological Survey's Geographic Applications Program (now the Geography Program), in cooperation with the National Aeronautics and Space Administration, conducted a conference of potential users of CARETS land-use data products at the National Academy of Sciences in Washington, D.C. Conducted under the auspices of the National Academy of Sciences, National Research Council committee on Space Programs for Earth Observations Advisory to the Department of the Interior, the conference was designed to introduce the CARETS demonstration project to users. Other goals of the conference were to invite the participation and critical review of representatives of Federal, State, and local institutions having interests or responsibilities involving resource or environmental problems in the test region, and to discuss plans for continuing participation in the development of the programs. News media representatives also attended the conference. Appendix A presents a list of the representation at this initial conference.

Before the conference, the CARETS project sent each invitee a questionnaire designed to indicate the range of user data interests and responsibilities. Of the 93 respondents, 75 attended the conference. Table 2 presents the functions, data requirements, and resources of the respondents. The largest number, 51, needed water-quality data; 44 needed urban data; 43 needed agriculture, soils, and forest data; and 38 needed transportation data. In response to the question concerning the type of data used, 57 reported use of map data; 48, air photos; 44, hydrological data; and 42, climatological data.

CARETS investigators also asked conference participants to submit questions concerning the CARETS project to be discussed in the afternoon

Table 2--Responses to Data Requirements Questionnaire from Invitees to the CARETS Initial User Conference

Question	Number of positive responses
Function of agency represented	
Administration	34
Regulation	5
Research	60
Planning	44
Other	17
Type of data required	
Urban	44
Transportation	38
Agriculture, soils, forest	43
Water quality	51
Mining and quarries	20
Recreation	35
Air quality	30
Other	32
Data resources (source of)	
We collect	66
Provided by State government	36
Provided by Federal government	57
Other	13
Data formats used	
Maps	57
Air photos	48
Census data	33
Traffic surveys	20
Building permits	16
Climatological data	42
Hydrological data	44
Other	20
Total Number of responders	93
Responders attending conference	75
Total conference attendees	198

session. Many questions concerned the agency's role as a CARETS user, especially the availability and cost of the CARETS data, the operation of the proposed experimental information center, and provisions for users lacking technical resources for interpretation. Other questions involved scales, resolution, and digitization of the data.

This initial conference introduced the CARETS project to the potential user community, established contacts with users, and provided insight into the land-use data needs of the many agencies interested in land resources. User responses at this conference and results of prior technical evaluations influenced the decision to establish the regional mapping scale of 1:100,000 for the CARETS Level II data.

INTERACTION WITH THE SOUTHEASTERN VIRGINIA USER COMMUNITY

The critical evaluation of CARETS concepts, functions, and goals by the initial user conference attendees revealed that the CARETS project and the data it would generate might be valuable to a wide range of users in the administrative, research, and planning communities. Using the Norfolk, Virginia area as a prototype for the whole CARETS region, the project has focused its user interaction on the Southeastern Virginia Planning District Commission (SEVPDC). SEVPDC is the regional planning organization for the Norfolk area, which performs tasks involving transportation, land use, and open space. A member of the SEVPDC staff attended the initial user conference, and the SEVPDC Executive Director, in a letter to the CARETS Project Coordinator (June 22, 1971), reported considerable interest in the development of the CARETS project's applications at the user level. He was particularly

interested in CARETS innovations concerning land use and resource inventory, since data gathering is usually the most expensive aspect of the planning process.

On February 20, 1973 a representative of the SEVPDC visited the Geography Program office to learn how ERTS imagery and high-altitude aircraft photography could be useful to his organization. He reported that the CARETS Level I and II maps might be useful in long-range planning within his agency. Moreover, he was interested in obtaining copies of the 1970 Level II land-use maps and photomosaics covering southeastern Virginia. The SEVPDC's most significant request was that CARETS 1970-72 change maps be made available as soon as possible since SEVPDC was required to provide the U.S. Department of Transportation (DOT) with a map of 1970-72 land-use change to be used in a continuing reporting system to verify projected land use changes upon which road construction plans largely depend.

The requirement for land-use change data comprises a significant part of data gathering costs. The SEVPDC currently spends approximately $10,000 per year for annual update of their land-use inventory for the portion of the district which coincides with the Norfolk test site. Their land-use update is required by three Federal programs: DOT urban transportation planning under Section 9 of the Federal-Aid Highway Act of 1962; Housing and Urban Development comprehensive planning requirements under Section 701 of the Federal Housing Act; and Federal program clearinghouse coordination as required by Office of Management and Budget Circular A-95. SEVPDC staff members examined the land-use change maps and area summaries prepared by CARETS for the Norfolk test site, and

determined that approximately $5,000 could be saved if they had similar information each year, plus color-transparencies of the RB-57 frames used to derive the information. One additional data set--number of dwelling units--could produce annual savings amounting to approximately $10,000.

CARETS program cost to obtain the Level II land-use change at 1:100,000 for the Norfolk test site was approximately 24 interpreter-hours, using both ERTS and high-altitude aircraft data. Approximately eight frames of high-altitude aircraft photography were required to cover the Norfolk test site. The cost estimate for supplying the SEVPDC with CARETS data is $780. This total should be compared to the $5,000 cost of obtaining the data by conventional means.

Photo-interpreter: 24 hours @ $15 per hour	$360
8 color-infrared transparencies @ $10 each	80
Map preparation, edit, and final processing: 22 hours @ $14 per man-hour	330
Drafting materials and supplies	10
TOTAL	$780

This $780 amounts to a cost of approximately $1.00 per mi^2 for a land use update, which assumes the existence of a land-use data base from which to measure change.

To provide an in-depth evaluation of finished CARETS products for the Norfolk test site and to determine the potential use of these data in the planning process, the CARETS staff members met with representatives of the SEVPDC in Norfolk. At this meeting the CARETS staff presented the SEVPDC with data products for examination and review. These products included examples of raw data, finished maps, and a computer printout of

land-use area summaries for the Norfolk test site. The SEVPDC Executive Director agreed to help in the CARETS user evaluation by presenting these products at the next meeting of city and county planners of southeastern Virginia and by making the products left with him available to interested local planners.

The response to questionnaires concerning CARETS data (appendix B) was quite favorable as reported by the SEVPDC's Director of Planning. USGS orthophotoquads (1:24,000) seemed to have great potential for planning, although examples did not exist for their area of interest. The commission planners reported that the CARETS land-use maps, land-use change maps, and photomosaics were useful in support of agency functions, and the agency would be willing to obtain them on a cost-sharing basis. The planners also discussed the commission's project to provide annual land-use change information for urbanized areas to the DOT. The CARETS Level II change maps could be used as a check on the changes occurring. The SEVPDC did not, however, consider the change maps sufficiently detailed for the DOT requirements.

SEVPDC planners saw the high-altitude aircraft color-infrared photography as useful, although its scale was too small. The SEVPDC's minimum acceptable scale is 1:100,000. Agency planners, however, made no attempt to enlarge the film transparency either optically or photographically. The planners found the ERTS imagery to be less valuable. It could only be useful if provided by the Federal Government. The ERTS land-use map (1:250,000), gridded image (1:500,000), and county boundary overlay, however, lacked sufficient detail to be of any value to the agency. The planners considered the CARETS surficial geology overlays excellent for use by the agency.

The SEVPDC planners did not rate as useful the remainder of the 1:100,000-scale overlay sheets--the drainage basin, census tracts, and cultural feature maps. Since the commission already has maps of such phenomena, these sheets would not contribute anything new to their data base.

The computer data listings and land-use area summaries received favorable comment, especially land-use summaries by census tracts. SEVPDC planners reported finding few errors in the land-use data. They considered the data currency adequate. More detailed Level III data, however, would be desirable.

SEVPDC's evaluation of CARETS revealed that measurement, summarization, correlation, modelling, and projections had been or would be preformed on those data found useful. It also revealed that besides their use for analysis these data provided general background information and information used for making specific recommendations to decision making authorities. SEVPDC planners also considered these data useful for educational purposes and for supplying to another person or agency.

USER SERVICES AND THE CARETS INFORMATION CENTER

At the initial CARETS conference users expressed considerable interest in the acquisition of CARETS data and the CARETS services available to the user community. USGS Earth Resources Observation Systems (EROS) Program representatives at the user conference were sensitive to this expression of interest, and the EROS Program subsequently funded an experimental regional information center within the Geographic Applications Program office.

The design of the CARETS information center as originally conceived by project investigators appears in figure 3. The center was designed to be a place where representatives of user agencies of the region could visit and have access to remote-sensor data and other materials related to the operation of the CARETS project. Not only would all the raw data used by the project be available for examination but also the processed products, including maps, analytical reports, and computer data summaries.

Funding reductions, however, forced the project to reduce the level of user services from that originally conceived. Such services as imagery reproduction, search and retrieval assistance, and analysis and imagery interpretation assistance, for example, were reduced in scope. The center's primary functions have been to assist users interested in CARETS products and to respond to user inquiries concerning the project.

The CARETS information center provided numerous services to users. Users within and outside the USGS have taken advantage of the center to view photography and imagery covering the CARETS region and to examine and discuss CARETS products. One user requested information concerning the CARETS user evaluation program to help him conduct a similar study in his State.

The CARETS project faced the problem of providing interested users with reproductions of its products. Investigators found a solution in the USGS open file system by which maps approved by the USGS were delivered to the USGS Public Inquiries Office (PIO) in Washington, D.C., where the public could view them. To gain reproductions of these maps, however, users have had to contact a commercial reproduction firm,

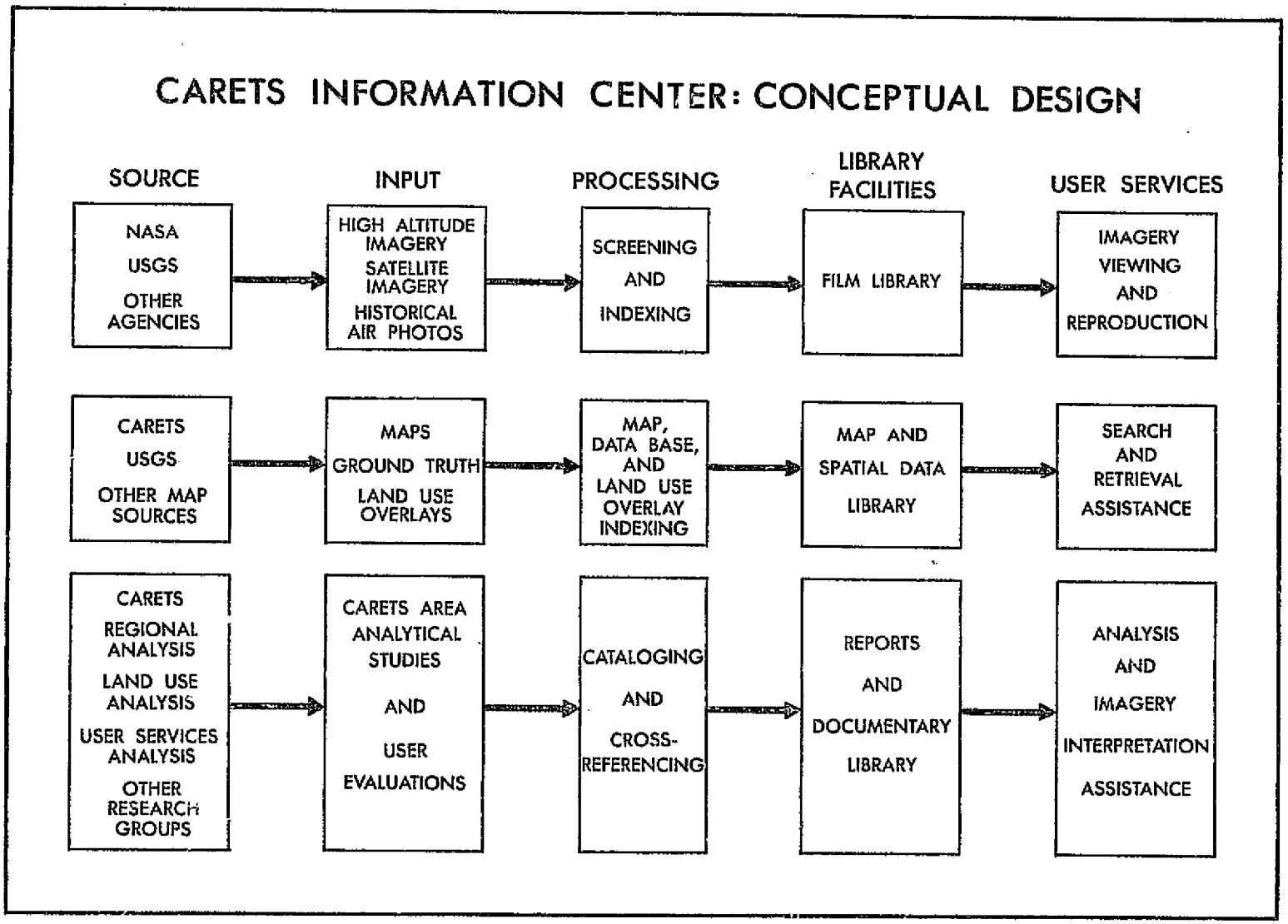

CARETS INFORMATION CENTER: CONCEPTUAL DESIGN
SOURCE
INPUT
PROCESSING
LIBRARY FACILITIES
USER SERVICES
NASA
USGS
OTHER AGENCIES
HIGH ALTITUDE IMAGERY
SATELLITE IMAGERY
HISTORICAL AIR PHOTOS
SCREENING AND INDEXING
FILM LIBRARY
IMAGERY VIEWING AND REPRODUCTION
CARETS
USGS
OTHER MAP SOURCES
MAPS
GROUND TRUTH
LAND USE OVERLAYS
MAP, DATA BASE, AND LAND USE OVERLAY INDEXING
MAP AND SPATIAL DATA LIBRARY
SEARCH AND RETRIEVAL ASSISTANCE
CARETS REGIONAL ANALYSIS
LAND USE ANALYSIS
USER SERVICES ANALYSIS
OTHER RESEARCH GROUPS
CARETS AREA ANALYTICAL STUDIES AND USER EVALUATIONS
CATALOGING AND CROSS-REFERENCING
REPORTS AND DOCUMENTARY LIBRARY
ANALYSIS AND IMAGERY INTERPRETATION ASSISTANCE

Figure 3

and make arrangements for the work. The commercial firm then has had to request the use of the maps from the PIO.

The open file process, suitable for smaller data sets, has not been an effective means of making the map data available to the public, and has caused problems for users and the PIO alike. When the 1:100,000-scale photomosaics, land-use maps, and overlays were released, the PIO was immediately swamped with inquiries, which required a great amount of time to answer and reduced the attention devoted to other PIO services, including the sale of USGS topographic maps. The imprecision of the initial press release also caused problems since most initial requests concerned the cost and procedures for obtaining the maps. Nevertheless, between May 1974 and August 1975 the PIO pulled 613 CARETS map sheets for viewing and sent 518 transparencies to commercial firms for reproduction.

The PIO and the reproduction firms had difficulty communicating with users about the type of reproduction desired and the best way of using the CARETS sheets. According to a public information specialist in the PIO, the lack of professional mapping techniques on the CARETS maps also created reproduction and user problems, especially with difficult-to-see and read lines and numbers. (CARETS investigators decided against scribing the line maps because of the additional expense that would be required. Moreover, the final CARETS product was intended to be in computerized form, and the line maps were considered only a step in the process.)

Users also reported difficulties with the open file system. Many agencies have access to ozalid reproduction facilities, yet they cannot

borrow reproducible copies of maps from the PIO. A representative of the Virginia Department of State Planning and Community Affairs reported that his office ordered copies of the CARETS maps as soon as they were released in open file, but soon incurred the frustration and expense of the system and discovered the costly mistake of having land-use and cultural features maps reproduced on a single sheet. Other users have registered similar complaints.

Despite the problem, the open file system has been extensively used, and users have been able to obtain the maps they desire. The USGS library and the Geography Program in Reston, Virginia, also have complete sets of the CARETS maps available for user examination.

EVALUATION OF CARETS DATA PRODUCTS BY USER AGENCIES

ORGANIZATION OF USER EVALUATION STUDY

The basic purpose of the CARETS user evaluation study has been to determine the worth or potential value of CARETS and associated data products to the multiplicity of local, regional, State, Federal, university, and private sector users in the Central Atlantic region. CARETS investigators decided the best means of obtaining evaluation was to identify as many potential users as possible, select a fairly representative sample of users, introduce these users to the CARETS project and its products at a user workshop, present them with appropriate sample data products for evaluation, and after a short interval, conduct interviews with the users to obtain as much evaluative information as possible.

Temporal, fiscal, and organizational considerations limited the number of agencies and agency representatives participating in the CARETS data products evaluation. In almost all cases, participating agencies rather than CARETS investigators chose the representatives actually evaluating the products.

Three primary levels of government users--local, State, and Federal--participated in the evaluation of CARETS products. The project conducted the local planning agency evaluation in cooperation with the Metropolitan Washington Council of Governments (MWCOG), which was funded for this purpose by the Earth Resources Observation Systems (EROS) Program. At a MWCOG planning directors' meeting, a CARETS representative presented an introduction to the project and asked the directors to participate in the evaluation program. Those responding positively were then invited to attend or sent representatives to a user evaluation workshop at the USGS National Center.

Generally the State geologist or planning director recommended State agencies and contacts within them that would be most interested in participating in the CARETS user evaluation. The CARETS project then invited these recommended contacts to attend the workshop. In addition to State representatives, the project also invited several regional planning agencies to participate.

The Federal agency selection process was somewhat more complex. First, investigators compiled a list of agencies with potential need for land-resource data, and for some of these agencies a list of persons with whom the CARETS project had had close contacts. The Acting Chief of the USGS Land Information and Analysis Office (LIA)

then sent letters of invitation to the appropriate office chiefs for the agencies, and carbon copies of these letters went to the various pre-existing contacts. The responses to these letters indicated who would attend the workshops.

The CARETS project held user evaluation workshops on March 26, October 23, and November 6, 1974 for local, State, and Federal agencies, respectively. All three workshops followed the same basic format of an introduction to the CARETS project and its user evaluation phase followed by small group discussions in which users received the data packets and group leaders explained the data. Along with other literature relating to the work of the EROS and Geography Programs, each attended received a copy of the user evaluation questionnaire (see appendix B), which was to be filled out during a later interview. The agendas for the workshops are presented in appendix C and a list of organizations and individuals participating in the evaluation interviews is presented in appendix D.

In the weeks following the workshops, researchers arranged the evaluation interviews. In most cases, those participating in the workshops expressed interest in this interview, but in some cases the workshop attendees delivered the products to others, to whom the data were more relevant or of greater interest.

Investigators conducted interviews in person with all of the MWCOG planning agencies and most of the other agencies, although they conducted some by telephone. Because many agency representatives did not have the authority to speak officially for their agencies, the evaluation of CARETS products, especially at the Federal level, are not necessarily the official responses of the agency but rather

the beliefs of those being interviewed. CARETS researchers did send copies of the notes taken during user evaluation interviews and relevant portions of a draft of this user report to all the organizations participating in the evaluation for their review and corrections. This report reflects changes resulting from that review. Notes taken during the interviews are presented in appendix E.

LIMITATIONS

The CARETS user evaluation study has used basically a qualitative rather than a quantitative methodology, and the resulting limitations must be recognized and considered in interpreting the results of the study. Some of these limitations have already been mentioned but nevertheless should be stressed.

Several limitations concern the participants in the evaluation. The method of choosing participating agencies and representatives was not necessarily the best, since it did not always reach the agencies that had any use for the data or the representatives capable or interested in evaluating the data. The amount of time devoted to evaluating the products varied considerably among participants. Some of those attending evaluation sessions had not seen the data before the interview. Other agencies were very conscientious about circulating the data, discussing them in meetings, and choosing the most interested and knowledgeable people to respond to the products.

Moreover, one might recognize an urban or metropolitan area bias in the choice of participants in the evaluation, especially among local planning agencies. CARETS investigators have conducted many of their

experiments in metropolitan areas, and the CARETS area (74,712-km^2) and population (13,404,558 in 1970) lead investigators to expect the results of CARETS research to be applicable to a populous State with a relatively small area.

Another significant limitation resulted from fiscal considerations. Since the cost of full-size and stable base reproductions of the data products (the most desirable format for an evaluation) would have been prohibitively high, cheaper ozalid and xerox reproduction of maps on nonstable paper and 35-mm transparencies of imagery had to be used. These reproductions did not show the products in their best light. For example, poor reproductions of the CARETS photomosaics may be in part responsible for some users finding them of little value. This limitation, however, may well be realistic in terms of actual conditions governing user delivery of such types of data products.

The user evaluation questionnaire (appendix B), despite two revisions, had certain deficiencies that should be recognized. Many users felt that the questionnaire was confusing and difficult to fill out. Moreover, the questions permitted ambiguities in responses depending upon individual perceptions of the questionnaire. For example, in response to the question of whether products were useful in support of agency functions, some users responded negatively because a product was not needed at the time, whereas others with no present use for the data responded positively because they could envision potential or proposed projects in which the product could be of use. CARETS investigators designed the questionnaire to be filled out during the interview, but in a few cases where several people of differing views

participated in the evaluation, they filled the questionnaire out after the interview and returned it by mail. Also, a reluctance on the part of some users to answer questions or provide certain information resulted in data gaps. From the experience of conducting interviews, researchers designed a third revised questionnaire, which has not been used but is believed to be easier to use and more effective. This questionnaire is presented in appendix F.

A final limitation has been the incompleteness of the data base. Landform and surface materials maps were not available for most areas, nor were computer plots of land use or computer data summaries.

DATA PRODUCTS EVALUATED

The range of potential data products for the CARETS project and those presented to users are shown in table 3. These products are arranged by order of processing. Even though CARETS researchers recognized that some of the data products might not be produced, they believed the best way to encourage user responses was to provide a comprehensive listing which would present most of the possibilities. The project actually presented considerably fewer products to the users. These products are shown in the user evaluation questionnaire in appendix B.

Most of the products evaluated were raw data and processed graphics derived from raw data by the USGS. Because computer plots of land use, computer data listings, and analytical reports were not available for user evaluation except for users in the Norfolk test site, these products could not be evaluated by agencies outside southeast Virginia.

Table 3--CARETS Products, Available or Potentially Available

*I. Raw Data Products

High-altitude color-infrared photography, 1:120,000, 1970, 1972, 1973

ERTS imagery, 70-mm and 9.5-inch transparencies at 18-day intervals

ERTS imagery, black and white prints of single bands, 1:100,000

ERTS diazochrome, color transparencies, 1:1,000,000

ERTS black and white single band prints, 1:250,000

ERTS color-composite transparencies, color-infrared format, 1:250,000, 1972, 1973

*II. Processed Graphics

Photomosaic with UTM grid, black and white, 1:100,000, 1970

Land-use map 1:100,000, Level II, aircraft data, 1970, 1972

1970-72 land-use change 1:100,000

Major drainage basins overlay, 1:100,000

Census tract overlay in SMSA's county boundaries, outside SMSA, 1:100,000

Culture and locational feature overlay, 1:100,000

1972 land-use 1:250,000 derived from ERTS Level I

Landforms and surface materials maps

Orthophotoquads 1:24,000, 1:50,000

Land-use overlay to orthophotoquads, 1:24,000, 1:50,000

ERTS gridded image, 1:500,000

ERTS location and county boundary overlay

*III. Computer Plots of Land Use

1:250,000 ERTS and 1:100,000 data plots

Plot of all land uses: 1970 - 1:100,000; 1972 - 1:100,000; 1972 - 1:250,000; 1973 - 1:250,000

Plot of urban and built-up land only, 1970 and 1972, ERTS 1972

Plot of urban and built-up change, 1970-72

Plot of agricultural land only, 1970, 1972, ERTS 1972

Plot of agricultural land change, 1970-72

Plot of forest land only, 1970, 1972, ERTS 1972

Plot of forest land change, 1970-72

*Presently available

Table 3--Continued

Plot of nonforested wetlands only, 1970, 1972 ERTS 1972

Plot of nonforested wetland change, 1970-72

Plot of barren land only, 1970, 1972 ERTS 1972

Plot of barren land change, 1970-72

IV. Data Listings and Summaries

1. *Area measurements of land-use Level II from 1:100,000 aircraft data 1970:

   *By county and independent city

   By major drainage basin

   *By census tract

   By geologic map units

   By individual polygons

   By kilometre grid cells

2. Area measurements of land-use change estimated from 1972-73 from ERTS imagery, 1:250,000:

   By county of independent city

   By census tract

   By geologic map units

   By individual polygons

   By kilometre grid cells

   Other data summaries or computations

V. Analytical Reports

Interpretive analysis of land-use patterns and changes

Analysis of regional land-use trends in regions adjacent to user's area of interest

Analysis of accuracy of region's land-use data

Sources and interpretation of remote-sensing data

Procedures for developing and maintaining remote-sensing-based land-use information system

Description of Federal, State, and local governmental programs involving land-use data, affecting the user's region of interest

Hydrologic impact of land-use patterns and changes in the region of interest

Geological factors affecting land use in the region of interest

Interpretation of coastal and wetland environmental problems associated with land-use patterns and change

Air quality impact of land-use patterns and change in the region of interest

*Presently available

CARETS researchers asked user agencies, however, to indicate how useful the computer plots and area summaries would be in support of agency functions.

Not all of the processed graphics evaluated were produced in the CARETS studies. The evaluation included the ERTS gridded mosaic and the orthophotoquads because they are relatively new remote sensor-derived products that might prove valuable for users of land-resource data.

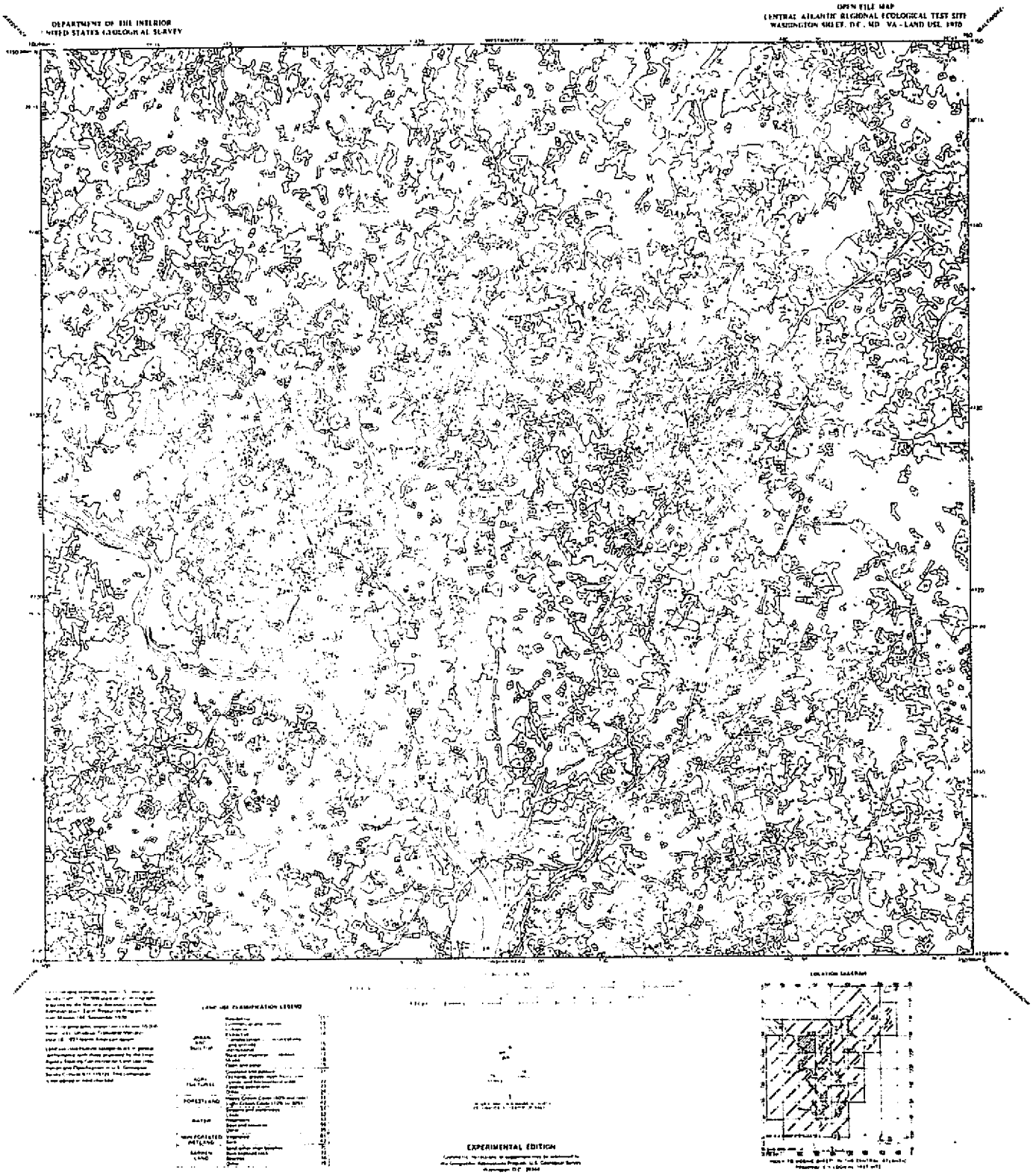
Samples of the major set of 1:100,000-scale land-use maps and overlays (greatly reduced in scale from the originals) are presented in figures 4 - 8. Drainage basin overlays (figure 8), though placed in open file, were not presented to Federal, State, and most regional agencies for evaluation. Figure 9 shows the ERTS-derived Level I land-use map covering the Baltimore 1:250,000-scale sheet.

RESULTS OF THE USER EVALUATION INTERVIEWS

This section of the CARETS user evaluation report discusses the responses of users at all levels to the CARETS data.

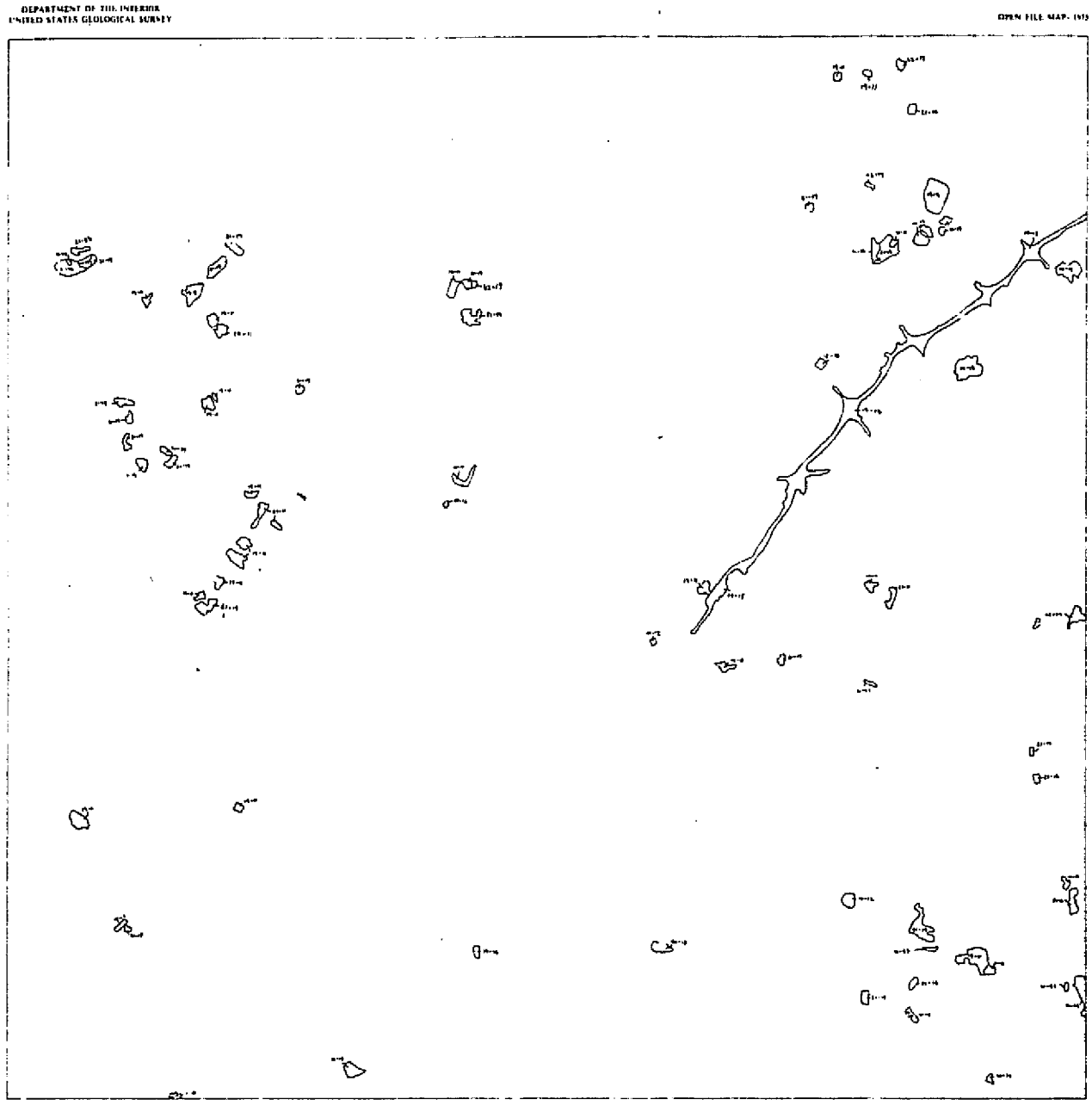
The results of the CARETS user evaluation study reveal that a majority of interviewed user agencies found some applications for some of the data and a few agencies found the data of high value. A majority, however, prefer more detailed data than that supplied by the CARETS project.

Table 4 shows the requirements and utility of land-use data at three levels of generalization or detail. With only a few exceptions, user agency representatives reported the greatest detailed data



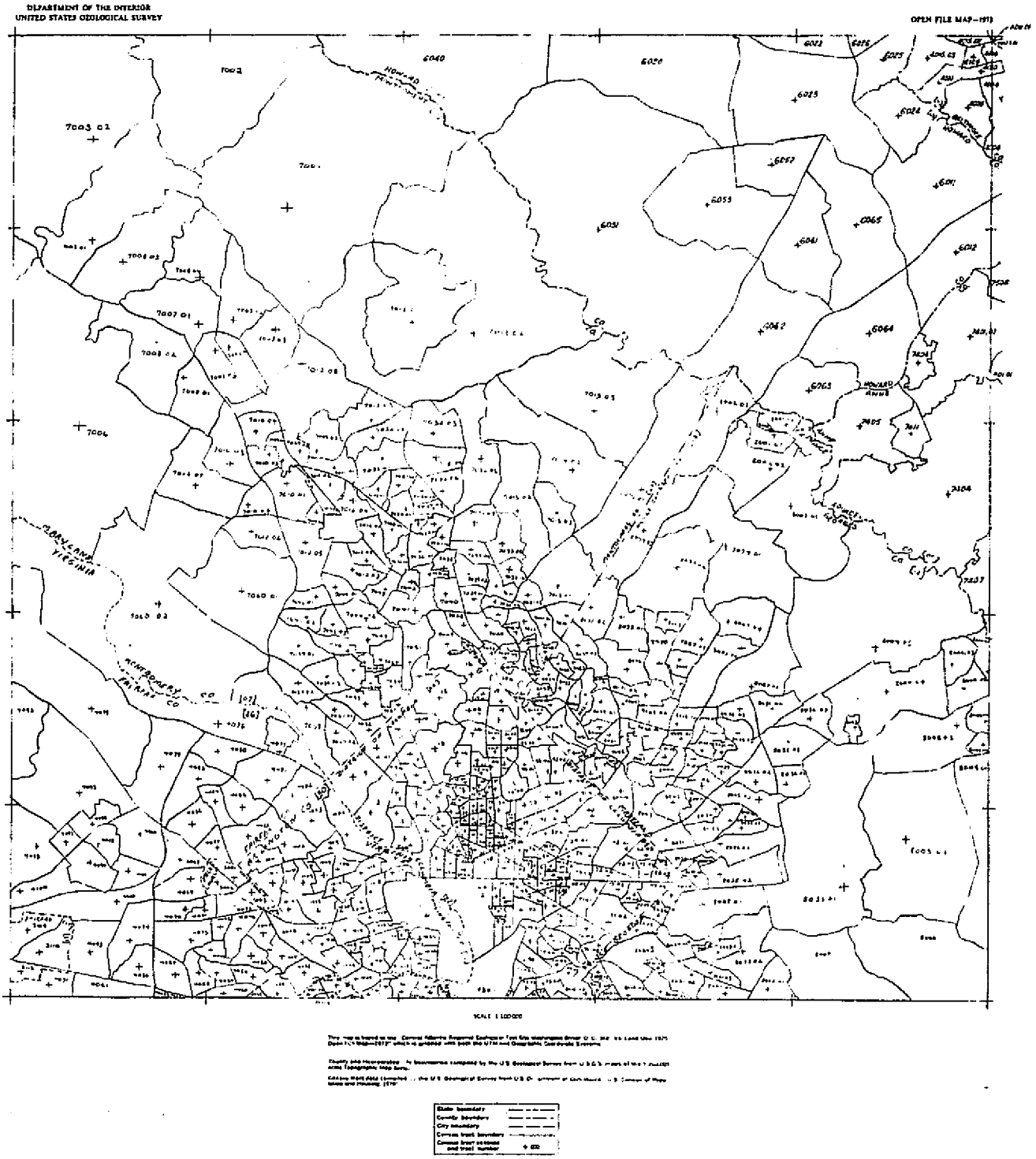
LAND USE MAP IN 1970 OF THE WASHINGTON SHEET, D.C., MD., VA.
1973

Figure 4--Reduction of specimen sheet of land-use map of one of the 48 CARETS sheets.



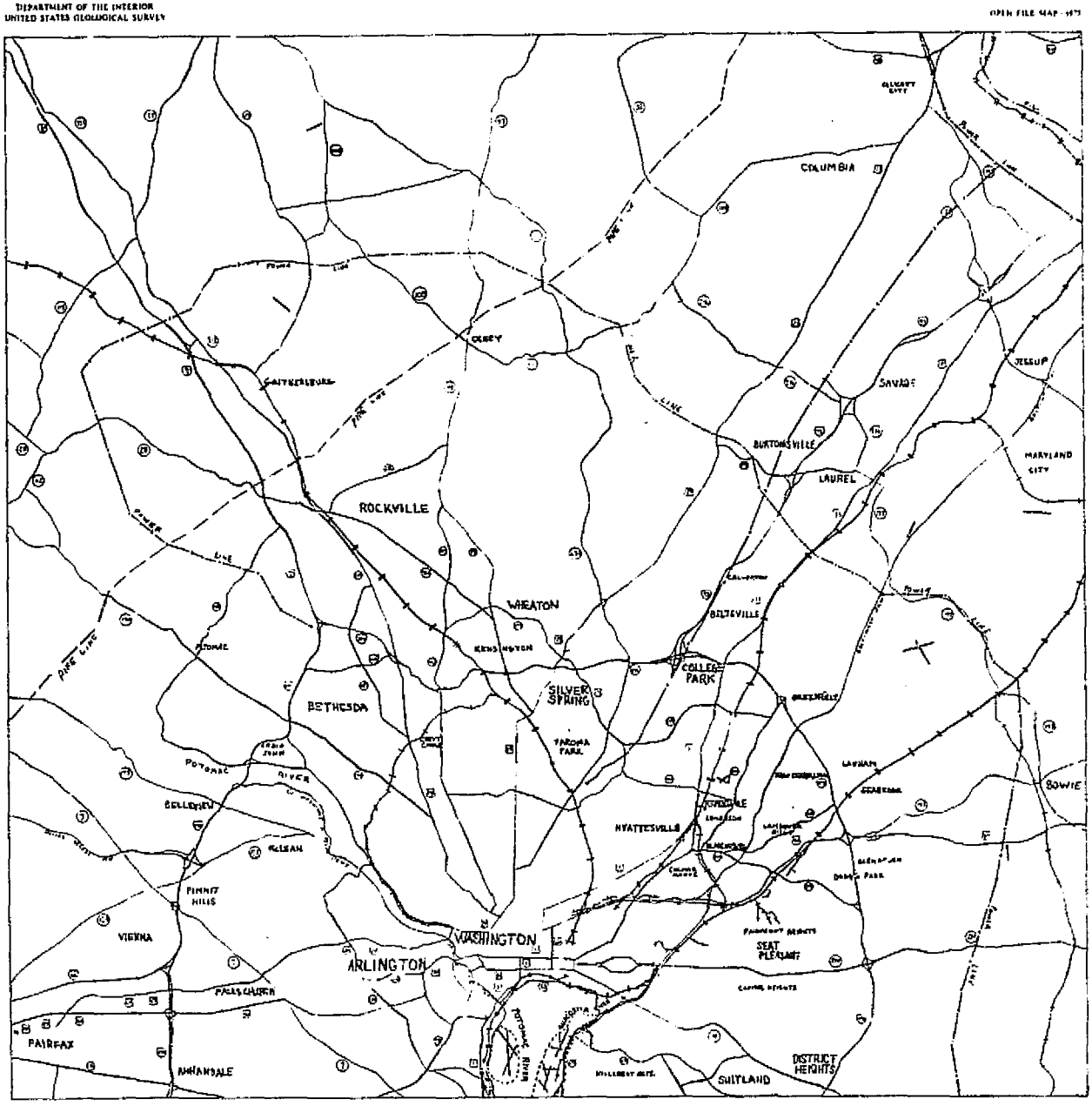
LAND USE CHANGE MAP, 1970–72, WASHINGTON SHEET, D. C., MD., VA.
1973

Figure 5--Reduction of specimen sheet of land-use change map.



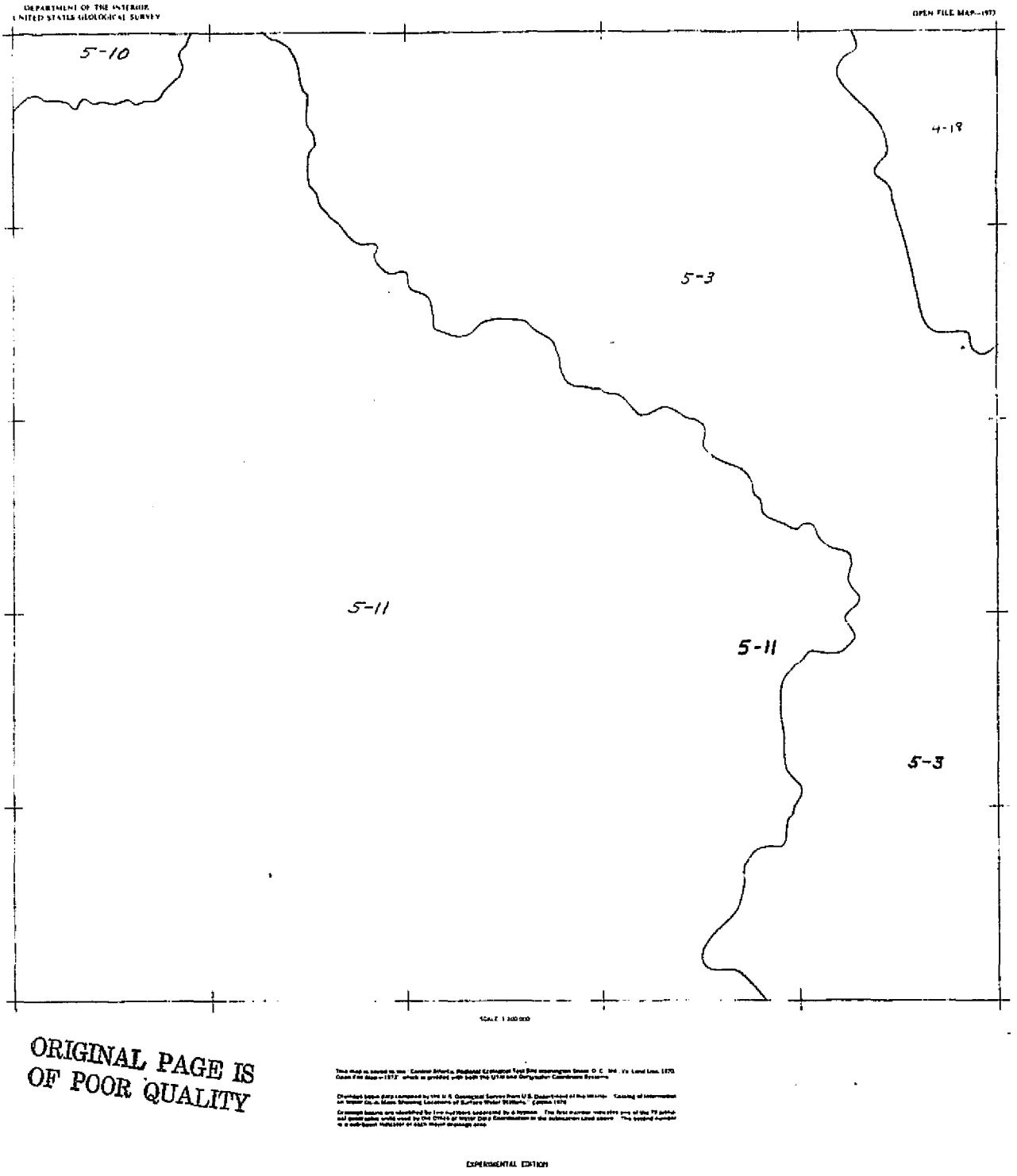
COUNTY BOUNDARY AND CENSUS TRACT MAP, 1970, WASHINGTON SHEET, D. C., MD., VA.
1973

Figure 6--Reduction of specimen sheet of county boundary and census tract map.



CULTURAL FEATURES MAP, 1970, WASHINGTON SHEET, D. C., MD., VA.
1973

Figure 7--Reduction of specimen sheet of cultural features map.



DRAINAGE BASIN MAP, 1970, WASHINGTON SHEET, D. C., MD., VA.
1973

Figure 8--Reduction of specimen sheet of drainage basin map.

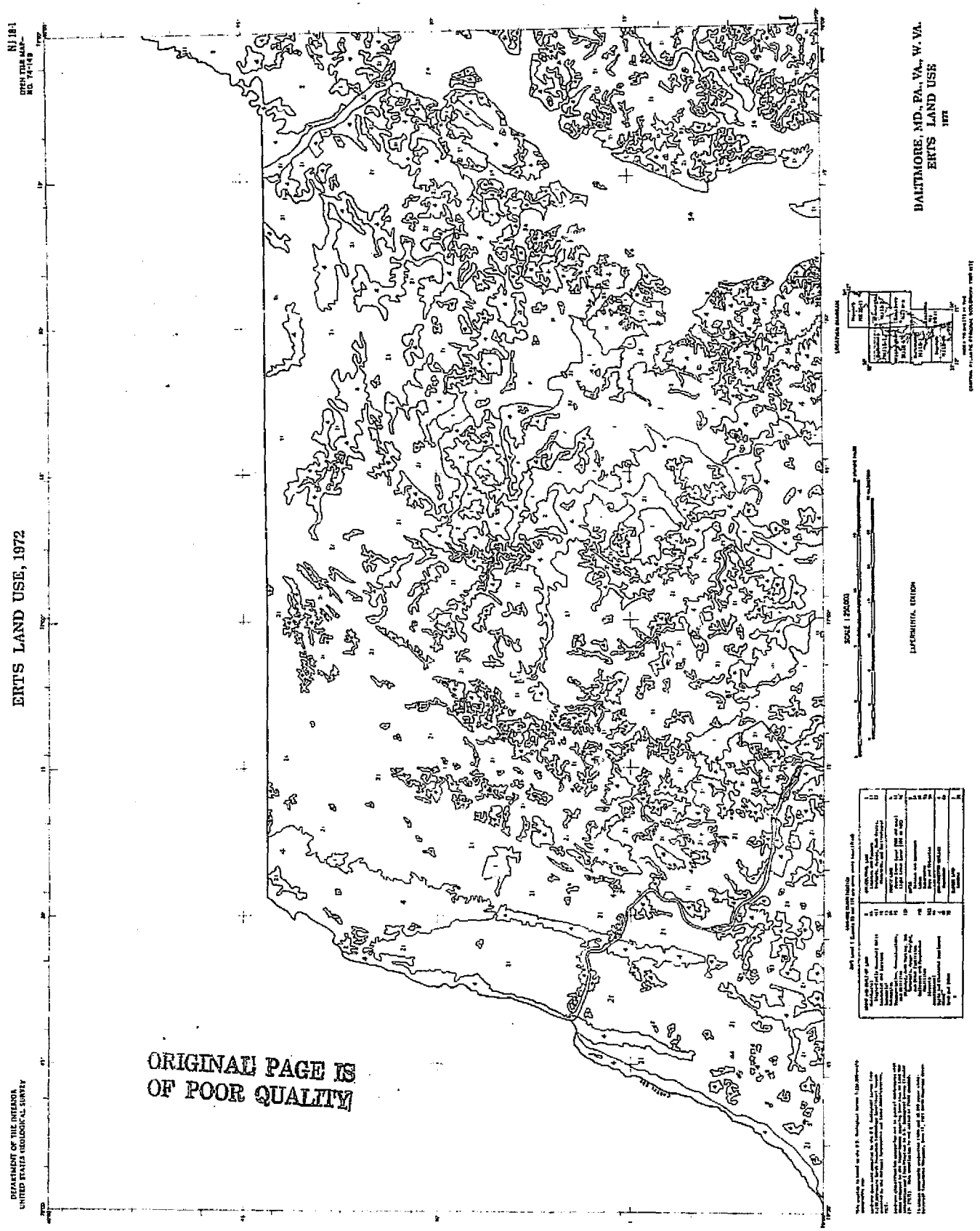


Figure 9--Reduction of specimen sheet of ERTS-derived land-use map.

Table 4.--CARETS User Agency Generalization Requirements For Land-Use Data

User Agencies* by Major Function	Level I ERTS 1:250,000 or smaller	Level II aircraft 1:125,000-1:24,000	Level III (or higher) aircraft and other sources 1:24,000 and larger
Land-use planning			
Arlington Co., Va., Planning Office			1
Fairfax Co., Va., Office of Comprehensive Planning		2	1
Loudoun Co., Va., Department of Planning and Zoning		2	1
Maryland National Capital Park and Planning Commission**		2	1
Metropolitan Washington Council of Governments	3	2	1
Montgomery Co., Md., Department of Community and Economic Development		2	1
National Capital Planning Commission		2	1
Northern Virginia Planning District Commission		2	1
Prince William Co., Va., Planning Office		2	1
Delaware Valley Regional Planning Commission	3	2	1
Economic Development Council of Northeastern Pennsylvania	2	1	
RADCO Planning District Commission		2	1

1 - primary utility, of high value in performance of agency functions
2 - secondary utility, useful but not necessary in performance of agency functions
3 - tertiary utility, limited utility in performance of agency functions
*Excludes organizations primarily engaged in research and agencies not having an actual need for such data.
**Includes 3 divisions of MNCPPC: Montgomery Co., Prince Georges Co., & Bi-County.

Table 4.--CARETS User Agency Generalization Requirements For Land-Use Data

User Agencies* by Major Function	Level I ERTS 1:250,000 or smaller	Level II aircraft 1:125,000-1:24,000	Level III (or higher) aircraft and other sources 1:24,000 and larger
Land-use planning (con't)			
Southeastern Virginia Planning District Commission		2	1
Delaware State Planning Office		2	1
Maryland Department of State Planning	3	2	1
New Jersey Department of Community Affairs, Division of State and Regional Planning		2	1
Pennsylvania Office of State Planning and Development	3	2	1
Virginia Division of State Planning and Community Affairs		1	
NOAA, Office of Coastal Zone Management		1	1
HUD, Office of Environmental Quality			1
Transportation planning			
Maryland Department of Transportation			1
Delaware Department of Highways and Transportation			1
New Jersey Department of Transportation		2	1
Virginia Department of Highways and Transportation		2	1

1 - primary utility 2 - secondary utility 3 - tertiary utility
*Excludes organizations primarily engaged in research and agencies not having an actual need for such data.

Table 4.--CARETS User Agency Generalization Requirements for Land-Use Data

User Agencies* by Major Function	Level I FRTS 1:250,000 or smaller	Level II aircraft 1:125,000-1:24,000	Level III (or higher) aircraft and other sources 1:24,000 and larger
Environmental protection			
Delaware Department of Natural Resources and Environmental Control Planning & Hearing Office		2	1
New Jersey Department of Environmental Protection		2	1
Pennsylvania Department of Environmental Resources, Environmental Master Planning		1	
Environmental Protection Agency		2	1
Nuclear Regulatory Commission		2	1
Mineral/energy survey			
Maryland Geological Survey		2	1
Pennsylvania Department of Environmental Resources, Pa. Geological Survey			1
Virginia Division of Mineral Resources			1
Disaster warning/assessment			
DOD, Defense Civil Preparedness Agency			1
HUD, National Flood Insurance Program			1
Outdoor recreation planning			
USDI, Bureau of Outdoor Recreation			1

1 - primary utility 2 - secondary utility 3 - tertiary utility

*Excludes organizations primarily engaged in research and agencies not having an actual need for such data.

Table 4.—CARETS User Agency Generalization Requirements For Land-Use Data

User Agencies* by Major Function	Level I ERTS 1:250,000 or smaller	Level II aircraft 1:125,000-1:24,000	Level III (or higher) aircraft and other sources 1:24,000 and larger
Water resource planning			
Interstate Commission on the Potomac River Basin	1	2	1
Delaware Department of Natural Resources and Environmental Control, Water Resources Section		2	1
Fish and wildlife management			
New Jersey Division of Fish, Game, and Shellfisheries		2	1
USDI, Fish and Wildlife Service		2	1
Agricultural management			
USDA, Agricultural Stabilization and Conservation Service		2	1
USDA, Soil Conservation Service		1	1
Socio economic data collection			
U.S. Department of Commerce Bureau of the Census	3	2	1
Utility planning			
Federal Power Commission		2	1
Economic and Community Development			
Maryland Department of Economic and Community Development		1	1

1 - primary utility 2 - secondary utility 3 - tertiary utility

*Excludes organizations primarily engaged in research and agencies not having an actual need for such data.

Table 4.--CARETS User Agency Generalization Requirements For Land-Use Data

User Agencies* by Major Function	Level I ERTS 1:250,000 or smaller	Level II aircraft 1:125,000-1:24,000	Level III (or higher) aircraft and other sources 1:24,000 and larger
Economic and community development			
HUD, new communities administration		2	1
Multipurpose resources management			
U.S. Army Corps of Engineers Baltimore District	1		
Forest management			
USDA, Forest Service		2	1
New Jersey Bureau of Forestry		2	1

1 - primary utility 2 - secondary utility 3 - tertiary utility

*Excludes organizations primarily engaged in research and agencies not having an actual need for such data.

(Level III or higher) to have the greatest utility. In several cases, users could use only the more detailed data. On the other hand, few user agencies reported any utility for highly generalized Level I data, as presented on the ERTS-derived 1:250,000-scale land-use maps. A majority of those finding Level I data useful reported only a tertiary utility. CARETS users found the Level II data to be generally of secondary utility.

An overall view of user responses is presented in tables 5 - 9, which list the products that agencies found useful in support of their functions. Since degree of usefulness for data products varies greatly among different products and among different user agencies, these matrices represent at best a generalization, designed to provide an overview of products found useful or not useful. More specific data and a more comprehensive view of the reported value of the CARETS products are presented in the following text. The agencies interviewed and their representatives are presented in appendix D. They have been grouped into five categories: planning agencies belonging to the Metropolitan Washington Council of Governments; regional planning agencies; State agencies; Federal agencies; and the university and research community.

University and Research Community Response

During user evaluation interviews, the CARETS project received evaluations from six university and other private or State-supported organizations conducting environmental research within the CARETS region. Most of these organizations have been involved in research for State and Federal agencies, and differ somewhat from operational agencies in their varied, multidisciplinary, often short-term programs.

Table 5--Products Reported Useful in Support of Agency Functions

Member Agencies of the Metropolitan Washington Council of Governments

	High-Altitude Aircraft Photography	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1972 Land-Use Change, 1:100,000	Census Tracts and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Drainage Basin Maps 1:100,000	Landforms and Surface Materials Map, 1:100,000	Orthophotoquads	Computer Plots of all Land Use	Computer Data Listings	Level I Land-Use Map, ERTS-Derived 1:250,000
Arlington County, Va., Planning Office	X									X			
Fairfax County, Va., Office of Comprehensive Planning	X			X	X				X	X	X	X	
Loudoun County, Va., Dept. of Planning and Zoning	X		X	X	X			X		X	X	X	
Md. Natl. Capital Park and Planning Commission - Bi-County	X		X	X	X				X	X	X	X	
Md. Natl. Capital Park and Planning Commission - Prince Georges County	X		X	X	X	X			X	X	X	X	
Metropolitan Washington Council of Governments	X		X	X	X				X	X	X	X	X
Montgomery County, Md. Dept. of Community & Economic Development	X	X		X	X		X	X	X	X	X	X	
National Capital Planning Commission	X		X	X	X	X	X		X	X	X	X	
Northern Va., Planning District Commission	X		X	X	X	X	X		X	X	X	X	
Prince William County, Va., Planning Office	X			X	X	X			X	X			

X = Useful in support of agency functions

Table 6--Products Reported Useful in Support of Agency Functions

Regional Planning Agencies

	High-Altitude Aircraft Photography	Skylab Photography	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS-Derived, 1:250,000	Landforms and Surface Materials Map, 1:100,000	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000, 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
Delaware Valley Regional Planning Commission	X		X						X				X		
Economic Development Council of Northeastern Pennsylvania	X		X	X	X	X	X	X	X	X	X				X
Interstate Commission on the Potomac River Basin	X		X	X	X	X	X	X	X	X					
RADCO Planning District Commission	X				X	X	X	X	X	X	X	X	X	X	X
Southeastern Va. Planning District Commission	X		X	X	X	X				X					X

X = Useful in support of agency functions

Table 7--Products Reported Useful in Support of Agency Functions

State Agencies

	High-Altitude Aircraft Photography	Skylab Photography	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS-Derived, 1:250,000	Landforms and Surface Materials Map, 1:100,000	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000 and 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
DELAWARE															
Delaware Dept. of Highways and Transportation											X				
Delaware Dept. of Natural Resources & Environmental Control (Planning & Hearing Office)				X	X	X	X	X		X	X	X		X	X
Delaware Dept of Natural Resources & Environmental Control (Water Resources Section)					X	X				X	X	X		X	X
Delaware State Planning Office	X	X	X	X	X	X	X	X		X	X	X		X	X
MARYLAND															
Md. Dept. of Agriculture															
Md. Dept. of Economic and Community Development	X				X	X		X							

X = Useful in support of agency functions

Table 7--Continued

	High-Altitude Aircraft Photography	Skylab Photography	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS -Derived, 1:250,000	Landforms and Surface Materials Map, 1:100,000	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000, 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
Md. Dept. of Health & Mental Hygiene															
Md. Dept. of State Planning	X		X		X	X			X		X		X		
Md. Dept. of Transportation				X							X				
Md. Geological Survey	X	X	X		X					X	X	X			
NEW JERSEY															
N.J. Bureau of Forestry	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N.J. Dept. of Community Affairs, Div. of State & Regional Planning	X	X	X	X		X			X		X	X	X	X	X
N.J. Dept. of Environmental Protection	X	X	X	X	X					X	X	X	X	X	X
N.J. Dept. of Transportation	X	X			X	X	X			X				X	
N.J. Div. of Fish, Game, & Shellfisheries					X		X								X
PENNSYLVANIA															
Pa. Dept. of Environmental Resources, Environmental Master Planning	X		X	X	X	X		X	X	X	X	X	X	X	X
Pa. Dept. of Environmental Resources, Pa. Geological Survey	X		X	X							X				

Table 7--Continued

	High-Altitude Aircraft Photography	Skylab Photography	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS-Derived, 1:250,000	Landforms and Surface Materials Map, 1:100,000	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000, 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
Pa. Office of State Planning & Development				X	X		X	X	X	X					
VIRGINIA															
Va. Dept. of Highways & Transportation					X	X	X				X	X		X	X
Va. Div. of Industrial Development											X	X			
Va. Div. of Mineral Resources	X	X	X	X		X		X			X		X	X	X
Va. Div. of State Planning & Community Affairs	X			X	X	X	X								

Table 8--Products Reported Useful in Support of Agency Functions
Federal Agencies

	High-Altitude Aircraft Photography	Skylab Photography	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS-Derived, 1:250,000	Landforms and Surface Materials Map, 1:100,000	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000, 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
DEPT. OF AGRICULTURE															
Agricultural Stabilization & Conservation Service	X			X	X	X	X		X		X				
Forest Service	X	X			X	X		X						X	X
Soil Conservation Service	X				X	X					X	X			X
COUNCIL ON ENVIRONMENTAL QUALITY															X
DEPT. OF COMMERCE															
Bureau of the Census	X	X	X	X	X	X	X	X			X				X
NOAA - Office of Coastal Zone Management	X				X	X					X	X			X
DEPT. OF DEFENSE															
Army Corps of Engineers, Baltimore District					X				X						
Defense Civil Preparedness Agency															
Defense Mapping Agency	X									X					
ENVIRONMENTAL PROTECTION AGENCY - Office of R&D	X	X	X	X	X	X	X	X		X	X	X			X

X = Useful in support of agency functions

Table 8--Continued

	High-Altitude Aircraft Photography	Skylab Imagery	ERTS Imagery	Photomosaic, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS-Derived, 1:250,000	Landforms and Surface Materials Map	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000, 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
FEDERAL POWER COMMISSION - Environmental Assessment Branch	X			X	X	X	X			X		X		X	
DEPT. HOUSING & URBAN DEVELOPMENT															
New Communities Admin.	X	X		X	X	X	X	X		X	X		X	X	X
Natl. Flood Insurance Program											X				
Office of Environmental Quality	X									X	X			X	X
DEPT. OF THE INTERIOR															
Bureau of Outdoor Recreation	X										X				X
Fish & Wildlife Service	X			X	X	X		X		X					X
Office of Land-Use & Water Planning	X		X			X				X	X				
DEPT. OF TRANSPORTATION															
Federal Highway Admin.	X										X				
NASA															
Goddard Space Flight Center Earth Resources Program	X	X	X												
Wallops Flight Center	X	X	X	X	X	X					X	X			
NUCLEAR REGULATORY COMMISSION	X	X	X		X	X					X	X			X

Table 9 --Products Reported Useful in Support of Agency Functions

University and Research Community

	High-Altitude Aircraft Photography	Skylab Photography	ERTS Imagery	Photomosaics, 1:100,000	Level II Land-Use Map, 1:100,000	1970-72 Land-Use Change, 1:100,000	Census Tract and Political Boundary Overlay, 1:100,000	Cultural and Locational Feature Overlay, 1:100,000	Level I Land-Use Map, ERTS-Derived, 1:250,000	Landforms and Surface Materials Map	Orthophotoquads	Orthophotoquad Land-Use Overlay, 1:24,000, 1:50,000	ERTS Gridded Image	Computer Plots of all Land Use	Computer Data Listings
American University Dept. of Biology	X	X	X								X				
Center for Natural Areas	X		X			X				X		X			X
Chesapeake Research Consortium, Inc.	X			X	X	X	X	X		X				X	X
University of Delaware College of Marine Studies	X	X	X	X	X	X									
University of Virginia Project for the Study of Coastal Environments											X	X			
Va. Institute of Marine Science	X	X										X			X

X = Useful in support of agency functions

Although some of these organizations did not find a great amount of utility in the CARETS data products, their comments are worth reporting.

The American University Department of Biology is under contract to the National Park Service to conduct remote-sensing research to determine the type of information that can be of value to national Park managers. For the first year, the department is examining two parks in Maryland, Catoctin Mountain Park and Assateague Island National Seashore. For their present efforts, the researchers cannot use the CARETS land-use maps or overlays, but they consider the other products useful, particularly the raw data. The researchers found the high-altitude aircraft photography and ERTS imagery to be useful. They reported Skylab photography particularly valuable in wetlands research. The orthophotoquad was seen as useful for research work and an excellent way to introduce the potentials of remote sensing. One of the American University researchers expressed the belief that the CARETS information center was very valuable for anyone conducting rese. ·h in the region and that a real need for such a regional center exists.

The Center for Natural Areas (CNA) was established in July 1972, with grants for the Nature Conservancy and the Chesapeake Bay Foundation, matched by funds from the Smithsonian Institution's Office of Environmental Science, to conduct research on natural areas in the Chesapeake Bay region. Though originally within the Smithsonian Institution, CNA is now a private, nonprofit corporation affiliated with the Smithsonian, which is involved in several projects concerning critical resources, land planning, and natural areas. The CNA is most

interested in raw data products, finding the high-altitude photography, ERTS imagery, land-use change, cultural features and surficial geology overlays (especially for previously unmapped areas), and computer data listings useful. CNA representatives considered the CARETS land-use maps difficult to read, in an unacceptable format, and possessing land-use categories lacking the evaluative information the center representatives need.

The Chesapeake Research Consortium (CRC) is a consortium of the Johns Hopkins University, University of Maryland, the Smithsonian Institution, and Virginia Institute of Marine Science. The CRC reported two proposed projects that could make use of the CARETS data products. The first involves the time rate of land-use change in the Chesapeake Bay region, which would allow the drawing of curves to predict future land-use change and suggest how alterations in zoning laws might help prevent undesirable changes. The second project involves the production of a coastal zone atlas of the Chesapeake Bay modelled after the Environmental Geologic Atlas of the Texas Coast 1 Zone (1972), which has been compiled by the University of Texas, Bureau of Economic Geology and provides land-resource information such as environmental geology, land use, topography, physical properties, and active processes. The CRC reported a greater interest in the processed than the raw data and considered land use, land-use change, other overlays, computer plots, and area summaries useful.

The University of Delaware College of Marine Studies is involved in the large-scale (1:2,400) mapping of tidal wetlands for the State Department of Natural Resources and has both ERTS and Skylab contracts

to conduct wetlands research. For the large-scale wetland mapping, CARETS data are not of value because of insufficient detail. The raw remote-sensor data, however, are of great value. The Level II land-use maps have been used as ground truth for research using ERTS computer compatible tapes, although researchers consider high-altitude aircraft photography a better source than the Level II maps. Level II land-use change data could also be of value as ground truth for ERTS change detection work if the change maps covered the right time periods. Researchers found the rest of the CARETS data products to be of little value.

The University of Virginia Project for the Study of Coastal Environments (PSCE) is conducting research for the National Park Service. Its project at the time of the evaluation--measuring change in coastal overwash penetration--required the use of large-scale aerial photography, and consequently the PSCE reported little use for the CARETS products. Future projects, however, may very well use the raw or processed products.

The Virginia Institute of Marine Science (VIMS) concluded from the CARETS products examined that very few could be of value, primarily because most of the data are too gross and too expensive for the information provided. VIMS is concerned with coastline changes and the location of sewage outfalls, harbors, electric power plants, and other detailed phenomena. VIMS might have some use for high-altitude photography, orthophotoquads and land-use area summaries in sedimentation and flood studies. The rest of the data, however, have little value.

For the research organizations interviewed, the value of data products is highly dependent upon projects in operation or proposed. Generally, researchers found the raw data more useful, but a few researchers reported that the processed data products were or could be of considerable value for some specific studies.

High-Altitude Aircraft Color-Infrared Photography

The data product found most useful by local, State and Federal agencies was the high-altitude aircraft color-infrared photography. This photography is one of the two products found useful by all the local planning agencies interviewed and is the product that has evoked the greatest interest from visitors to the CARETS information center.

The reported applications for these data are numerous. Users involved in land-resources research have found the value or potential value of the photography for such projects as detecting historical land-use patterns (American University Department of Biology for the National Park Service), scenic rivers research (Bureau of Outdoor Recreation), and detecting critical environmental areas (Virginia Division of State Planning and Community Affairs). Local planners see considerable public relations value in a color enlargement or mosaic of this photography, showing their jurisdictions. The Earth Satellite Corporation used this photography to map Level III land use for the State of Maryland.

Users see many advantages in the color-infrared over conventional black and white photography, especially its color and infrared formats. The photography's small scale (1:120,000) permits a much

larger area to appear on a single frame than larger scale data. Also one can enlarge such photography optically or photographically without a great loss in resolution.

On the other hand, the high-altitude aircraft photography did present some problems for users. Perhaps the greatest difficulty involved the acquisition of the photography from the EROS Data Center. The Department of the Interior's Office of Land Use and Water Planning reported the frustration of time delays and poor-quality products experienced by many users in trying to obtain photography and imagery from Sioux Falls. Related problems involve determining the NASA photography availability and quality. For areas within the Central Atlantic region, the CARETS information center has helped users to some extent, and the EROS user facility at Reston, Virginia, maintains microfilm coverage of many of NASA's flights. NASA's Chesapeake Bay Regional Data Center at Wallops Island, Virginia, also provides a facility for examining all NASA photography available for the region.

Other user reservations concern the timeliness of the data and the frequency of coverage. For many users, such photography can be of great value if provided at the right time and at regular intervals such as every 2 years.

Several users responded negatively to this aerial photography. For some, the scale is just too small. For others the lack of uniformity in quality and processing creates problems. For still others, traditional methods do not allow for the use of such photography. The U.S. Forest Service cannot use high-altitude aircraft photography because the agency currently uses timber volume in defining and choosing

sampling locations. This photography could be used in a general way to determine area covered by forest land.

Despite the problems, numerous users in CARETS have become excited by the photography, have ordered it, are using it, and have expressed the wish that NASA high-altitude flights be flown operationally.

Satellite Photography and Imagery

User agencies participating in the CARETS data evaluation did not find ERTS and Skylab data as useful as the aircraft photography. A majority of local and Federal agencies found the satellite data of little value, basically because they lacked desired detail. Some State user agencies, however, looked more favorably on ERTS in its image and digital forms.

Local users were almost unanimous in finding the ERTS data of little value in support of agency functions, except as display items. The lack of detail posed the main problem. Few local users were interested in the broad picture patterns revealed by the imagery. One representative of the Metropolitan Washington Council of Governments, however, remarked that an enlarged image demonstrated, as few other devices could, how the Washington area's Year 2000 plan was breaking down, in that open wedges between developed corridors are themselves being filled with urban sprawl.

Regional and State agencies found somewhat more use in the ERTS data than did the local users. State geological surveys found the ERTS data potentially useful for structural geological analysis, inventories of strip mines, or monitoring of surface disturbances. Other regional and State agencies saw some value in the ERTS imagery

for display or graphic purposes or for providing a broad view of a large area. The Interstate Commission on the Potomac River Basin, which has produced a Level I land-use map for the entire basin from ERTS color-composite prints, reported that the broad picture provided by ERTS is valuable for the agency's purposes. One of the commission's planners hopes to produce a land-resources atlas for the basin using ERTS imagery as his major data source.

State agencies in New Jersey were particularly interested in the use of ERTS computer compatible tapes (CCT's). Representatives of both the Department of Environmental Protection and the Department of Community Affairs, Division of State and Regional Planning stated that the CCT work demonstrated at the State agency user evaluation workshop seemed to be the most useful product for their purposes. These planners are now considering the use of the CCT's for mapping the whole State.

Federal agency users found little value in the ERTS data. Of six Federal agencies finding the ERTS imagery of value, two are NASA offices involved in remote-sensing work, another performs a clearinghouse function, providing information to other users, two were involved in environmental impact assessment or research, and one--the Bureau of the Census--found the ERTS imagery of marginal utility for distinguishing between urban and rural areas. Although many of the Federal agency representatives were impressed by the ERTS CCT work, most felt that work with the tapes was far too sophisticated and expensive for their needs.

CARETS investigators also asked State and Federal agencies to evaluate USGS ERTS gridded images--1:500,000-scale color composites of ERTS images. Two such products covering portions of the CARETS region are available to the public as lithograph prints--the Upper Chesapeake Bay image and a mosaic of the State of New Jersey. This product received the most negative response of all products evaluated. No Federal agencies found them of value, and only six State agencies reported them to be useful. The New Jersey agencies provided the most positive response, finding the maps extremely useful as a public relations and display item. In all cases, users saw the gridded images basically as display items, of value only for providing an overview.

Negative user response to Skylab photography is probably less a reflection of the photography's value than the limited coverage of such photography and the lack of user exposure to it. Skylab photographs were not available at the time of the MWCOG evaluation. Moreover, the project could provide only 35-mm transparency reproductions of the S-190A and S-190B coverage of the Washington-Baltimore area for the evaluation. In all but two cases, users finding value in Skylab photography also saw ERTS imagery as useful. The Delaware Valley Regional Planning Commission viewed Skylab photography as having little benefit because good coverage of their area was not available. Other users also commented negatively on the limited or sporadic Skylab coverage.

The most positive user response to Skylab came from the American University Department of Biology, which has found the Skylab data valuable in wetland research. Researchers reported that a false-color composite of three black and white bands of the S-190A photography, enlarged to 1:250,000, is more useful in some respects than the color-infrared band from the multispectral camera. They found also that the S-190B photography, enlarged to 1:63,360 held its resolution quite well.

Photomosaics

User agencies finding value in the CARETS 1970 1:100,000-scale photomosaics, generally considered them only marginally so, despite their usefulness as mapping bases for phenomena that can be related to land use and their extensive use by CARETS project researchers. The photomosaics were designed as mapping bases for land-use data and as underlays for the land-use transparencies. Providing locational aids and a rough picture of the land, the photomosaics have not evoked the interest they might have, had they been of better quality or larger scale. In a majority of cases, users finding the photomosaics of value, likewise were interested primarily in raw data. One such agency, the Virginia Division of Mineral Resources, however, reported that the mosaics would be of greater value if the 1-km grid were not present to obscure some of the picture.

The user agency reacting most enthusiastically toward the photomosaics was the Interstate Commission on the Potomac River Basin (ICPRB), which reported that such photomosaics were of high value for identifying sites and providing a broad perspective. For the

ICPRB, the photomosaics facilitate the identification of sites, which normally requires the use of numerous topographic sheets.

Level II Land-Use Maps, 1:100,000-scale

Although the evaluation of a land-use map and its characteristics are nearly inextricable, this report treats the two sepatately. This section on Level II land use at 1:100,000 will discuss how users reacted to the product, with an emphasis on the utility and applications of such products. The section concerning land-use data characteristics will present the problems that mapping scale, format, accuracy, and the land-use classification impose on users of land-resource information.

Of the 11 local users organizations from the Washington metropolitan area, all but one reported that the CARETS Level II, 1:100,000 land-use maps were useful in support of agency functions. Most agencies, however, exhibited a lack of enthusiasm towards these maps, having the general attitude that the maps provide a fairly good overview of land use within an area, contain some errors, are somewhat out-of-date, but are still useful as generalized views. The local users, however, see the maps as lacking needed urban detail (perhaps the distinction between single- and multiple-family residential areas or between retail and wholesale commercial land use) and as being much too small in scale. Several planners stated a need for a scale no smaller than 1:24,000, and others desire even larger scales.

The National Capital Planning Commission (NCPC) found the Level II land-use maps of value as an informational source for their planning responsibilities beyond the District of Columbia boundaries. One NCPC planner saw such data particularly useful for his task of monitoring

land-use change around Federal installations, and reported that he could not obtain better data for such purposes through county governments or Federal agencies.

The CARETS project did not provide land use area summaries to user agencies from the Washington area. Since the accurate measurement of land-use areas from maps is a tedious task that planners were reluctant to pursue, most Washington area local planners had not used the land-use data for measurement or analytical purposes. The extent of analysis of any user agency was the color coding of the maps and comparison of the revealed land-use patterns to personal knowledge or previously produced land-use maps.

The Southeastern Virginia Planning District Commission (SEVPDC) reported quite favorably on the Level II land-use maps despite the incompatibility of the CARETS land-use classification scheme with that used by the commission. SEVPDC planners considered the map accuracy excellent and the currency adequate. If more detail were provided, the maps would be even more valuable.

Other regional or multijurisdictional agencies interviewed had a mixed reaction to the 1:100,000-scale land-use maps. The Interstate Commission on the Potomac River Basin considered such maps "nice to have," but not vital for fulfilling agency functions. The Delaware Valley Regional Planning Commission considered their own 1:130,000-scale series of land-resource data for the Philadelphia region much superior to CARETS Level II maps. On the other hand, the Economic Development Council of Northeastern Pennsylvania received the Level II data quite well, believing the scale of

1:100,000 to be the most satisfactory for planning at the regional level.

State agency responses to the Level II land-use maps were somewhat favorable. As in the case of local planning agencies, however, these maps do not fully meet land-use data needs of the organizations that find them useful in support of agency functions.

The Maryland Department of State Planning was one of the major users of the Level II maps; CARETS covers all but the three western-most counties of the State. CARETS investigators established relations with this agency early in the project and provided the agency with preliminary copies of the land-use maps of the State as soon as they were available. The Department of State Planning reduced the scale of the maps, mosaicked the maps into sheets covering planning districts, and distributed them to local government planning offices for field editing and evaluation. The local evaluations concluded that greater scale and detail were needed and resulted in the Planning Department's decision to remap the State's land use at Level III rather than Level II and at a scale of 1:63,360 rather than 1:100,000. The department's basic evaluation of both the Level II land-use and land-use change maps was that these maps are useful for some types of general planning as well as demonstrative graphics, although they lack the desired larger scale and detail.

Other Maryland State agencies also saw some potential value in the Level II maps despite the existence of the more detailed, larger scaled, and more current (1973) Department of State Planning maps. The Maryland Geological Survey saw potential in the maps for evaluating

the onshore impact of offshore drilling for oil. The Department of Economic and Community Development can use the CARETS land-use and land-use change maps for recognition of patterns and trends within the State. Finally, the Department of Transportation saw some value in the CARETS maps for providing out-of-State land-use information on areas which impact Maryland's transportation planning. Such information was unavailable from the Maryland Department of State Planning's information system.

The Commonwealth of Pennsylvania, having only a four-category statewide land-use map produced by the Office of State Planning and Development, received the CARETS Level II maps (covering only a small portion of the State) quite well. The Pennsylvania Department of Environmental Resources reported several applications for such land-use data including use in the State water plan, the comprehensive water quality plan, and the environmental master plan. The Office of State Planning and Development likewise has a number of applications for Level II data, including use for defining areas of growth and developing land-resource policies. For these two Pennsylvania agencies the CARETS data are now somewhat out-of-date, but their scale is appropriate.

For the State of Delaware, the scale of 1:100,000 for Level II land-use maps is much too small. In fact the State has decided to have its entire area mapped at 1:24,000 in USGS 7-1/2-minute quadrangle format. The State Planning Office reported that the Level II land-use maps are primarily useful for providing a general overview of land use but are not worth investing agency resources. The Department of

Natural Resources and Environmental Control, on the other hand, found the Level II maps valuable for resource studies, for providing a generalized view, and for monitoring land-use change.

Despite the lack of a statewide land-use map, the reaction of New Jersey State agencies to the Level II maps was somewhat negative. The Division of State and Regional Planning and the Bureau of Forestry found little use in the maps because of problems with the classification scheme. The Division of Fish, Game, and Shellfisheries reported possessing some data in greater detail than CARETS provides and anticipates using more comprehensive land-use data being developed by the New Jersey Department of Environmental Protection's Office of Environmental Analysis. The Department of Transportation, however, reported that, despite their small scale, such maps are valuable as an overview and for aviation planning. The Department of Environmental Protection is planning to incorporate the CARETS Level II land-use and land-use change data into the State's coastal area inventory.

Only two of the four Virginia State agencies participating in the evaluation reported any value in the Level II land-use maps. The Virginia Department of Highways and Transportation reported that these maps can be of value for land-use studies of mile-wide strips along both sides of interstate highways as well as for land-use change studies for metropolitan areas of 50,000 population or larger, required by the U.S. Department of Transportation.

Planners in the Division of State Planning saw such maps as having immediate value for educational and public relations purposes. No real analysis would be performed on the data except perhaps a

recognition of the growth patterns they reveal. The Division later informed CARETS researchers that it had transferred county boundary maps to the Level II land-use maps, covering Virginia's coastal zone, mosaicked sheets together by planning district, and color coded and mounted them. The division then used these sheets for display purposes for presentation to regional advisory committees (local government officials and citizens) in discussion of coastal zone management plans. A planner in the division reported that the further processed Level II maps were useful for eliciting discussion among local and regional planners.

The Federal agency evaluation of CARETS Level II land-use maps was similar to that of State agencies. Several Federal agencies interviewed are not direct users of land-resource data; rather, they administer programs involving users of such data or provide advice and information concerning such data. NASA's Chesapeake Bay Regional Data Center at Wallops Island is primarily concerned with CARETS data as it might be needed by users of the center. The Department of the Interior's Office of Land Use and Water Planning, considers itself a clearinghouse to which local, State, and regional agencies can turn for advice. The Office of Environmental Quality, as the staff for the Council on Environmental Quality, has the function of formulating and recommending national policies to promote environmental quality. The National Oceanic and Atmospheric Administration's Office of Coastal Zone Management has the basic function of granting money and technical assistance to the 30 participating States in the administration of the Coastal Zone Management Act. The Federal

Highway Administration (FHA) is not concerned with land-use data per se but rather their use and applications by State highway departments to which the FHA is administering Federal highway aid. Similarly the Department of Housing and Urban Development's Office of Community Planning and Development is concerned with land-use data requirements for those seeking aid under Section 701 of the Housing Act of 1954. Nevertheless, the agencies listed above are well qualified to evaluate CARETS data products because they are in touch with users and are knowledgeable concerning the data requirements of the acts they administer.

Other Federal agency applications for land-use data fall into three broad categories: (1) Land resource information inventory, (2) environmental impact analysis, and (3) environmental modelling.

The Bureau of the Census sees considerable value in Level II land-use maps for defining urbanized areas, providing such data are available 2 or 3 years preceding the taking of the census. For their purposes, Level II maps at smaller scales would also be valuable, especially if covering the whole country. Having recently attended a USGS Land Use Data and Analysis (LUDA) workshop, a Census Bureau representative reported that the LUDA map series at 1:125,000 or 1:250,000 will be of great value as an inventory and map delineation of unincorporated places. Such a map inventory presently exists only on topographic maps. A delineation of unincorporated places is still unavailalbe.

The NOAA Office of Coastal Zone Management reported a need for two types of land-use maps, a generalized map for planning, for which CARETS Level II maps would serve well, and a much larger scaled map for management. NOAA has just compiled a prototype coastal zone

management map at a scale of 1:100,000, covering an area of 1 degree in longitude by 30 minutes in latitude.

Of the three different offices in the Department of Housing and Urban Development with particular interest in land-use data, only one, the New Communities Administration (NCA), found value in the Level II land-use maps. The other offices need much greater detail and scale. The NCA could use such maps to examine the relationship of the new community projects to surrounding areas, to detect growth patterns and rates, and to determine if new communities create growth or just continue trends already begun.

Two of the Federal agencies interviewed found Level II land-use maps useful for environmental impact analysis. The Nuclear Regulatory Commission (formerly part of the Atomic Energy Commission) found value in these maps for initial site selection--narrowing down the site choices for nuclear power plants--and in environmental impact analysis for examining the land use within 80 km of a proposed site and along proposed routes of power transmission lines. Similarly, the Federal Power Commission (FPC) Environmental Assessment Branch found the Level II maps of value as inputs to environmental impact statements for the construction of interstate natural gas pipelines, hydroelectric transmission lines, and pump storage reservoirs. FPC researchers reported that a more detailed classification would make the land-use data more useful.

The Environmental Protection Agency, Office of Research and Development reported three programs for which the Level II maps could be of value. In the Air Quality Maintenance Program, air quality

projects will be developed for a 10-year period based on land use projections, since certain pollution levels can be related to land uses or land-cover features. If air pollution levels are projected to violate clear air standards, then a plan must be submitted to bring air quality up to standards. The Area Wide Waste Treatment Management Program is similar to the Air Quality Maintenance Program but involves water quality. A third program, the Significant Deterioration of Air Quality Program, requires a State to zone its land into three classes by the type of development necessary to maintain certain air quality standards.

Other EPA land-use data applications exist for (1) water-resource studies including the determination of pollution input from basin-wide (non-point) sources and (2) lake eutrophication studies in which the water quality of lakes is correlated with surrounding land uses. In such studies, if 50 percent of lake nutrients are found to have originated from non-point sources rather than from sources that can be controlled by tertiary water treatment facilities, such facilities may not be warranted or effective in controlling pollution.

The Department of the Interior, Fish and Wildlife Service (FWS) reported possibilities for the use of Level II data in monitoring land uses that have an impact on the amount and species of wildlife. FWS representatives reported, however, that in some cases, Level II maps are not as valuable as the high-altitude photography or the more processed change detection overlays. They did report the need for a more detailed land-use classification. For example, FWS has devised 20 categories of wetlands as opposed to the 3 Level II categories used by the CARETS project.

Three agencies of the Department of Agriculture participated in the CARETS user evaluation, and all found the Level II maps useful in support of agency functions. The Forest Service Northeast Region and the Soil Conservation Service, Maryland field office both felt that such maps at such scale and detail of classification would suffice for the USDA Delmarva river basin, the data may never be used for the Delmarva study because they did not exist in digital form when needed. The CARETS project will eventually be able to supply such data when digital has been completed. The Agricultural Stabilization and Conservation Service (ASCS), Environment and Land Use Division reported value in the data for providing land-cover information to help determine conservation needs as the basis of ASCS fund allocation to States. The Conservation Needs Inventory requires the more general land-cover picture that is presented in Level II. Presently the Conservation Needs Inventory is conducted every 5 years and is based on a 2-percent sample.

The discussion of user reaction to Level II land-use maps has focused primarily on positive responses. Negative reaction will be presented separately in the discussion of the data characteristics--currency, accuracy, scale, format, and classification.

1970-72 Land Use Change Overlays

Most of the agencies that found the Level II land use maps of value also found the 1970-72 land-use change overlays useful. This was true for all the planning agency members of the Metropolitan

Washington Council of Governments, for 10 of 15 State agencies, and for 11 of 13 Federal agencies interviewed. Some agencies felt that the land-use data would be of value only if updated periodically.

Various agencies found the Level II land-use maps of value, but did not find the land-use change overlays helpful for varying reasons. One user agency found the minimum mapping size for land-use change (2 mm on the map or 4 hectares on the ground) not small enough. Urban change often occurs in plots smaller than 4 hectares, and a record of only gross changes was not considered sufficient. The New Jersey Department of Environmental Protection found the land-use change too out-of-date to be useful.

Users finding value in the land-use change overlays but not in the land-use maps are interested in a more processed product that provides information (change within a specified period of time) unavailable from any other source. A researcher from the Center for Natural Areas found the land-use data of little value because of the land-use classification scheme but found the land-use change at the same scale and classification useful.

Use of Level II Land-Use Data by Nonparticipants in the User Evaluation Study

Although many users reported potential uses for CARETS data, few of those participating in the CARETS user evaluation actually had used the CARETS Level II land-use maps for work in support of agency functions. Those that had used the maps include the Baltimore District of the Army Corps of Engineers, the Maryland Department of State Planning, the New Jersey Department of Environmental Protection, and the Virginia Division of State Planning and Community Affairs.

To discover other applications by nonparticipants, researchers contacted organizations that ordered large numbers of CARETS maps through the open file system and organizations that had sent inquiries to the CARETS information center. This survey revealed several examples of how CARETS land-use data are being used.

County and regional planning organizations comprised a major group of agencies actually using CARETS land-use data. The Cape May County, New Jersey, Planning Board used the CARETS Level II land-use and land-use change maps (enlarged to 1:48,000) to update the county master plan. The planning office is primarily concerned with general development, not local zoning problems, and thus the Level II classification is sufficient. According to a Cape May County planner, use of the CARETS sheets saved the county the expense of conducting a new land-use survey, amounting to approximately $2,000.

Similarly the Piedmont Environmental Council, a nonprofit research organization in Warrenton, Virginia, involved in a variety of studies from town design to regional analysis, used the CARETS Level II maps, enlarged to 1:63,360, for developing an open space plan for the Loudoun County, Virginia, Open Space Advisory Committee. Researchers superimposed the CARETS land-use maps on a tax map to define open space areas to be secured by easement. According to the Executive Director of the Council, the CARETS maps probably saved $1,000 to $2,000 in time and survey work. The Piedmont Environmental Council obtained the CARETS maps from Loudoun County, which in turn, received them from the CARETS project during its user evaluation activities.

A representative of Virginia's Middle Peninsula Planning Commission reported that the Commission was planning to mosaic the Level II maps, color code them, and use them as the regional land-use map for the district.

The Carroll County (Maryland) Planning Zone Commission has also adopted the CARETS land-use maps. The entire county appears on the Westminster sheet. Planners report that this sheet is valuable as reference for providing a general view of the county's land use.

Betz Environmental Engineers found the CARETS Level II land-use map covering Delaware County, Pennsylvania (Philadelphia Sheet) useful as input into a detailed land-use inventory for wastewater facility planning as required by Section 208 of the Federal Water Pollution Control Act. If such maps had been available for the entire State, they would have been valuable for regional and drainage basin planning in Pennsylvania. If Betz had not obtained the CARETS sheets, their researchers would have had to rely on the next best available source, which might not have been as timely or as easy to reproduce as the CARETS sheets.

Another private organization, Wilcox, Gravatt, and Hacunda, civil engineers, land surveyors, and professional planners of Forked River, New Jersey, obtained complete coverage of the CARETS portion of New Jersey and are using these maps as a general overview and reference. Color coded and mounted, these maps are considered a valuable item for displaying and identifying many phenomena, including developed areas and open space with potential for development.

Although only a few examples are cited here, these reveal that uses exist for Level II data and that CARETS data have saved users money and effort required to obtain the data from other sources. A longer time frame or a more comprehensive survey would probably reveal more extensive use of the maps. Moreover, conversations with users inquiring about the maps but not obtaining them indicate that if such data had been easier to obtain than through the open file system, more agencies would have acquired them and found uses for them.

Land-Use Data Characteristics

The data characteristics section of the CARETS data utility evaluation questionnaire sought to determine how currency, accuracy, the classification scheme, and format affected the utility of the CARETS data, specifically the land-use data. Although many agencies found these data useful, few found them ideal for all purposes because of certain data characteristics.

Few of the user agencies interviewed considered the CARETS land-use data unusable because they were out-of-date. A majority felt that the 1970 Level II land-use data were somewhat out-of-date but still useful, and a considerable number felt that the currency of the 1970 data, though not necessarily ideal, was adequate. These latter include those interested in change trends, those wanting to relate 1970 land use to census data, and those for whom CARETS land-use maps are the only data available. The New Jersey Department of Transportation reported that some of their studies are 10 years in the making and that data 4 or 5 years old are quite adequate.

The question concerning how often a land-use update is needed was answered only by those who found some value in the maps. A majority of local users wished to see an annual update but would accept a maximum interval of 2 years. State users reported a need for updating from every 1 to 5 years. Since the need for updating is directly related to the total amount of changing land use, some States could not propose a specific optimum interval. The New Jersey Department of Transportation expressed the need to update land use in the State's portion of the northeast corridor every 2 years and in the rest of the State every 5 years. For the Pennsylvania Department of Natural Resources, a land-use update would be desirable every year or whenever significant change occurs.

The range of Federal desires for a land-use update is even greater, but nearly all agencies stated a need for updates every 2 to 5 years. HUD's New Communities Administration needs current data for rapidly changing areas and would like an annual land-use update. At the other extreme, representatives of the U.S. Department of Commerce, Bureau of the Census and the USDA Forest Service reported needing land-use updates only every 10 years. The Fish and Wildlife Service expressed a need for a 3-year update for wetlands and a 5-year update for other major habitat classification.

The accuracy of the Level II land-use and land-use change data is an issue that many users have had difficulty approaching. Few users at any governmental level have actually examined the maps for accuracy; most assumed that these maps had some errors but were still useful. Those who did examine the maps for accuracy reported numerous errors, although no agency conducted a systematic accuracy study.

The Prince William County, Virginia, Planning Office reported numerous inaccuracies in the land-use maps--so many as to make the maps of little value. County planners believed the errors resulted from overgeneralization, incorrect interpretation, lack of currency, and the exclusion of areas below the minimum mapping size. The largest error was that of commercial land being classified as residential. In sum, county planners felt that they could draw a more accurate and detailed map than that presented for evaluation. The Arlington County, Virginia, Planning Office found similar inaccuracies for its small urbanized area.

The Delaware Valley Regional Planning Commission found the accuracy of the land-use data to be poor, specifically for the 1970-72 land-use change maps. In comparing the CARETS land-use change map of the Philadelphia sheet to a similarly scaled commission map of residential changes occurring during the same period, planners discovered that the CARETS maps did not include a large amount of residential change.

At the State level three agencies provided specific examples of inaccuracies in the Level II land-use maps. During an initial accuracy check, planners in the Virginia Division of State Planning and Community Affairs detected certain annoying errors, including objects below minimum mapping size (rivers) that they felt should have been mapped and structures hidden beneath tree cover. In one area, a residential development beneath tree cover was misclassified as forest. Researchers for the University of Delaware College of Marine Studies

found interpretation errors in the Lewes-Rehoboth Beach area where shrubby, sandy land was misclassified as nonforested wetlands.

In a comprehensive evaluation of the accuracy of the CARETS Level II land-use maps, the New Jersey Geological Survey compared an area from the CARETS Atlantic City sheet with the same area mapped at 1:24,000 from medium-altitude photography. The agency reported errors attributed to hasty interpretation of details, lack of local knowledge, and omission of details. Some of the errors, however, are best explained by differences in definitions. The New Jersey evaluators, for example, considered forested land subdivided for development but without structures, as "residential" as opposed to the "forest" classification required by the CARETS classification scheme. The evaluators also criticized the CARETS sheets for generalizing low-density residential areas out of existence. Other errors, such as highway crossings classified as sand pits, resulted from the difficulty in making certain distinctions on the high-altitude photography. Finally, the evaluators criticized conditions resulting from minimum mapping size limitations, especially the inclusion of only intersections of major highways and the disappearance of rivers as their widths approach minimum mapping size. The New Jersey State Geologist reported that within the limitations discussed, the CARETS Level II land-use maps seem to have obtained correct interpretations 75 to 80 percent of the time.

Federal agency representatives spent less time in analyzing the accuracy of the land-use maps than those from State or local agencies.

Representatives of the Federal Highway Administration, however, reported weaknesses in the accuracy of the CARETS maps. Although their only concrete example of misinterpretation error involved barren and urban land on the ERTS maps, the representatives felt that both the ERTS- and aircraft-derived land-use maps were inaccurate, poorly drafted, and inadequately edited. They stated that the products would have been improved if professional, well-rounded interpreters had been used. They also believed that major divided highways and their rights-of-way should have been included on the 1:100,000-scale maps.

That most users did not evaluate the land-use data for accuracy suggests another flaw in the CARETS land-use maps--the problem of using them. The Center for Natural Areas found the polygon line maps difficult to read and to use for the location of a specific land use or land-use patterns. Coloring the maps, however, would facilitate their use considerably. Most users did not have the time for coloring and thus could not evaluate the data as well as they might otherwise have been able to do. Most of those using the maps for display did color them.

Users from local, regional, State, and Federal agencies had difficulty arriving at a desired level of accuracy. Some did not understand the concept of map accuracy, how accuracy is determined, or the meaning of "a percentage of accuracy." Nevertheless, most of those interviewed provided desired accuracy levels, which ranged from 80 to 95 percent. For agencies interested in a generalized picture of land use, accuracy is not a large issue; for those needing more specific information, it is. Generally, the larger the scale and the greater the level of detail, the greater is the need for an accurate map.

Evaluation of Circular 671

Among the vital characteristics of any land-use data set are the classification scheme used and the definition of categories within the scheme. The USGS Geography Program exerted considerable effort in obtaining user evaluation of the USGS Land Use Classification System for Use with Remote Sensor Data. But CARETS investigators believed that user evaluation of the earlier version of the classification scheme used by the CARETS project would provide a valuable test of the scheme through its presentation on completed land-use maps. Such an evaluation might also be a means of correlating land-use data applications or needs (as indicated on the questionnaires) with land-use data categories.

In a series of questions concerning CARETS data characteristics, the questionnaire asked users to indicate their view of the scheme as satisfactory, incompatible with other data but still useful, or incompatible and not useful. A fourth category, "compatible but greater detail desired," might have been included, although such information was also obtained in the evaluation of the land-use and land-use change maps. In any event, the responses provided considerable insight into the land-use data needs of the participating user agencies.

Many of the local, State, and Federal agencies found the classification scheme quite satisfactory for their needs. Of the local planning agencies satisfied with the scheme, most would have preferred more detailed categories, specifically Level III. For these users,

Level II might suffice for display purposes, but Level III or IV would be valuable for analysis. One county planning agency saw Level II rural land-use categories adequate but urban categories insufficient. An environmental planner in an adjacent county preferred greater natural resource differentiation.

The State agency response to the Level II classification was similar to that of local agencies in a general request for more detail. In fact, the State of Maryland's decision to complete a statewide Level III land-use map was based on evaluations of local planning organizations. Other agencies saw the Level II scheme incomplete because it did not include enough detail in urban areas or in vegetational categories such as forests or wetlands.

The New Jersey Geological Survey reported a number of faults in the CARETS classification scheme. Among the criticisms was the vagueness of the nonforested wetland--vegetated category, which to be useful needs to be translated to a specific kind of marsh. A distinction is also needed between partially developed forest areas bordering urban areas and essentially undeveloped forest. Finally, the agency expressed the need for a separate designation for forest land laced with roads.

Some users found Level II categories incompatible with the data needed. A representative of the New Jersey Department of Planning felt that the Level II categories do not suffice as surrogates for needed economic and ecological information. Representatives of the Virginia Division of Mineral Resources felt that not only should a more detailed classification be used, but a scheme is needed that will classify intensity of use.

The Federal agency response to the CARETS classification scheme revealed dissatisfaction, perhaps resulting from the greater amount of functional specialization at the Federal level. As with local and State users, many Federal agencies who found the classification compatible, would have found it more useful if greater detail were provided. A Level III scheme for urban areas is desired by many agencies, especially the Department of Housing and Urban Development (HUD) and the Bureau of the Census. A category such as urban forestry would highly interest the U.S. Forest Service. And such agencies as the Environmental Protection Agency, the Nuclear Regulatory Commission, and the Fish and Wildlife Service, involved in regulation and research, all expressed a desire for Level III or IV information.

More than local or State agencies, the Federal agencies found the USGS system incompatible and its categories not greatly useful as surrogates for more costly or difficult-to-obtain information. HUD representatives suggested a need for reconceptualizing the USGS scheme to account for such qualitative aspects of urban land use as redevelopment, direction of growth, and deterioration. The Federal Highway Administration felt that the USGS classification does not reflect the needs of that bureau as well as does the Standard Land Use Coding Manual, and the information really needed should include the intensities of residences, retail sales, and employment. The Center for Natural Areas criticized the Circular 671 classification for a lack of the expression of values. The Center is interested in quality and the potential for land as well as the location and amount of a particular land use. A representative from the Council on Environmental

Quality found similar fault with the classification and proposed that in addition to land's cover or functions, characteristics of the land (slope, soil, plot size, contiguous uses, proximity to flood plains, density of development, parameters of location in respect to urban centers) that are relevant to environmental quality be incorporated into a land-use classification system.

From the responses of local, State, and Federal agencies, one can conclude that a majority of respondents would have preferred a more detailed land-use classification system than that provided by Level II of the CARETS or USGS scheme. In many cases, those who find Level II adequate, see the greatest value of the CARETS land-use map as a display item for educational or public relations purposes, and as a means of providing a good generalized overview of land-use patterns.

Some agencies need Level III information for limited types of land uses and Level II or I for uses in which they have less interest. The Virginia Department of Highways and Transportation reported that if Level III residential information were included, the CARETS land-use data would meet U.S. Department of Transportation requirements for land-use change data. This ongoing DOT program is designed to verify the occurrence of projected land-use changes, upon which road construction plans largely depend. The University of Delaware College of Marine Studies, on the other hand, needs Level III or IV data for the land-use mapping of wetlands but Level I data for non-wetland areas.

Scale

The problem of scale is second only to detail of classification as a reason for finding the CARETS land-use data not useful. The main issues involved are the minimum mapping size and level of generalization required at different scales. For a land-use map of any scale, some land-use parcels will be too small to be mapped and must be incorporated within an adjacent or surrounding land use. The larger the mapping scale, the smaller will be the parcel of land that will be mapped. Scale is an issue of particular importance for urban areas where land-use parcels tend to be smaller and more numerous.

Representatives of the Department of the Interior Office of Land Use and Water Planning believe that 1:100,000 is a good scale for users. It is close to 1:125,000, the scale the Tennessee Valley Authority, HUD, and the Atomic Energy Commission found to be most applicalbe for regional land-use mapping. Many agencies interviewed need scales larger than 1:100,000 and thus cannot use the CARETS data. For others, CARETS maps can be used but are less useful because of their scale.

A majority of the planning agencies belonging to MWCOG reported needing a scale no smaller than 1:24,000. Many preferred even larger scales. On the other hand, the Economic Council of Northeastern Pennsylvania, with jurisdiction over a primarily rural area, saw 1:100,000 as an ideal scale for its planning purposes and 1:50,000 as that preferred by county planners within the region. The Delaware Valley Regional Planning Commission, which did not find the CARETS

Level II land-use maps of value, uses a scale of 1:130,000 to display regional data.

For State agencies, scale demands vary considerably, although some States attempt to maintain a uniformity or standardization among agencies. The Maryland Department of State Planning found that local users prefer 1:63,360, a standardized mapping scale for that agency. Delaware, a considerably smaller State, finds the best scale for State mapping to be 1:24,000. At this scale, 48 7-1/2-minute sheets will cover the entire State. Pennsylvania, which has contracted with the USGS for complete LUDA land-use coverage, reported a scale between 1:100,000 and 1:125,000 as the best for a State land-use map; the LUDA compilation scale is approximately 1:125,000. In New Jersey, the Department of Transportation reported some difficulties in using 1:100,000-scale data rather than their working scale of 1:2,400. Finally, although the Virginia Division of Mineral Resources is committed to the scale of 1:24,000 for all its work, a representative of the Virginia Division of State Planning and Community Affairs found the scale of 1:100,000 ideal.

For many Federal agencies the scale of 1:100,000 poses few problems, but some agencies did report scale deficiencies. HUD's Office of Environmental Quality reported that scales appropriate for city planning should be no smaller than 1:12,000 and those appropriate for regional (SMSA) planning, 1:24,000. HUD's National Flood Insurance Program needs urban area land-use data at scales of 1:5,000 and larger. The Environmental Protection Agency sees the

need for a scale of 1:24,000, and the Federal Power Commission prefers 1:50,000.

Format

In a few cases, users objected more to format of the CARETS maps than to the scale. The Virginia Division of Mineral Resources reported that, although it could live with conflicts in scale, conflicts in format between CARETS and 7-1/2-minute format sheets cause real problems. Similarly, representatives of the Center for Natural Areas and the Environmental Protection Agency criticized the CARETS format for being difficult to work with and for not conforming to standard mapping formats.

ERTS Level I Land-Use Maps, 1972, 1:250,000

The ERTS Level I land-use map at a scale of 1:250,000 received highly negative reactions from most users interviewed. The general response was that such maps are much too generalized and at too small a scale to be of any value. Even most users responding favorably to these maps did so only because they believe that any additional data can be of some value at the present time when almost no data are available. The USGS Public Inquiries Office reported no inquiries concerning these maps in the 6-month period they had been on open file (August, 1974 - January, 1975), and the private firm processing a large majority of reproductions of CARETS maps reported only one request for the copies of ERTS maps in the same period of time. A representative of the NASA Goddard Space Flight Center expressed the

belief that the CARETS ERTS-derived land-use maps reflect poorly on ERTS as a source of land-use data, especially in view of the capabilities of the ERTS computer compatible tapes.

Regional and multijurisdictional agencies found the most value in the ERTS Level I land-use maps. A representative of the MWCOG Information Center said that a high public demand for generalized land-use maps such as those derived from ERTS imagery existed, and that such a map would be valuable for distribution. The Interstate Commission on the Potomac River Basin, encouraged by cost and time advantages, mapped the Potomac River basin at Level I using ERTS imagery. Representatives of the Economic Council of Northeastern Pennsylvania, the regional planning agency for a predominantly rural seven-county area lying outside the boundaries of CARETS, saw value in the ERTS maps for providing a quick and inexpensive overview. The agency inquired about the possibility of contracting the USGS Geography Program for the manual mapping of its region using ERTS imagery.

Planners from the Delaware Valley Regional Planning Commission, which has produced a series of 29 environmental overlays, preferred the Level I ERTS land-use maps to the Level II aircraft maps. The Level II maps compete with but are inferior to maps the commission has already produced, whereas the ERTS land-use maps provide a needed generalized overview.

This need for a highly generalized land-use map is well illustrated by the case of the Baltimore District of the Army Corps of Engineers. Unaware of the production of the CARETS Level I, 1:250,000-scale land-use map, the Corps reduced the scale of the CARETS 1:100,000-scale Level II

land-use maps to 1:250,000. They then converted the maps from Level II to Level I categories differing from the CARETS classification only in the inclusion of an industrial land-use category. These sheets are to be used in the Chesapeake Bay Study Group's report to provide a good visual presentation of land use in the region and to display how land use relates to other factors.

The U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (USDA/ASCS) Environment and Land Use Division saw value in the ERTS Level I maps for use in selecting counties to participate in programs based on their amounts of forest, wetlands, or other ground cover categories. With the digitization of the ERTS-derived land-use maps by county, the resulting area summaries may prove to be of value.

One organization not participating in the evaluation but having contact with CARETS investigators through the CARETS information center, the NUS Corporation, used the Level I land-use maps to aid in the description of land and water uses within a 10-mile radius of a proposed nuclear ship-building facility in Newport News, Virginia. NUS researchers used the information obtained in a preliminary study for the U.S. Maritime Commission.

The manually interpreted ERTS Level I land-use maps failed to interest most users because of their small scale and gross generalization. Organizations that were interested, however, required a generalized product cheaply and quickly produced.

Census Tract and Cultural Feature Overlays

The CARETS census tract and cultural feature overlays were designed in the same format as the 1:100,000-scale land-use maps to enable a user to register this additional information with the land-use maps. Neither set of overlays, however, evoked much interest from users at any level. Users interested in these sheets form a small subset of those finding the Level II land-use maps of value. User agencies as a whole found approximately the same value in the two different products and generally observed that these data sets are readily available from other sources.

The census tract and political boundary overlays, were designed for relating land use to socioeconomic data and for identifying political areas on the land-use maps. An official of the Department of the Interior Office of Land Use and Water Planning predicted that States would not be interested in these overlays because State agencies seem to have little desire for census data on a spatial basis. The Bureau of the Census, however, found the overlays useful despite the availability of similar data from the bureau itself. The USDA/ASCS reported potential use of such maps by field representatives studying public access for hunting and hiking.

Several potential applications for the cultural and locational feature overlays have been recognized, including relating transportation and communication facilities to surrounding land uses. Most of the users responding positively toward these products reported a usefulness for providing locational cues. A few users, like the Federal Power

Commission, believe that their own researchers can compile more comprehensive and useful cultural feature maps than those produced by the CARETS project.

Landforms and Surficial Materials Maps

The response of user agencies to the landforms and surficial material maps was somewhat mixed. Because only a seven-sheet area of southeast Virginia was mapped and available for user review during the evaluation, most local, State and regional users could not examine maps covering their jurisdictions or areas of interest. CARETS investigators conducted the MWCOG evaluation without the benefit of these maps, but 9 out of 11 agencies interviewed responded that such maps would be useful.

The Southeastern Virginia Planning District Commission, the only local or regional planning organization interviewed whose jurisdiction was covered by the landform and surficial material maps, found such maps very useful. On the other hand, none of the Virginia State agencies interviewed found these maps to be of much value. The Division of State Planning and Community Affairs saw the maps of little value because such data already exist at greater detail. The Division of Mineral Resources, the most qualified agency to evaluate these maps, considered them an intermediate step, not detailed enough to be useful. According to division representatives, superior sources of such data are available.

A majority of all State agencies interviewed saw little value in these sheets, some for lack of need and others because of the characteristics of the data. As in the case of Virginia, the Pennsylvania Geological Survey found the maps of little use because of the existence of greater detailed soil and geology maps. The Maryland State Geologist, however, liked the maps' combination of slope and relief data and felt that, although the scale negates their value for use on the county or local level, these maps might be useful for a regional approach to planning. A representative of the Delaware Department of Natural Resources and Environmental Control also saw some use in these products, providing they are not too costly. Finally, the New Jersey Department of Transportation reported that the generalized surficial materials maps would be good encugh for preliminary site studies in airport planning.

The Federal agency response to the landforms and surficial materials maps was similar to that of State agencies, with 7 positive responses out of 21 interviews with agency representatives. Most of the representatives responding positively did not cite specific projects for which the geology data might be useful. In many cases the data's value would depend upon a specific project that needed such information.

One highly negative response to these maps came from representatives of the Federal Highway Administration (FHA) who considered the maps "insufficient" and "backwards" in following a format that highway departments cannot use. Highway departments need to know the location of specific deposits of sand and gravel suitable for highway construction--

information that the CARETS maps do not provide. The FHA representatives also felt that highway departments should have been consulted concerning such surficial materials maps, since they need them and have been making similar maps for at least 30 years.

Orthophotoquads and Orthophotoquad Land-Use Overlays

The USGS orthophotoquad and its land-use overlay were the largest scaled products presented to users in the CARETS data evaluation study. These products were similar to the high-altitude photography in that they were very popular with users, including those who found little value in most of the other products.

Local and regional users particularly liked the larger scaled data. All of the local users responded positively toward the orthophotoquads. The local users did not evaluate the orthophotoquad land-use overlay, an experimental Level II land-use map compiled on a 7-1/2-minute orthophotoquad by the USGS Topographic Division. Representatives of the RADCO Planning District Commission (Fredericksburg, Virginia) found the orthophotoquad land-use overlays, which cover the Fredericksburg area, to be the most useful of the CARETS products.

The State agency response to the orthophotoquads was also positive, with 14 out of 24 agencies finding these products useful in support of agency functions. All Delaware State agency representatives saw the orthophotoquads as useful, to some extent a reflection of the State's decision to have its land use mapped at 1:24,000. Most New Jersey agencies likewise reported usefulness in these orthophotoquads, and New Jersey has already obtained privately flown 7-1/2-minute

quad-centered, medium-altitude photography that has been enlarged to a scale of 1:24,000 and is available to the public from reproducible transparencies. This photography, however, has not been geometrically rectified.

The evaluation of these orthophotoquads was particularly relevant in Virginia since the Virginia Division of Mineral Resources contracted with the USGS Topographic Division for the production of 26 orthophotoquads for selected areas of rapid change within the State. Some of the completed sheets are the only orthophotoquads presently available for the CARETS region. The Virginia Division of Industrial Development found the orthophotoquads and land-use overlays as the only products useful in support of agency functions. A representative of the Virginia Division of State Planning reported the orthophotoquads and overlays to be of little value because the division needs a broader view than they provide.

Other State agencies as well, like the orthophotoquads. In Maryland, users from the Department of State Planning, the Geological Survey, and the Department of Transportation saw the orthophotoquads as valuable. Finally, the Pennsylvania Geological Survey and the Department of Environmental Resources also considered the orthophotoquads useful.

Federal agency users generally liked the orthophotoquads and to a somewhat lesser extent, the land-use overlay. Some agencies more interested in a processed product, however, saw more applications for the land-use overlays than the orthophotoquad. The orthophotoquads

were of particular interest to agencies dealing with urban phenomena (HUD, FHA, Census) and those involved in environmental impact analysis and environmental modelling (EPA, FPC, Fish and Wildlife Service, Nuclear Regulatory Commission).

Computer Plots of Land-Use and Computer Summaries

In all but one case, user agencies evaluated computer plots of land use and computer summaries of land-use areas without examples from their area of interest, because most of the land-use data had not been digitized at the time the user workshops and evaluation interviews were conducted. This may be of no great significance, however, since users seemed to have little difficulty understanding the nature of these products or responding to them.

User reaction to the area summaries and computer plots was equally positive for local and State agencies, but Federal agency users expressed a marked preference for area summaries. The present availability of land-use area summaries from other sources seems to have decreased the value of this product for some users.

Local planning agencies were the most positive concerning the products, with 9 out of 11 agencies finding value in both. The two county planning agencies not interested believed that the area summaries for needed data could be obtained from better sources or that the inaccuracy and small scale of the Level II data would invalidate such products. The Southeastern Virginia Planning District Commission, the only jurisdiction to receive computerized plots and area summaries, found such data useful despite a lack of compatibility of CARETS

land-use categories with some of the categories the commission normally uses.

The State agency response was not as positive as the local reaction, with only 10 and 9 positive responses respectively for the computer plots and area summaries. The fact that no Maryland State agencies were interested in such data is probably best explained by the existence of the Maryland Automated Geographic Information System (MAGI), a competing source of computerized land-use data. Although most State agencies responding positively did not list applications for such data, the Virginia Division of Mineral Resources found the area summaries useful for analysis of trends and for information in support of project proposals.

Federal agencies generally found little utility in the computer plots of land use but considerable value in land-use area summaries. The computer area summaries were the only CARETS products that the Council on Environmental Quality (CEQ) can use--as part of a national environmental statistical package to be part of the CEQ next annual report. The Bureau of the Census was also enthusiastic about computer land-use area summaries and even suggested a willingness to pay for the publication of such summaries for LUDA maps if the USGS does not publish them. The Baltimore District Corps of Engineers, as well, needs land-use area summaries for its final report on its Chesapeake Bay study, and will include such CARETS data if they are available by the time of publication. And the USDA Soil Conservation Service is interested in land-use area summaries by drainage basin for its Delmarva river basin study.

Federal agencies involved in environmental modelling, monitoring, and impact assessment found the area summaries of particular value. The Environmental Protection Agency reported these products of value for use with EPA-calculated coefficients to estimate pollution loads from area sources and for use in drainage basin and eutrophication studies. The Nuclear Regulatory Commission saw value in the computer area summaries as a quick way of checking land-use information supplied by a utility wishing to build a nuclear power station. And the Fish and Wildlife Service needs such data for documentation in its wetlands inventory. Federal Power Commission representatives involved in environmental impact assessment, however, reported that the CARETS area summaries would be of little value to them, since researchers rely heavily on land-use information supplied by the local jurisdictions.

CONCLUSIONS AND RECOMMENDATIONS

Several initial conclusions can be drawn from the evaluation of CARETS data by user agencies. Foremost, perhaps, is that the data needs of user agencies interviewed are so numerous and diverse that any project such as CARETS would have difficulty meeting a great number of them. Most agencies need greater detail than that provided by Level II of the CARETS classification. Many agencies interested in land resources prefer raw data products, which they can interpret to suit their own needs. Other agencies admit having little expertise in raw data interpretation and prefer the more processed products. Still other users express the need for more qualitative information

(housing conditions, water quality, suitability of land for differing purposes) than that supplied by CARETS products.

Users requiring land-resource data express three basic attitudes toward the different data types in the CARETS evaluation. Some see the data as extremely useful, being the best existing source, facilitating agency functions, saving money, and providing information previously unobtainable or prohibitively expensive. A second attitude is that a data product might be used and might even be valuable to have but is not vital to operations. The third is that a data product for various reasons cannot be used or is inferior to already existing products.

The attitude that the data might be somewhat useful predominates among users at all governmental levels. Although users mentioned many potential applications for the processed products, they provided relatively few examples of the actual use of any products. This can be explained by the short interval between the presentation of the CARETS products and the follow-up evaluation interviews, and the fact that many projects are tailored to meet the availability of existing data. Although agencies may not have present projects requiring such data, future projects may well be designed with the availability of CARETS data in mind.

One must also recognize that the use of the CARETS data was limited by their availability, and that sample products provided to users were not always in formats that could be readily used. The most well received product--the high-altitude color-infrared photography--is being used by many of the organizations interviewed because it has

been available for several years and because complete coverage exists for all of CARETS. For much of the region multiple coverage is available. Other products such as orthophotoquads and surficial geology maps, however, are available only for extremely limited areas. The difficulty of obtaining full-sized and stable-base copies of the land-use maps through the USGS open file system discouraged somewhat the use of the maps. Moreover, products not available at the time of the evaluations, such as area summaries and computer plots might have been used had they been available.

User attitudes towards the CARETS land-use maps varied. Few users saw much value in the Level I ERTS-derived land-use maps. Those who saw utility in such maps wanted a very broad, generalized, inexpensive overview. Although many users reported that the Level II land-use maps are useful in support of agency functions, few users found these maps ideal for their purposes. The users interviewed generally found the Level II land-use maps to be not as timely or accurate as they might want but still useful. Few agencies examined the maps for interpretation errors, but those who did, found errors. Users generally desire a level of accuracy ranging from 80 to 95 percent. Most users commented on detail and scale before accuracy.

Although no single scale, format, or level of detail could please all potential CARETS users, a Level III land-use interpretation, emphasizing the user's specific interest, and conforming to USGS standard mapping formats, would be of greater value than the CARETS maps in their present format. Color maps would have aided agencies in their use of and evaluation of such maps. For many users, scale is

a vital factor. But a scale large enough to please urban planners and to be of value for site planning will not provide the regional overview desired by many regional and State agencies. The scale of 1:100,000 is a compromise that is adequate for some but not for others. Agencies have proposed larger scales such as 1:62,500, 1:24,000, and 1:50,000 as more appropriate for local and urban uses.

CARETS products received negative responses for several reasons that involve the data characteristics and the diversity of participating users. For some users, the applications of remote-sensor data are not well understood nor are the applications of land-use data as surrogates for much more costly and difficult-to-obtain information. Also, the urbanized nature of part of CARETS, the complexity of its land-use patterns, and the sophistication of some of its planning organizations help explain the lack of acceptance of the generalized land-use view provided by CARETS land-use maps.

In conclusion, investigators can make certain recommendations concerning user needs. Many of these reflect user desire for more detailed information. Some of these have been part of the original CARETS design but were abandoned during the project. Others have been direct suggestions of users during the evaluation. These recommendations are listed below:

1) A more thorough survey of land-use data needs should be made before data are produced to obtain a better idea of what products will be useful. Although the CARETS project did survey data requirements at its initial user conference, it did not obtain such important information as the level of detail needed by all prospective users.

2) A single inventory of land-use data is not sufficient. A program to provide periodic updates of land use should be initiated.

3) The use of Level III categories for the land use mapping of residential areas as well as other urban and rural land uses would greatly increase the value of the data to users.

4) Any further land-use mapping efforts should be compatible with USGS standard mapping formats and scales (1:24,000, 1:62,500, 1:250,000).

5) The USGS should provide a multi-level, multi-scale land-use mapping capability to allow user agencies to select the type of data that most suits their needs.

6) Producing color-coded land-use maps, though expensive, will greatly enhance their value to users. The Census Cities color-coded land-use map of the Washington, D.C. urbanized area has been a very popular product.

7) High-altitude aircraft photography, found to be the most popular and useful product by user agencies at all levels, should be flown operationally for urban areas.

8) If larger scale mapping of urban areas cannot be provided, large-scale, color-infrared photography should be made available to users.

9) The USGS orthophotoquad is a popular product especially with urban-oriented and local users and those interested in site specific data. The production of orthophotoquads should be increased, especially for areas of rapid change or critical environmental concern.

10) A better means of making map products available to users than the USGS open file system should be devised. Possible alternatives to the present system include increasing the size of the Public Inquiries Office staff, contracting a private firm for the requested map reproductions, or the microfilming of such products and having copies produced from microfilm.

11) Service at the EROS Data Center (EDC) should be improved. Several users have complained about EDC's poor and slow service. Such service has surely discouraged many users from obtaining remote-sensor data.

REFERENCES

Anderson, J. R., Hardy, E. E., and Roach, J. T., 1972, A land-use classification system for use with remote-sensor data: U.S. Geol. Survey Circ. 671, 16 p.

Crowder, Robert, Porreca, Robert, and Tarantino, James, 1974, LUNR (Land Use and National Resource) inventory survey of users: Albany, N.Y., State of New York Office of Planning Services, 39 p.

Earth Satellite Corporation and Booz-Allen Applied Research Corporation, 1974, Earth resources survey benefit-cost study: Prepared for USGS under contract 14-08-0061-13519. Available from Natl. Tech. Inf. Service, Springfield, Va. 22151 as PB-238702-SET.

Goodell, H. G., Woolheater, C. M., and Echternacht, K. L., 1972, Environmental application of remote sensing methods to coastal zone land use and marine resource management: U.S. Geol. Survey interagency rept. USGS-243, 138 p. Prepared by Univ. of Va. under contract 14-08-001-12540. Available from Natl. Tech. Inf. Service, Springfield, Va. 22151 as PB-214547.

McAllister, Donald M., ed., 1973, Environment: a new focus for land use planning: Washington Natl. Science Found., 328 p.

U.S. Army Corps of Engineers, Baltimore District, 1973, Chesapeake Bay existing conditions report - summary: Baltimore, Md., 126 p.

Appendix A

Representation at the CARETS Initial User Conference

June 11, 1971

Representation at the CARETS initial user conference
June 11, 1971

DEPARTMENT OF THE INTERIOR

- U.S. Geological Survey
- Bureau of Outdoor Recreation
- National Park Service
- Bureau of Indian Affairs
- Bureau of Mines
- Bureau of Land Management
- Office of Water Quality Research

DEPARTMENT OF TRANSPORTATION

- Federal Highway Administration
- U.S. Coast Guard

DEPARTMENT OF DEFENSE

- Office of Naval Research
- Army Corps of Engineers
- Industrial College of the Armed Forces
- Office of Civil Defense
- U.S. Army Topographic Command
- U.S. Naval Oceanographic Office

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

- Office of New Communities Development
- Office of Research and Technology

DEPARTMENT OF AGRICULTURE

- Statistical Reporting Service
- Program Performance Division
- Agricultural Research Service
- Soil Conservation Service

DEPARTMENT OF COMMERCE

- Bureau of the Census
- Economic Development Administration
- National Oceanographic and Atmospheric Administration

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

- NASA Headquarters
- Goddard Spaceflight Center
- Langley Research Center
- Manned Spacecraft Center

NASA (continued)
Wallops Station

OTHER FEDERAL ORGANIZATIONS
Environmental Protection Agency
Office of Emergency Preparedness
Office of Science and Technology
Council on Environmental Quality
National Science Foundation
Smithsonian Institution
National Academy of Sciences
National Academy of Engineering
Oak Ridge National Laboratories

VIRGINIA STATE GOVERNMENT

Department of Highways
State Air Pollution Control Board
Division of State Planning and Community Affairs

MARYLAND STATE GOVERNMENT

Department of State Planning
Department of Chesapeake Bay Affairs
Fish and Wildlife Administration
Maryland Geological Survey
Department of Economic and Community Development
Department of Water Resources
Maryland Environmental Services
State Roads Commission

DELAWARE STATE GOVERNMENT
Department of Natural Resources and Environmental Control
Department of Agriculture and Forestry
State Planning Office

PLANNING COMMISSIONS

Peninsula Planning District Commission (Hampton, Va.)
Southeastern Virginia Planning District Commission (Norfolk, Va.)
Regional Planning Council (Baltimore, Md.)
Metropolitan Washington Council of Governments
Northern Virginia Planning District Commission
Appalachian Regional Commission
Department of City Planning, Norfolk, Va.
Department of City Planning, Virginia Beach, Va.
Interstate Commission on the Potomac River Basin
Delaware River Basin Commission
Prince Georges County (Md.) Executive's Office
Anne Arundel County (Md.) Executive's Office
Washington, D. C. Mayor's Office

OTHER INSTITUTIONS

Coastal Plain Center for Marine Development
National Association of Counties
Washington Center for Metropolitan Studies
Institute for Defense Analysis
Carnegie Institute
Chesapeake Research Consortium
Natural Resources Institute of Maryland
Association of American Geographers
National Geographic Society
Virginia Institute of Marine Science
Virginia Polytechnic Institute
The Johns Hopkins University
University of Virginia
University of Iowa
University of Delaware
University of Maryland
Cornell University
East Tennessee State University
Old Dominion University
Ohio State University
George Washington University
American University

CORPORATIONS

Virginia Electric Power Co.
Potomac Electric Power Co.
Delaware Power and Light Co.
Baltimore Gas and Electric Co.
General Electric Space Division
Grumman Corporation

Appendix B

CARETS User Evaluation Questionnaires

CARETS User
Evaluation Form #3

DATA PRODUCTS	Useful in support of agency functions: Yes	Useful in support of agency functions: No	Useful but only if provided by Federal Government	USEFUL ENOUGH TO INVEST OWN RESOURCES: Willing to obtain on cost sharing basis	USEFUL ENOUGH TO INVEST OWN RESOURCES: Need additional funds to obtain	USEFUL ENOUGH TO INVEST OWN RESOURCES: Have resources to develop in-house	Not detailed enough	IS NOT USEFUL: No capability	IS NOT USEFUL: Too interpreted	IS NOT USEFUL: Other (specify)
High-altitude color-infrared photography 1:120,000										
Skylab - photography										
ERTS imagery										
Photomosaic with UTM grid, 1970 black and white 1:100,000										
Land-use map 1:100,000 1970 Level II, aircraft data 1972										
1970-72 land-use change 1:100,000 Level II, aircraft data										
Census tract overlay in SMSA's, county boundaries, outside SMSA 1:100,000										
Cultural and locational feature, overlay 1:100,000										
1972 land-use 1:250,000 derived from ERTS imagery - Level I										
Generalized geologic maps, map units comprised of slope surficial materials and engineering characteristics 1:100,000										
USGS Orthophotoquad 1:24,000 - 1:50,000										
Orthophotoquad land-use overlay 1:24,000										
ERTS gridded image 1:500,000										
Topographic black and blue line overlay for ERTS Level I land use 1:250,000										
Computer plots of land use										
Computer data listings and land-use area summaries										

CARETS User
Evaluation Form #4

CARETS DATA UTILITY EVALUATION
(Check or Fill Out if Applicable)

1. DATA CHARACTERISTICS	High-altitude color-infrared photography	ERTS imagery	Photomosaic 1:100,000	Land use 1:100,000	Land-use change 1:100,000	ERTS land use 1:250,000	Other (specify)	Other (specify)
Currency of Data:								
Adequate								
Somewhat out-of-date but still useful								
Out-of-date and not useful								

How often would this data need to be updated for your project/application?

Accuracy of Data:								
No errors detected								
Some errors, but data still useful								
Too many errors to be useful								

What level of accuracy would you consider necessary for your project/application?

Utility of Classification Scheme:								
Satisfactory								
Incompatible with other data but still useful								
Incompatible and not useful								

What changes would be required to make this data more useful to you for this project/application?

CARETS User
Evaluation Form #4

CARETS DATA UTILITY EVALUATION
(Check or Fill Out if Applicable)

2. DATA UTILIZATION	High-altitude color-infrared photography	ERTS imagery	Photomosaic 1:100,000	Land use 1:100,000	Land-use change 1:100,000	ERTS land use 1:250,000	Other (specify)	Other (specify)
What analysis was or will be performed on data:								
Measurement								
Summarization								
Correlation								
Modelling								
Projections								
Other:								

What was or will be the main use of the data:								
Analysis								
Display								

3. DATA USEFULNESS

Data was or will be used for the following purposes:								
General background information								
Specific study/analysis								
Specific recommendations to decision making authority								
Educational purposes								
Public relations purposes								
Information supplied to another person or agency								

4. COST CONSIDERATIONS

Out of your total current or upcoming year's budget for land-use data collection, please estimate the percentage or total amount you would allocate for each type of data product for your area								

Please estimate the percentage or absolute amount of your total operating budget devoted to land-use data collection, including procurement of aerial photography.

Appendix C

Agendas for CARETS User Evaluation Workshops

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

SATELLITE DATA TO ASSIST LAND USE PLANNING

U.S. Geological Survey--Metropolitan Washington Council of Governments

Workshop for MWCOG Planning Directors
March 26, 1974
U.S. Geological Survey
National Center
Reston, Virginia 22092

REVISED AGENDA

I. 9:30 - 10:30 a.m., Director's Conference Room, Room 7A413

1.	Opening Remarks	William Fischer Chief Scientist EROS Program
2.	Objectives of USGS/COG Project	Robert H. Alexander, USGS Frank Goodyear, MWCOG Stuart Bendelow, MWCOG
3.	Workshop Plan and User Evaluation	Robert Alexander, USGS
4.	Data Products Display and Check List	Ken McGinty, USGS

II. 10:45 - 12:30, CARETS Project Office, Room 2D107

Presentation of Data Products to Groups of 5 or 6:

CARETS Project Team Leaders:
Peter Buzzanell
Katherine Fitzpatrick
Harry Lins
Ken McGinty

Lunch Break

III. 1:30 - 2:30 p.m., CARETS Project Office, Room 2D107

Discussion and Demonstration of Computer Processing	Robin Fegeas, USGS Robert Alexander, USGS

CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE (CARETS)

Workshop for State Agency Representatives
23 October 1974
U.S. Geological Survey, Geography Program
National Center Auditorium
Reston, Virginia

Purpose: To explain experimental land use data products, derived from satellite and high-altitude aircraft remote sensing sources, and to receive critique of those products from potential users.

AGENDA

9:15 - 9:30 - Registration

9:30 - 9:45 - Welcome and Introductory Remarks
James R. Anderson, Chief Geographer, USGS

9:45 - 10:00 - CARETS Project Objectives and Purpose of User Evaluation
Robert H. Alexander, Principal Investigator CARETS Project

10:00- 10:30 - Maryland Automated Geographic Information System (MAGI) Presentation
John Antenucci, Maryland Department of State Planning

10:30- 12:00 - Work Group Sessions for Discussion and Presentation of CARETS Data Products

12:00- 1:30 - Lunch

1:30- 2:00 - Data Products Evaluation and Follow-Up

1:45- 2:15 - Geographic Information System Support
Robin Fegeas, USGS Geography Program

2:15- 3:00 - Land Use Maps and Information from ERTS Computer-Compatible Tapes
James R. Wray, USGS Geography Program

Appendix D

Organizations and Representatives Participating in the CARETS User Evaluation Program

ORGANIZATIONS AND REPRESENTATIVES
PARTICIPATING IN THE CARETS USER EVALUATION PROGRAM

Metropolitan Washington Council of Governments Planning Agencies

Arlington County, Virginia, Planning Office - May 9, 1974
John Gessaman
Robert Wheeler

Fairfax County, Virginia, Office of Comprehensive Planning - June 14, 1974
Robert O. Otto

Loudoun County, Virginia, Department of Planning/Zoning - May 16, 1974
Mark Kavanaugh
Joe Trocino

Maryland National Capital Park and Planning Commission - May 15, 1974
Frank Jaklitsch (representing Peince Georges County)
Loretta Rohr (representing the bi-county organization)
John Stuart (representing Montgomery County)

Metropolitan Washington Council of Governments - June 20, 1974
Faith Vander Clute
Robert T. Dunphy
Frank Goodyear
Ed Johnson
Khrisna Murthy

Montgomery County, Maryland, Department of Community and Economic Development - June 17, 1974
Edwin Dassori
Ted Graham (Montgomery County Environmental Planning Office)
Oswaldo Ocando
Lee Pasarew

National Capital Planning Commission - May 10, 1974
Francis Deter
George Oberlander
Martin J. Rody
Leo Schmittel
Richard B. Westbrook

Northern Virginia Planning District Commission - April 29, 1974
Ralph Basile

Prince William County, Virginia, Planning Office - May 8, 1974
Anthony Archer
Henry Bibber
John Clark
Tom Davis
Randy Hodgson
Jeff Middlebrooks

Regional Planning Agencies

Delaware Valley Regional Planning Commission - December 16, 1974
Jessica Krow
Mike Ontko
Roger Smith

Economic Development Council of Northeastern Pennsylvania - December 2, 1974
Leonard Carlin
Adam Crist
Leonard Ziolkowski

Interstate Commission on the Potomac River Basin - November 25, 1974
Richard Dworsky
Dan Sheer

RADCO Planning District Commission (Fredericksburg) - June 21, 1974
Ronald Rebman

Southeast Virginia Planning District Commission - June 18, 1974
Arthur Collins

State Agencies

DELAWARE

Delaware Department of Highways and Transportation (Unified Systems Planning) - December 10, 1974
Raymond H. Malefant

Delaware Department of Natural Resources and Environmental Control (Planning and Hearing Office) - December 10, 1974
Rudolph F. Jass

Delaware Department of Natural Resources and Environmental Control (Water Resources Section) - December 10, 1974
James L. Pase

Delaware State Planning Office - December 10, 1974
John Jagoski

MARYLAND

Maryland Department of Agriculture - November 22, 1974
Dale Churchy

Maryland Department of Economic and Community Development - November 22, 1974
Jeff Evans

Maryland Department of Health and Mental Hygiene - November 14, 1974
Merrill Glasser

Maryland Department of State Planning - June 3, 1974
John Antenucci
Ed Thomas
Gil Wagner

Maryland Department of Transportation - December 6, 1974
Tom Buchanan
Edwin Crawford

Maryland Geological Survey - December 6, 1974
Emery T. Cleaves
Kenneth Weaver

NEW JERSEY

New Jersey Bureau of Forestry - December 17, 1974
George H. Pierson

New Jersey Department of Community Affairs, Division of State and Regional Planning - February 6, 1975
Dennis Jones

New Jersey Department of Environmental Protection - December 17, 1974
Daryl Caputo

New Jersey Department of Transportation - December 17, 1974
Mike Silvestrov
Douglas Webb
Howard Zahn

New Jersey Division of Fish, Game, and Shellfisheries - December 30, 1974
Frank Tourine

New Jersey Geological Survey - March 21, 1975
Kemble Widmer

PENNSYLVANIA

Pennsylvania Department of Environmental Resources, Environmental Master Planning - December 18, 1974
William McGlade

Pennsylvania Department of Environmental Resources, Pennsylvania Geological Survey - December 18, 1974
Don Hoskins

Pennsylvania Office of State Planning and Development - February 21, 1975
Abe Gottlieb

VIRGINIA

Virginia Department of Highways and Transportation - December 11, 1974
Robert P. Chandler

Virginia Division of Industrial Development - December 4, 1974
June Batchell

Virginia Division of Mineral Resources - December 5, 1975
Paul Daniels
Harry Webb

Virginia Division of State Planning and Community Affairs - November 14, 1974
Keith Buttleman

Federal Agencies

DEPARTMENT OF AGRICULTURE

Agricultural Stabilization and Conservation Service - December 13, 1974
Richard Ensminger
Ray Hunter

Forest Service - December 12, 1974
Alfred G. Darrach
Marvin Meier

Soil Conservation Service - December 13, 1974
John DeGroot
Ted Ifft
Harold Krell
Harold Scholl
Harold Stevens

COUNCIL ON ENVIRONMENTAL QUALITY - December 19, 1974
Edwin Clark

DEPARTMENT OF COMMERCE

Bureau of the Census - November 20, 1974
Robert Aageenbrug
James Davis
Robert Durland

National Oceanic and Atmospheric Administration, Office of Coastal Zone Management - January 3, 1975
Paul Stang

DEPARTMENT OF DEFENSE

Army Corps of Engineers, Baltimore District - January 8, 1975
Noel Beegle

Defense Civil Preparedness Agency - January 2, 1975
John Vacarra

Defense Mapping Agency - December 12, 1974
Mike Mullins
Fred Neininger
Luther Rhodes

ENVIRONMENTAL PROTECTION AGENCY, Office of Research and Development
Charles N. Ehler - January 30, 1975
Robert Holmes - January 3, 1975

FEDERAL POWER COMMISSION, Environmental Assessment Branch - December 12, 1974
Tom DeWitt
Bill Douglas
John Isaacs
Mary Ivory
Lynn Nakata

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

New Communities Administration - November 25, 1974
Gerry Coan
Roy Gast
Lessley Wiles

National Flood Insurance Program - November 25, 1974
Mel Crompton
Charles Lindsay

Office of Environmental Quality - November 20, 1974
Walter Prybyla
Ray Sherry

DEPARTMENT OF THE INTERIOR

Bureau of Outdoor Recreation - December 3, 1974
Bernie Collins
Sam Hall
Jerry Kazmierczak
John Kumb
Ruby Smith
Neil Stout

Fish and Wildlife Service
Richard Curnow - January 16, 1975
Paul Nickerson - January 10, 1975

Office of Land Use and Water Planning - November 27, 1974
Frank Colson
Chuck Meyers

DEPARTMENT OF TRANSPORTATION

Federal Highway Administration - December 3, 1974
James Koka
Walter Manning
Norm Mueller
Frank Perchalski
Harold Rib

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Goddard Space Flight Center Earth Resources Program - January 9, 1975
John Barker
Charles Bohn

Wallops Flight Center - January 27, 1975
Paul Alfonsi
Mike Conger
Dick Dowd

NUCLEAR REGULATORY COMMISSION - January 16, 1975
Stan Echols

University and Research Community

American University Department of Biology - January 10, 1975
Richard Anderson
Dennis McFaden

Center for Natural Areas - January 17, 1975
David Kunhardt

Chesapeake Research Consortium, Inc. - February 21, 1975
Theodore Chamberlain

University of Delaware College of Marine Studies - January 21, 1975
Dave Bartlett

University of Virginia Project for the Study of Coastal Environments - December 5, 1974
Jeffrey Heywood

Virginia Institute of Marine Science - December 9, 1974
John B. Pleasants

Appendix E

Notes Taken During User Evaluation Interviews

ARLINGTON COUNTY, VIRGINIA, PLANNING OFFICE
May 9, 1974

Attending: Robert Wheeler
John Gessaman

As the smallest and most thoroughly urbanized county in the metropolitan Washington area, Arlington County found very little value in CARETS data products. The only products receiving a positive response were the high-altitude photography and the orthophotoquads. The planners reported that Arlington County had detailed land-use data, updated by building permits and thus they had a much better grasp of what was occurring than could be provided by ERTS or aircraft data.

The data were seen as being somewhat out-of-date with some errors. The Circular 671 classification scheme was not detailed enough, although a Level II classification might be of value.

Though the county spends approximately $50,000 for aerial photography surveys, the planners reported that any additional money should be spent on real estate assessment data.

FAIRFAX COUNTY, VIRGINIA, OFFICE OF COMPREHENSIVE PLANNING
June 14, 1974

Attending: Robert O. Otto

The meeting with Robert Otto of the Fairfax County Office of Comprehensive Planning illustrates some of the difficulties in dealing with a large and busy planning agency. It was only after great effort that the meeting was arranged, and then there were two postponements. The original user package was given to Philip Leber of the county's Office of Research and Statistics, who as the only Fairfax County representative at the user conference, forwarded it to the planning office. And Otto, an environmental systems analyst, is relatively new to planning and not totally familiar with all of the land-use data the county presently possesses. Nevertheless, he provided much valuable information.

Otto found only the high-altitude photography, land-use, and land-use change maps, geology maps, and orthophotoquads of value, and the land use and orthophoto sheets useful only if provided by the Federal government. The rest of the products were reported to be either not needed by the county or not as good as already existing data. According to Otto, there is only one copy of the most recent Fairfax County land-use map (1:4,000) which was placed on display at another of the Comprehensive Planning Office's locations. Otto was unfamiliar with the classification system used.

Generally, the data considered useful were seen as somewhat out of date with some errors. Otto felt that an accuracy of 90-95 percent was desirable and an update every 2 years.

A variety of analyses are being performed on the land-use data, including summarization, correlations and projection. As well, the data are being used for general background information, recommendations to decision-making authorities, public relations purposes, and information supplied to another person or agency. The planning office has enlarged two NASA high-altitude photographs (winter and summer coverage) to a scale of 1:4,000 and has used these for display purposes as well as to cross check for the land-use information.

One data set presented exclusively to Fairfax County consisted of land-use area summaries by census tract for the county, derived from dot counting the 1970 land-use maps overlaid by the census tract and political boundary maps. The area summaries evoked great interest, especially the percentages of the county area in differing land uses.

One important point that Otto emphasized during the interview was the need for a CARETS program to train planners in how to use CARETS data. According to Otto, many planners might find a greater use for the CARETS materials if they could better understand how the data were produced, could be used, and could be replicated or updated.

LOUDOUN COUNTY, VIRGINIA, DEPARTMENT OF PLANNING/ZONING
May 16, 1974

Attending: Mark Kavanaugh
Joe Trocino

Planners from Loudoun County, one of the most rural counties of the Washington metropolitan area, with one of the smaller planning organizations, found the CARETS photomosaics, land-use and land-use change maps, and major drainage basin overlays useful in support of agency functions, but at the same time reported that the data were somewhat out-of-date. The map scales were also much too small for the planners, who desire scales no smaller than 1:20,000 and who normally work with scales of from 1:16,000 to 1:600. The land use classification itself was found to be adequate; the county presently has no land-use map or classification system.

Census tract, cultural feature, and geology overlays were not considered useful, nor were ERTS imagery, gridded images or land-use maps, or cultural features overlays. Lack of detail was the major reason for these data's lack of utility, although lack of interpretation capability explains the negative response to the geology overlays.

MARYLAND NATIONAL CAPITAL PARK AND PLANNING COMMISSION
May 15, 1974

Attending: John Stuart (representing Montgomery County)
Loretta Rohr (representing the bi-county organization)
Frank Jaklitsch (representing Prince Georges County)

The evaluation of CARETS data products by planners from the Maryland National Capital Park and Planning Commission illustrates differences among different planners concerning the utility of data. Stuart, Jaklitsch and Edward Murphy (who could not attend the interview) filled out separate questionnaires with somewhat differing responses. All three planners agreed that the high-altitude photography, the photomosaic, generalized geologic maps, orthophoto-quads and computer plots and data listings were useful in support of agency functions. Jaklitsch, however, saw little value in any of the other data, though both Stuart and Murphy saw some value in the land-use and land-use change maps. Only Stuart felt that the census tract maps could be of use. None of the planners viewed the ERTS imagery or land-use maps as having any value for their purposes. All three planners found the land-use data to be somewhat out-of-date but still useful. The classification system was unanimously seen as being satisfactory.

The general reaction of these planners was that some of the data could be useful for display or analysis. These products, however, with the exception of the high-altitude photography and the geology, would not contribute significantly to their already existing data bases.

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS
June 20, 1974

Attending: Frank Goodyear
Robert T. Dunphy
Faith Vander Clute
Ed Johnson
Khrisna Murthy

Though deeply involved in the CARETS evaluation program under contract to GAP, the Metropolitan Washington Council of Governments is also considered an important user, and conseqently, a group of planners from that agency was assembled to provide an evaluation of CARETS products. The personnel interviewed had varying interests and needs and thus responded differently to differing data forms as well as providing important insights into the data needs of planners.

Those data products deemed useful included the high-altitude aircraft photos, photomosaic, 1:100,000 land-use and land-use change maps, ERTS land-use maps, generalized geology maps, USGS orthophotoquads, and computer plots and data summaries. An emphasis, however, was made on the "possible" and "conditional" value of these products.

Dunphy stressed his belief that urban planners are concerned with quantified and spatially located data--primarily dwelling units rather than the area occupied by residences. According to him, such planners don't really want or use land-use data, but need to know the activity characteristics and intensity of use of areas. It is rather the environmental planner who is concerned more with the amount of land occupied by a particular use.

The high-altitude photography derived land-use maps were seen as being of value as a generalized map, especially for one who is not familiar with an area. Faith Vander Clute, in charge of the COG Information Center, described a high public demand for 1:100,000 land-use maps as well as the 1:250,000 ERTS-derived land use maps. Such data was seen as somewhat out-of-date and their accuracy quite difficult to determine. No desired level of accuracy could be provided since the need for accuracy was seen as dependent upon the data's function. The planners felt that the data's greatest use would be for display, although projections might be made based upon land-use changes detected. An important condition for the usefulness of this data was that the data become a continuing source of information, upon which planners could depend. Without this reliability, much of the data could be of little value.

The USGS land-use classification was seen as incompatible with existing data, but still useful. COG's only existing land-use map was compiled at a scale of 1:96,000 in 1967, was colored in, and is hanging on a planner's wall.

MONTGOMERY COUNTY DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT
June 17, 1974

Attending: Stuart Bendelow, COG
Oswaldo Ocando (planner)
Edwin Dassori (programmer/analyst)
Lee Pasarew (planner)
Ted Graham, Montgomery County Environmental Planning Office

Representatives of the Montgomery County Department of Community and Economic Development were fairly positive in their reaction towards CARETS data products, finding only the photomosaic of little use in support of agency functions. Ocando, the contact person with the Geography Program however, felt he had little decision-making authority, and he thus could not provide much of the information concerning the agency's willingness to obtain the data. Edwin Dassori felt that some of the CARETS data could be incorporated into the Montgomery County computer information system. It was also believed that the data might be valuable for the western part of the county, where no good data base exists.

In respect to data usefulness and utilization, the land-use maps were found to be useful basically for providing general background information for the county.

NATIONAL CAPITAL PLANNING COMMISSION
May 10, 1974

Attending: George Oberlander
Martin J. Rody
Richard B. Westbrook
Francis Deter
Leo Schmittel

The meeting with five planners from the National Capital Planning Commission revealed that planners from the same agency are not always in agreement over the value of data, that parts of the user questionnaire were ambiguous to the planners, and that some of the CARETS data were of value to the planners but not for detailed land use analysis.

CARETS land-use and land-use change maps were seen as having value as an informational source for land use of the entire metropolican area, especially since this agency has responsibilities beyond the District of Columbia boundaries, where what is happening to the land is difficult to determine. These planners saw the CARETS data particularly useful in their task of monitoring land-use change around Federal installations and reported that better data for their purposes were obtainable neither through the county government nor Federal agency. At the meeting, arrangements were made to have copies of all land-use maps for the Washington, D. C. SMSA reproduced. A need, however, was expressed for the annual or biennial updating of these land-use maps.

The high-altitude photography was also viewed favorably, if enlarged to a greater scale and updated every 2 or so years. The cultural feature overlays, photomosaic, and orthophotoquads were reported to be useful in support of agency functions. Much interest was also expressed in land-use computer plots and area summaries.

The products reported to have little value inculded the drainage basin overlays, ERTS imagery and land-use maps, and the county boundary overlays.

NORTHERN VIRGINIA PLANNING DISTRICT COMMISSION
April 29, 1974

Attending: Ralph Basile

Ralph Basile's evaluation of CARETS products concluded that the data offered little to his agency. The high-altitude photography could be useful if enlarged to a greater scale; the geology maps could be of value; and ERTS computer compatible tapes seemed to have potential for his interest.

The land-use data had little value because of their small scale and their lack of currency. According to Basile, better methods exist for determining land-use change. He considered 1:24,000 an ideal scale for planning. Although the orthophotoquads and computer plots and data listings of land use could be of some value, the ERTS imagery and land-use maps could not be used.

Basile's basic interest is in determining land resource capabilities. In the Northern Virginia Planning District Commission's Broad Run Watershed study, variables such as surface water, percentage of developed land, vegetative cover, land use, soil erodability, topography, vegetation density, noise, visual attractiveness, seasonably high water table, soil suitability for excavating and grating, and others were computerized by 10-acre grid cells using the UTM grid and the Harvard grid computer mapping techniques. The Broad Run study is a prototype, which will lead to a similar study of the Occoquan basin.

PRINCE WILLIAM COUNTY, VIRGINIA, PLANNING OFFICE
May 8, 1974

Attending: Jeff Middlebrooks
Randy Hodgson
John Clark
Henry Bibber
Tom Davis
Anthony Archer

The planners from Prince William County were quite critical of CARETS products although they did recognize some value in the raw data products. Their greatest interest was expressed in the high-altitude photography, which they saw as useful for environmental purposes. Anthony Archer requested and was sent copies of indexes of NASA-flown photography, which he planned to order for his office. ERTS data were reported possibly to have some value for flood plain delimitation or historical purposes but little value in its image form as a source of land-use information.

CARETS land-use maps were evaluated by Archer and were found to lack needed detail and to be at much too small a scale since the county's basic land-use data is kept in parcel form. More significantly perhaps, was his criticism that the maps were far too inaccurate--either because of overgeneralization, incorrect interpretation, being out-of-date, or not including land-use areas below the minimum mapping size. According to Archer, who conducted the evaluation, many commercial areas were classified as residential and, in general, the county planners could draw a more accurate and detailed land-use map than was presented for evaluation. The group did concede that these maps, if accurate, could be of some use--perhaps for determining critical environmental areas.

The other products considered useful in support of agency functions include the census tract overlays, orchophotoquads, and generalized geologic maps.

REGIONAL PLANNING AGENCIES

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
December 16, 1974

Attending: Jessica Krow
Mike Ontko
Roger Smith

The meeting with the Delaware Valley Regional Planning Commission revealed that the Commission has a need for either greater detailed urban data or a more generalized overview than CARETS Level II land-use maps provide. High-altitude photography and ERTS imagery were both considered useful and are used frequently, but no Skylab coverage is available for the Philadelphia region. The ERTS imagery is useful in providing a regional overview, and the ERTS gridded image can be useful as a display item.

According to Mike Ontko, CARETS Level II maps are not detailed enough and compete with land-use products produced by the Commission--specifically a series of 29 environmental overlay sheets at 1:130,000, displaying topography, slopes, flood plains, open space, surface water, prevailing winds, precipitation, wetlands, forests, population density, and several other phenomena. The CARETS land-use change sheets appear to be deficient in omitting a great amount of change that occurred within the 2-year period. Census tract and cultural feature data are already available at the desired scale. The one land-use product appealing to the Commission representatives was the ERTS Level I land use map, which provides a needed generalized overview.

The surficial materials and slope maps were not considered useful. The geology information is already available.

The currency of most of the CARETS data except the photomosaic was considered adequate. An update of land use for the Philadelphia area would be desired every 2-2.5 years. The accuracy of the Level II land use data was not considered good. The USGS classification was considered incompatible with other data but still useful.

ECONOMIC DEVELOPMENT COUNCIL OF NORTHEASTERN PENNSYLVANIA
December 2, 1974

Attending: Adam Crist
Leonard Carlin
Leonard Ziolkowski (telephone)

The Economic Development Council of Northeastern Pennslyvania (EDCNP) is the regional planning agency for primarily rural Carbon, Lackawana, Lucerne, Monroe, Pike, Schuylkill, and Wayne Counties, Pennsylvania--all outside the

boundaries of CARETS. Like many such agencies, EDCNP possesses little power but must supply information and data to its member jurisdictions. It is thus interested in more generalized data for its own uses as well as more detailed data in which county and city planners would be interested. EDCNP was invited to participate in the evaluation because it expressed a deep interest in CARETS type of data products. EDCNP participation is valuable because the Council represents a large rural region whose planners up to this time have lacked some of the more sophisticated techniques that many of the urban jurisdictions in CARETS have adopted.

Because the EDCNP representatives were interviewed together by telephone, somewhat conflicting views were initially expressed. The differences were, however, rapidly ironed out, and all three men are in agreement with the views that will be presented.

ERTS imagery and the ERTS Level I land-use map were seen as having value at the regional level for providing a quick, dirty, and inexpensive overview. The scale of 1:250,000 was considered sufficient, and Crist even inquired about the possibility of contracting the Geography Program for the mapping of his region using ERTS imagery. Crist is also highly interested in the LUDA mapping program and is anxious to see the mapping of the Scranton 1:250,000 topographic sheet. All three men felt that local planners would see little value in the ERTS land-use maps. The ERTS gridded mosaic of New Jersey, covering the whole EDCNP region was seen as having only decorative value.

The high-altitude aircraft photography was also considered valuable, expecially for the region as a whole. The basic problem with such photography, however, is the Council's lack of expertise or ability to interpret it. The EDCNP planners saw little use for the Skylab photography.

All of the Level II land-use maps, photomosaics, and overlays were well received by the planners, who also suggested a need for overlays for detailed drainage basins and political jurisdictions on the sub-county level. The planners believe that a scale of 1:100,000 is the best for the regional level, but they believe that local planners would want to work with scales at least as large as 1:50,000. The EDCNP is trying to develop a program that will allow for the interface between regional and local, regional and State, and regional and Federal governments.

The representatives believe that the orthophotoquads and orthophotoquad land-use overlays are of marginal use for their planning purposes. They are nice to look at but are not needed at the regional level. Perhaps a scale of 1:50,000 would be more appropriate for local planners.

The planners expressed an interest in obtaining land use area summaries and analytical reports. One of the planners suggested that both his region and the USGS might benefit in respect to air quality information in a study of the Pocono Mountains as an airshed for the New York City area.

Overall, the three planners were very positive about the CARETS data. The scales, minimum mapping sizes, and classification scheme of the CARETS land-use data were all considered appropriate, and the Council would be willing to pay for the desired data if they could obtain funding. Although the data accuracy was not thoroughly examined, Crist replied that the CARETS land-use accuracy is higher than any the region had been able to obtain before. The EDCNP has hired consultants to conduct experiments testing the value of ERTS imagery and high-altitude aircraft photography.

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN
November 25, 1974

Attending: Dan Sheer
Richard Dworsky

The interview with representatives of the Interstate Commission on the Potomac River Basin illustrates how the value of data differs depending upon the user's particular needs. Although Sheer and Dworsky often took opposing views toward the data, between the two of them, almost all the data products were considered useful in support of agency functions.

Dworsky, a forester by training, felt that the ICPRB is not interested enough in land-use but rather is too water oriented. Not only did he like ERTS data as a source for land-use data, but he had a Level I land-use map compiled from EROS Data Center color composite prints (1:250,000) for the entire Potomac River basin. For Dworsky, the broad picture provided by ERTS is valuable, and the scale of 1:250,000 is just right. Such matters as accuracy and currency of data are not of the highest importance. Dworsky hopes one day to produce a land-resources (environmental) atlas for the basin using ERTS imagery as his major data source.

Sheer, on the other hand, is more interested in data for detailed analysis rather than for a broad general overview. He likes the high-altitude photography, the orthophotoquads, the photomosaic sheets. He saw the photomosaic as being particularly valuable for identifying sites and providing a broad perspective--facilitating a process that normally requires the use of numerous topographic sheets.

Most of the other products, including the 1:100,000 overlays and the generalized geological maps were identified as useful or "nice to have" but only for purposes that could readily use data already available. The land-use change map was considered of value for detecting trends.

RADCO PLANNING DISTRICT COMMISSION
June 21, 1974

Atterding: Ronald Rebman

Rebman's general reaction to the CARETS data was positive, although in many cases, the usefulness of the data was considered conditional. The products seen as not being useful in support of agency functions include the ERTS imagery (for a lack of expertise to interpret it), the 1:100,000 photomosaic, the land-use change overlay (because the photorevised topographic map is more useful), and the census tract and county boundary overlays. The latter are of little use because the RADCO Planning District is not within an SMSA and thus lacks census tracts. An overlay showing census enumeration districts for the district would be valuable.

The other products were deemed useful to varying extents. The high-altitude photography was considered useful if provided by the Federal government. The Level II land-use maps were seen as somewhat useful but not detailed enough for all applications. A Level III map is really needed. The major drainage basin overlays could be useful only if linked to a system for retrieving land-use data by them. The ERTS Level I land-use maps and the ERTS gridded mosaic were seen as useful for display purposes but only if provided by the Federal government. Rebman saw the locational and cultural features overlays as useful for display to the public, and these could be developed in-house. And the generalized geology maps were considered useful for providing a planning overview.

The product considered most useful is the USGS orthophotoquad land-use overlay, which covered part of the Fredericksburg, Virginia area, within the RADCO district. Rebman would like to have such photography as used for the orthophotoquad provided in an ongoing program. Both computer plots of land use and data listing would be valuable if provided from the 1:24,000 land-use map on an orthophotoquad base.

At the time of the interview, the RADCO planners had not actually used the CARETS data, but Rebman did present a view of his organization's data needs. He expressed a need for monthly updates of land-use change for urban areas and a 5-year update for rural areas. In respect to accuracy, urban data should be relatively accurate, whereas high accuracy in rural areas is not needed. The USGS classification scheme was considered satisfactory. The basic change in land-use data desired by the RADCO planners is greater detail in urban areas and greater scale. The scale of 1:100,000 is the smallest scale that can be used.

RADCO planners could use Level II data for such analysis as measurement, summarization, correlation, modelling, and projections. The primary uses would be for specific recommendations to decision makers and for educational and public relations purposes.

SOUTHEAST VIRGINIA PLANNING DISTRICT COMMISSION
June 18, 1974

Attending: Arthur Collins (telephone)

The Southeast Virginia Planning District Commission's (SEVPDC) response to questionnaires concerning CARETS data was quite favorable as reported by Arthur Collins, the Commission's Director of Planning. USGS orthophotoquads (1:24,000) seemed to have great potential for planning, although the Commission's planners had not actually seen examples of them. CARETS land-use maps, land-use change maps, and photomosaics were also reported to be useful in support of agency functions to the extent that the agency would be willing to obtain them on a cost sharing basis. The planners also reported that Old Dominion University in Norfolk possesses a photo interpretation capability from which the SEVPDC could receive aid in land-use mapping or updating.

Collins discussed the Commission's project to provide annual land-use change information for urbanized areas to the U.S. Department of Transportation. According to Collins, the CARETS Level II change maps could be used as a check on the changes occurring but, that they are not sufficiently detailed for the DOT requirements.

SEVPDC planners saw the high-altitude color-infrared photography as useful, although its scale is too small. The agency's minimum acceptable scale is 1:100,000. SEVPDC planners made no attempt, however, to enlarge the film transparency either optically or photographically. The ERTS imagery was found to be less valuable but still useful if provided by the Federal government. The ERTS land-use maps (1:250,000), ERTS gridded image (1:500,000), and land-use county boundary overlay for the ERTS land-use, however, lacked too much detail to be of any value to the agency.

One of the most favorable responses was the reaction to the generalized geological maps. The Commission received copies of maps compiled by both Neuschel and Davies, and considered both "excellent" for agency use.

The remainder of the 1:100,000 overlay sheets--drainage basin, census tracts, and cultural feature maps, did not receive a useful rating. Since the SEVPDC already possesses maps of such phenomena, these sheets would not contribute anything to the data base.

The computer data listings and land-use area summaries obtained favorable comment. The basic problem with the data summaries as well as the land-use maps is that the land-use categories are incompatible with the existing land-use code--that of the Standard Land Use Classification Manual. Collins reported that he found very few errors in the land-use data and that the data currency is adequate. Better detail, such as Level III would be desireable.

The SEVPDC evaluation of CARETS data revealed that such techniques of analysis as measurement, summarization, correlation, modelling, and projections had or would be performed on the data thathave been found useful. It also revealed that besides analysis, these data served the purpose of providing general background information, information for educational purposes, and information for supply to another person or agency.

STATE AGENCIES

DELAWARE DEPARTMENT OF HIGHWAYS AND TRANSPORTATION
(Unified Systems Planning)
December 10, 1974

Attending: Raymond Malefant

Raymond Malefant of the Department of Highways and Transportation reported that his agency had little use for the CARETS data products and that it did not use much land-use data per se. Rather, it is concerned with trip generation studies. The coarsest land-use data useable would be Level III. The most desirable scale would be 1:2,400, although the 1:24,000 orthophotoquad might be of some value.

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
December 10, 1974

Attending: Rudolph F. Jass

Rudolph Jass, representing the Department of Natural Resources and Environmental Control's Planning and Hearing Office, believes that any additional information is valuable. He responded quite positively to the CARETS data products, although some of the products, especially the raw data, were considered useful only if provided by the Federal government. Those products considered most useful, which Jass' office might be willing to obtain on a cost-sharing basis, include the 1:100,000 photomosaic, land-use map, land-use overlays, and 1:24,000 orthophotoquads and orthophotoquad land-use overlays. Jass also saw value in computer plots of land use and computer data listings and land-use area summaries. The data products seen as having the least value for Jass' purposes include the high-altitude and Skylab photography and ERTS imagery, gridded mosaic, and Level I land-use maps. Jass felt that, although some of these might be used, they are far too general for his purposes. Much larger-scaled data are needed.

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
(Water Resources Section)
December 10, 1974

Attending: James L. Pase

James L. Pase saw considerable potential for the use of CARETS data for his agency, although much of this is based on one-time use for specific problems rather than operational use. Such products considered marginally useful for "one-time" use include the high-altitude and Skylab photography and the ERTS

imagery, the photomosaic, census tract and cultural features overlays, and the ERTS Level I land-use map. The photography and imagery might be of use for identifying disturbances of the land, delineation of disaster conditions, or for providing a generalized view used as a base for the identification of problems. Pase saw value in the generalized geology maps, orthophotoquads, and computer plots of land use, providing they are not too costly. All these products could be used, but Pase didn't feel they are worth investing a great amount of money to obtain.

The products Pase saw as most valuable were the Level II land-use and land-use change maps and the computer data listings and area summaries. One basic need for such data is to provide a general view and to monitor what is happening to the land--to identify urban areas that are changing and rural areas that are being urbanized. The Level II map is available for resource studies but is inadequate for urban land-use planning. What are needed are two mapping scales--one for resources, the other for urban uses. The scale of 1:24,000 is considered the best for Delaware.

Pase also expressed a need for annual or biennial update of land-use data and an accuracy of greater than 90 percent.

DELAWARE STATE PLANNING OFFICE
December 10, 1974

Attending: John Nagoski

John Nagoski of the Delaware State Planning Office revealed that, although most of the CARETS data could be useful in support of his agency's functions, most were useful only if provided by the Federal government. These include the high-altitude and Skylab photography, 1:100,000 photomosaic, land-use maps, and all overlays. These data are useful for providing a general overview of land use and trends. The products considered not useful--ERTS imagery and gridded image, Level I land-use map and the black and blue line overlay to the Level I map--lack the detail that the State Planning Office needs. The product seen as having the greatest value was the orthophotoquad , which the State would be willing to obtain on a cost-sharing basis. Quad-centered, medium-altitude photography exists for all of the 48 topographic sheets in Delaware and is available in reproducible form for $900. The orthophoto-quad land-use overlay and computer plots and data listings were considered useful but additional funds would be needed to obtain them. Land-use coverage of Delaware at a scale of 1:24,000 would be highly desirable. Delaware is now accelerating its efforts to identify existing land-use in the State, not only for its Coastal Zone Act but also for water and sewer management. The Earth Satellite Corporation is completing a Level III/IV land use map for New Castle County.

Nagoski found all of the CARETS data to be somewhat out-of-date but still useful and the classification scheme to be incompatible with other data but still useful. Although the CARETS land-use maps were not examined for accuracy, Nagoski felt that an accuracy level of 90 percent is necessary. Nagoski listed

several ways in which the CARETS data can be made more valuable for the State of Delaware:

1) Compute accuracy by Level II classification
2) Improve accuracy where it falls below 90 percent
3) Interpret and provide Level II land-use changes at a scale of 1:24,000 on an annual basis

MARYLAND DEPARTMENT OF AGRICULTURE
November 22, 1974

Attending: Dale Churchy

As a newly formed State agency with a tightly limited budget, the Department of Agriculture, according to Dale Churchy, is involved basically in consumer services and coordination with local soil conservation districts. Consequently the agency presently has no use for any of the CARETS data products. Churchy reported that he had brought the products to the attention of the Secretary of Agriculture but could not get a commitment from him.

The questionnaire was thus not filled out; rather discussion of potential uses was held. Churchy felt that the land-use data might have some use for the soil conservation districts, which presently are using the State Planning Office's land-use maps, and he reported that he is planning to xerox copies of the CARETS press release and send them out to the districts involved.

The main use of the data for agriculture was seen as for monitoring pollution and land-use change. Churchy also mentioned that the Secretary of Agriculture is submitting a program to the General Assembly under which two or more farms with a minimum of 500 acres can form a special district that can sell an agricultural easement to the State for the difference between the agricultural and market values of the land. If the farmers later want to sell their land, they can buy back the easement for the original price plus 5 percent interest. Though providing a seemingly equitable solution, this program is likely to be resisted by many farmers who fear State interference in their affairs and by urban residents who believe the State can preserve open land merely by zoning it agricultural.

Churchy felt that the USGS land-use classification scheme is satisfactory and that the distinction between cropland and pasture is not as important to make as many believe. One reason is that such a distinction is difficult to make. Also such soil-conserving agricultural practices as planting crops in corn stubble and the use of herbicides rather than plowing are lessening the significance of the distinction. In Maryland, if sediment-control laws did apply to agriculture, these new practices would be used much more extensively. Churchy did feel that the distinction between deciduous and conifer-our forests, which CARETS land-use maps do not make, is valuable. Because of lack of currency of the land-use maps, the high-altitude photography, if provided on a regular basis, could be one of the most valuable CARETS products.

MARYLAND DEPARTMENT OF ECONOMIC AND COMMUNITY DEVELOPMENT
November 22, 1974

Attending: Jeff Evans

Jeff Evans of the Maryland Department of Economic and Community Development stated that his agency could well use the high-altitude aircraft photography, the Level II land-use and land-use change maps, and the cultural features overlays in obtaining an idea of the patterns of land-use and land-use change within the State. The scale of 1:100,000 is good for his purposes, although 1:250,000 is too small. He is particularly interested in the land-use change maps, which he sees as being useful for his purposes in about a year. The rest of the data products were not seen as having value, basically because the agency does not need them. The agency, however, does have the money to pay for any data it needs.

Evans stressed his agency's basic interest in economic development and its dependence upon cooperation with other State agencies such as the Department of Highways and the Department of State Planning and the adoption of their methodologies. His agency, is thus tied to the Department of State Planning's MAGI (Maryland Automated Geographic Information) system, for computer plots, data listings, and area summaries. Although Evans is interested in the ERTS computer compatible tapes, he feels that the Department of Economic and Community Development's computer resources are too limited and the CCT system too sophisticated to allow involvment.

The CARETS generalized land-use data seem to fit the agency's needs in most respects. In examining the maps, Evans and his colleagues discovered no obvious errors, but for them accuracy is not a major issue, since the data would be used to provide a general picture. The 1970 land-use maps are somewhat out-of-date, but the 1972 data are adequate. The classification system was considered satisfactory for providing a picture of land use within urban areas.

Evans reported the uses for which the CARETS data have been found of value to include specific study and analysis, general background and education, and public relations. If the socioeconomic data can be correlated to land use, such data could be used for summarization, correlation, modelling, and projection.

MARYLAND DEPARTMENT OF HEALTH AND MENTAL HYGIENE
November 14, 1974

Attending: Merrill Glasser

During a telephone contact with Merrill Glasser to arrange a follow-up user evaluation interview, Mr. Glasser informed me that, although he found the State user evaluation workshop quite interesting, his office, the Maryland Department of Health and Mental Hygiene, had no use for any of the USGS/CARETS data. These data, however, might of of use to local government health and sanitation departments. His office does not initiate any plans but rather reviews plans submitted to it by local governments. His Department is concerned with the viability of such plans, which is judged on the basis of knowledge of existing systems, population projections, and whether the plan is legal.

MARYLAND DEPARTMENT OF STATE PLANNING
June 3, 1974

Attending: Bill Brooner, Earth Satellite Corporation
John Antenucci
Ed Thomas
Gil Wagner

The meeting with representatives of the Maryland Department of State Planning consisted primarily in a briefing concerning the use by the department of CARETS land-use maps covering Maryland. The Department of State Planning had reduced the scale of the maps, mosaicked them into sheets covering planning districts and distributed them to local governments for evaluation and field editing. The local evaluation concluded that greater scale and detail were needed and resulted in the department's decision to remap the State at a scale of 1:63,360 at Level III rather than Level II. Time ran out, however, before the questionnaire could be completed.

Finding parts of the questionnaire confusing and ambiguous, John Antenucci submitted a written evaluation by mail on June 7. The high altitude photography was found to be quite useful when enlarged to 1:63,360, and the department is willing to consider cost sharing for a continuing acquisition program for this photography. The ERTS imagery, as well, has been used by the State but more for display or graphic use rather than any analytical purpose.

The land-use and land-use change maps were found useful for "some types of general planning as well as demonstrative graphics," although they lack the desired scale and detail. USGS orthophotoquads could be of some value if issued on a 5-year basis.

Antenucci wanted to stress the importance of the need for USGS "to spend less time in finding a use for the data and more time in educating potential users to use the data. If this is not undertaken, the more traditional data source will continue to be the mainstay, despite the potential of the new products."

The development of the Maryland Automated Geographic Information System (MAGI), which for Maryland purposes exceeds the proposed data available from CARETS, has resulted in little interest in the CARETS computer products.

Basically, the Maryland Department of State Planning, received CARETS land-use data, tested it, and then decided to compile a similar but more updated and detailed data base.

MARYLAND GEOLOGICAL SURVEY
December 6, 1974

Attending: Kenneth Weaver, State Geologist
Emery T. Cleaves, Assistant State Geologist

The Maryland State Geologist and Assistant State Geologist found considerable use in many of the CARETS products. Scale and detail problems limit the value of the processed maps, but the raw data have many applications.

The high-altitude photography has been very valuable to the Survey, especially in eastern Maryland where a number of ecological and geological mapping projects are being conducted, including an inventory of sand and gravel mining operations. Such photography can also be of value in assessing shore erosion. ERTS has limited potential for geological work, although it can be valuable for the annual inventorying of strip mines in Western Maryland. Skylab would be of even greater value if such photography were more cloud free and less sporadic.

The 1:100,000 land-use maps, although not specifically applicable to the work of the Maryland Geological Survey, could be of value in the evaluation of the in-shore impact of offshore drilling. The LUDA maps might also be useful for research and development projects but not in general operations of the Survey. The ERTS and aircraft land-use maps provide a fair general view but are not detailed enough. For example, the newly established coastal zone management program will need land-use information at a scale of 1:24,000.

In response to the generalized surficial geology maps, the geologists liked the combination of slope and relief and felt the maps might be useful for a regional approach to planning. At the county or local level, however, a much greater scale is necessary. The Maryland Geological Survey is engaged with the USGS in the mapping of certain geological characteristics of the Baltimore-Washington urban area, with the USGS concentrating on Washington and the State on Baltimore.

Finally, the orthophotoquads were found to be quite valuable in geologic mapping. In fact, a small cooperative project with the USGS will produce orthopictomaps with 5-foot contour intervals for the Eastern Shore.

The rest of the CARETS products were not seen as having any value for the Survey.

MARYLAND DEPARTMENT OF TRANSPORTATION
December 6, 1974

Attending: Edwin Crawford
Tom Buchanan

Representatives of the Maryland Department of Transportation found little value in the CARETS products. Crawford, who attended the State agency user evaluation workshop, stated that he did not feel qualified to evaluate most of the data and that he considered the workshop as primarily a source of information. Crawford is basically concerned with trying to find areas suitable for economic growth to determine the patterns of potential economic land use, predict probable trip generation, and attempt to shift such growth to desireable patterns. He reported that his agency had used NASA cameras to photograph land use along the State's roads from a moving van and that this original coverage would be updated. The one product Crawford did find of value was the Level II land-use series, which provides out-of-State land-use information, unavailable from the Department of State Planning's information system (MAGI).

Tom Buchanan is interested in the impact of transportation systems on the environment, especially air and water quality. Presently he uses such products as topographic sheets, soil maps, vegetation maps, and others. Although he did not have a chance to examine the CARETS products before the interview, the only product that interested him was the orthophotoquads.

NEW JERSEY BUREAU OF FORESTRY
December 17, 1974

Attending: George H. Pierson

George Pierson responded to the CARETS products by finding each of them useful to some degree. Most of the data obtainable from CARETS products, however, are presently available from other sources, which are generally more detailed and better adapted to the Bureau of Forestry's needs. The 1:100,000 land-use map has the best potential for development into a forest management tool. If a detailed breakdown of forest types could be mapped, the resulting forest cover type maps would be of use to forestry interests.

NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS
Division of State and Regional Planning
February 6, 1975

Attending: Dennis Jones

Although Dennis Jones found many of the CARETS data products useful to some extent, he is primarily interested in digital data rather than map products, which he sees as extremely difficult to use. Jones was most impressed with the data derived from the ERTS computer compatible tapes, and he and other New Jersians who attended the CARETS State agency user workshop have invited Jim Wray to New Jersey to explain his work with the ERTS tapes.

Jones saw the raw data products and the photomosaic useful but only if provided by the Federal government. He felt that Level II land-use maps are too interpreted and not useful for his purposes, but the land-use change could be quite useful. ERTS Level I land use might be of value for a generalized view if provided in digital form. The census tract data would also be useful in digital form, but the cultural and locational features overlays were seen as too lacking in detail to be of value. The generalized surficial geology maps were not deemed useful because New Jersey already has more detailed data available.

The remainder of the products were considered useful. Orthophotoquads (New Jersey already has a complete set of USGS 7-1/2'-quad-centered photography at a scale of 1:24,000) and orthophotoquad land-use overlays were seen as useful, as was the ERTS gridded image, which was considered a valuable display item, providing a good visual image of New Jersey. Both computer plots and computer data summaries were also considered quite valuable.

Jones sees the data's currency as adequate with a need for updating the data every 5 years. The accuracy question is one that is extremely difficult to answer. Generally, however, Jones felt that in respect to ground truth, the accuracy should be absolute, in respect to quantitative measurement, it should be relatively precise; and that in respect to the map product itself, accuracy is not of great importance. The USGS land-use classification was found to be incompatible with other data but still useful, mainly because it is only a surrogate for ecological and economic information really needed.

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
December 17, 1974

Attending: Darryl Caputo

According to Darryl Caputo, the State of New Jersey has limited use for many of the CARETS products because it already has equivalent or more detailed information. New Jersey has 1:80,000 color-infrared stereo photographic coverage, 1:24,000 quad-centered photographic coverage along with a complete set of USGS topographic sheet black line color separation plates.

Despite these available resources, Caputo sees considerable value in some of the CARETS products and some usefulness in all products except census tract and cultural feature overlays. The photomosaics, ERTS land-use maps, and computer data listings were considered useful but only if provided by the Federal government, and ERTS gridded images were seen as of value only for public relations purposes. Caputo reported that the Department of Environmental Protection is planning to incorporate the CARETS Level II land-use and land-use change data into its data base for the State's Coastal Area Inventory. The agency is also considering mapping land use for New Jersey using ERTS-1 computer compatible tapes.

Caputo found most of the CARETS data to be somewhat out-of-date but still useful, although he considered the 1970-72 land-use change maps out-of-date and not useful. The State's coastal zone program would prefer an annual update of the data. The data were not evaluated for accuracy, but the agency is presently attempting to determine the level of accuracy necessary for its coastal zone program. The USGS classification system could be improved considerably if it provided a more detailed breakdown of vegatation types.

NEW JERSEY DEPARTMENT OF TRANSPORTATION
December 17, 1974

Attending: Douglas Webb
Howard Zahn, Bureau of Environmental Analysis
Mike Silvestrov, Bureau of Avaiation Planning

The New Jersey Department of Transportation representatives saw several uses for CARETS data despite a major scale problem. The department already has good aerial photographic coverage, but the high-altitude photography could be of value as well as Skylab photography if roads are distinguishable on it. The Level II land-use maps were also seen as valuable as an overview and also for aviation planning. The Level I map, however, was considered much too general. Level II land-use change maps were seen as useful for monitoring change and defending studies made by the department, and census tract maps could provide needed census boundary information as well as indicate population

densities. The cultural features map was not considered useful. The generalized surficial materials and slope maps were viewed as good enough for preliminary site studies in airport planning. Areas selected for study would have to be ground checked in any event because no charts are trusted when making decisions. Finally, the computer data listings were considered useful for providing quantified data for environmental impact assessments.

The transportation planners found little fault with most of the data except for the scale. They are used to working with data at a scale of 1:2,400 and find that 1:100,000 is a difficult scale with which to work. The land-use classification system was considered adequate. The planners did not have the chance to examine the data for accuracy, and could not make a statement regarding accuracy requirements. The lack of currency of the CARETS data was not seen as a major problem bacause some of the Department's studies require as long as 10 years for completion. These representatives believed that land use in the Northeast Corridor of New Jersey should be updated every 2 years, and the rest of the State only every 5 years.

NEW JERSEY DIVISION OF FISH, GAME, AND SHELLFISHERIES
December 30, 1974

Attending: Frank Tourine

Frank Tourine reported that the CARETS land-use maps would have limited use for his agency since similar maps are already available from the Department's Office of Environmental Analysis. The census tract overlay might be of value in determining huntable and non-huntable areas for entire political divisions. The land-use change maps might also be of use in indicating trends. Tourine finally remarked that he was not in a position at the time to comment on the data characteristics or data utilization.

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
Environmental Master Planning
December 18, 1974

Attending: William McGlade

William McGlade was quite enthusiastic about CARETS data products and believed that all the products in some way could be useful for his agency. With the exception of a four-category map produced by the Office of State Planning and Development, Pennsylvania has no land-use map. In fact, the State has contracted with the USGS to produce LUDA land-use maps on a 50/50 cost sharing basis. McGlade felt that the LUDA Program came along at just the right time--when the data were needed and the State did not have the funds or experience to initiate a land-use mapping program of its own.

According to McGlade, the Department of Environmental Resources' uses for the data are almost unending. Such data are needed for the State water plan, the comprehensive water quality plan, and for environmental master plan. Presently any available data are being used.

The scale of 1:100,000-1:125,000 seems to be the best for a State land use map, and thus LUDA's 1:250,000 is somewhat a compromise. The USGS land-use classification scheme is considered adequate. In response to the currency question, McGlade felt that CARETS maps are somewhat out-of-date but still useful. Such data would be most useful if updated every year or whenever a certain percentage of the land use had changed. McGlade did not see accuracy as a major problem for a State land-use map.

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
Pennsylvania Geological Survey
December 18, 1974

Attending: Don Hoskins

According to Don Hoskins, the Pennsylvania Geological Survey is interested in any type of aerial photography or imagery useful for geological investigation, and thus the high-altitude and Skylab photography and the ERTS imagery are all of value. The only other product seen as useful was the orthophotoquad, which could be of great value at 1:50,000, the scale at which topographic maps are being compiled for Pennsylvania counties.

For geological purposes, repetitive coverage is not needed. Good, cloud-free, seasonal coverage, enhancing different aspects of an area's geology, however, could be very valuable.

The rest of the USGS/CARETS data were not considered useful because this agency is not concerned with land use. Hoskins did not consider the generalized surficial materials and slope maps of value because the State already has more detailed soil and geology maps.

PENNSYLVANIA OFFICE OF STATE PLANNING AND DEVELOPMENT
February 21, 1975

Attending: Abe Gottlieb (telephone)

Abe Gottlieb confessed that he was not very familiar with remote sensing or remote-sensing products, but would present as best he could his view of the CARETS products. The Pennsylvania Department of Environmental Resources is more involved with remote sensing and has contracted with the USGS for the production of LUDA maps.

Gottlieb saw little use for the raw data products, finding them too lacking in detail and feeling the larger scaled conventional aerial photography to be better for his agency's purposes.

He saw the ERTS and aircraft land-use maps as valuable, especially if statewide information could be obtained. Applications for such data include State land-use studies, defining areas of growth, and developing land resource policies. Gottlieb was not impressed by the land-use change maps, however, because they lack detected change below 10 acres. The census tract and cultural feature overlays were considered useful, and the generalized geologic overlays were considered particularly important. Gottlieb also saw value in computer plots of land use and computer derived area summaries.

In respect to data characteristics, Gottlieb saw the CARETS land-use data as somewhat out-of-date but still useful. He would prefer a 1-year update for areas of rapid change. Gottlieb felt that Level II is satisfactory for the present and for use in mapping the State as a whole, but he also felt that in the future and for local areas a greater level of detail might be desired.

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION
December 11, 1974

Attending: Robert P. Chandler (telephone)

While being interviewed, Robert Chandler of the Virginia Department of Highways and Transportation, Land Use Office, remarked that much of the CARETS land-use data had already been obtained by the department. Chandler generally felt that the less processed data products--high-altitude and Skylab photography, ERTS imagery, and the photomosaic--were of little value for lack of detail, incompatibility of interpretation, or too small a scale. The department relies mostly on its own photography (large scale) with one fifth of Virginia covered every year.

The Level II land-use and land-use change maps, census tract and cultural feature overlays, computer plots, and data listings could all be of great use to his agency. If such data were available for western Virginia, it could be used in a study of land-use along a mile-wide strip on both sides of Interstate 81. Such data could also be of value for conducting annual land-use change studies in metropolitan areas of 50,000 or larger, which are required by the Department of Transportation from the regional planning district commissions. The ERTS Level I land-use maps were viewed as too small in scale to be useful.

Presently, the currency of CARETS data is adequate, although updated land-use information is needed annually for metropolitan areas and every 5 years for populated places between the size of 10,000 and 50,000. Chandler did not examine the Level II land-use maps for accuracy, but he found no errors on the Fredericksburg 1:24,000 land-use map. A high level of accuracy (95-99 percent) is deemed necessary. The USGS Level II classification scheme is adequate in all categories except residential, which requires a Level III breakdown.

VIRGINIA DIVISION OF INDUSTRIAL DEVELOPMENT
December 4, 1974

Attending: June Batchell

According to June Batchell, the Division of Industrial Development's principal uses for land-use data are for industrial site selection as a part of the industrial site information presented to prospective industries. The later requires data at a scale of at least 1:24,000. Mrs. Batchell originally felt that the high-altitude photography might prove useful for site selection but later concluded that such photography was too small in scale. Most of the data used by the division is obtained from photography flown by the State Highway Department. Since only a limited coverage of the State is obtained each year, lack of currency of data for some areas poses the main problem. The scale of such coverage, however, is quite appropriate.

Only two data products were considered useful in support of agency functions: (1) the 1:24,000 orthophotoquads and (2) Level II land-use overlays for the 1:24,000 orthophotoquads. These were considered useful because of their relatively large scale and their 7-1/2-minute topographic sheet base, which itself is considered the most useful single data source.

Although Mrs. Batchell did find errors on the 1:24,000 Fredericksburg land-use overlay she examined, she felt such is more valuable than the orthophoto-quad base because of her lack of expertise in aerial photographic interpretation.

The Level II land-use classification was considered satisfactory, although categories that provided some idea of density or intensity of use would be of even greater value. Another product which would be useful if produced at a larger scale is the surficial geology overlay.

In concluding, Mrs. Batchell remarked that although the USGS/CARETS products are beautiful, they don't meet her needs.

VIRGINIA DIVISION OF MINERAL RESOURCES
December 5, 1974

Attending: Harry Webb
Paul Daniels

Harry Webb and Paul Daniels generally found that the less processed CARETS products were the most valuable for the Division of Mineral Resources. Most of the CARETS-type information the division could use is already available at a larger scale. All of the divsion's work is committed to a scale of 1:24,000 in the 7-1/2-minute topographic sheet format. Though the Division could live with conflicts in scale, conflicts in format between CARETS and the 7-1/2-minute sheets cause real problems. Webb and Daniels felt that more user input should have been obtained before the products were produced rather than after.

The high-altitude photography, Skylab photography and ERTS imagery were all seen as potentially valuable if enlarged to a useable scale and applied to structural geological analysis. The photomosaic might also be of value, although the removal of its grid, which tends to obliterate some of the photography, would be an improvement. The ERTS gridded image and the orthophotoquads were also considered useful, although interpreting the ERTS image requires expertise that the division lacks.

The CARETS Level I and II land-use maps were not seen as useful, but the land-use change overlays might be a useful planning tool provided land-use change data could be obtained at least every other year. Webb and Daniels saw little use for the census tract overlays but potential use for the cultural features overlays. Computer data listings and land-use area summaries were seen as possibly useful for analyzing trends and as information for support of project proposals.

Daniels and Webb saw little value in generalized surficial materials and slope maps, which were considered an "intermediate step," too interpreted yet not detailed enough to be useful. Superior sources of such data are available.

In responding to the USGS classification, the two representatives felt it is incompatible with other data but still useful. They believe a more detailed classification is needed that would include utilization and intensity of use. Such a classification would help to determine what areas should be mapped by geologists.

VIRGINIA DIVISION OF STATE PLANNING AND COMMUNITY AFFAIRS
November 14, 1974

Attending: Keith Buttleman (telephone)

Keith Buttleman prefaced his response to the CARETS data by warning that it would be somewhat hazy because he was not sure of the direction the division might take in the future and thus could only answer for the present.

All of the raw data--aircraft, Skylab, and ERTS--and the photomosaic were seen as having little value for the Division at present. Buttleman reported that his agency had used the high-altitude photography in the past for detecting critical environmental areas but is not using it presently. The Division is now mainly interested in Virginia's coastal zone, which is being mapped by the Virginia Institute of Marine Science.

The land-use, land-use change, census tract, and cultural features maps were all seen as having immediate value but basically for educational and public relations purposes. No real analysis would be performed on the data except perhaps a recognition of growth patterns as revealed on the land-use maps, parts of which he had color coded. Buttleman informed me that when the CARETS maps were first released on open file, his office immediately ordered sample copies but also incurred the frustrations and expense of the open file system and made the mistake of having the land-use and cultural feature maps reproduced on single sheet. The result was unsatisfactory. The ERTS-derived land-use maps were considered too lacking in detail even for display purposes.

The Level II land-use data were seen as somewhat out-of-date and somewhat inaccurate but still useful. During an initial accuracy check of the data, certain annoying errors were detected, including objects below minimum mapping size (rivers) that should have been included on the maps and structures hidden beneath tree cover. In one area a development of a couple hundred houses beneath trees was misclassified as forest.

Other items that were not seen as useful in support of agency functions include the generalized geology sheets--because the data already exist--the orthophotoquad--because it provides no information that is not on the topographic sheets at the same scale, the 1:24,000 land-use maps because the scale is too great for the recognition of regional patterns, and the ERTS gridded image--a pretty picture but of little value.

Buttleman was very receptive to the ERTS computer compatible tapes and had hopes (he felt might be unrealistic) to develop a statewide land-use inventory in digital form, which could be updated annually.

Not having seen a LUDA land-use map, Buttleman was reluctant to evaluate its potential utility. He had no qualms, however, about using such a map whose source data could not be made available for his inspection or use. In respect to scale, Buttleman felt that 1:100,000 is ideal for his purposes.

USDA AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE
December 13, 1974

Attending: Richard Ensminger

According to Richard Ensminger, the Agricultural Stabilization and Conservation Service (ASCS) in its Land Use Division could find considerable use for many of the CARETS products, especially the land-use data. The ASCS is under a Congressional directive to allocate funds to States on the basis of conservation needs, and the land-cover information provided by CARETS maps could help determine such needs. The division's needs inventory requires the more general picture of land cover that is presented on the ERTS, high-altitude aircraft, or LUDA maps. Presently the needs inventory is conducted every 5 years and based upon a 2-percent sample. One important information need that the USGS products do not supply is the distinction between cropland and pasture. Nevertheless Ensminger sees such land-use maps and area summaries by counties, derived from them, as very valuable. Even the very general ERTS Level I maps can be valuable for selecting counties to participate in programs based on their amounts of forest, wetlands, or other ground cover.

Ensminger also saw value in some of the overlays. The land-use change is of particular value for rural areas, although change from rural to urban uses is only of peripheral value to ASCS. The photomosaic and the census tract overlays were seen as having little value for the men in the Washington office but potential value for men in the field. Census tract data might be of help in public access (for hunting and hiking) studies. The photomosaic might be useful in the field if it is superior to what presently exists. The cultural features overlay and geology overlay were not seen as having much value. Ensminger liked the overlay method of displaying data, but his office is not concerned with delimiting individual areas. Such work is performed by field representatives.

Ensminger reported little value in the raw and less processed CARETS data. The ASCS flies its own low-altitude photography, which is sufficient for many uses. High-altitude photography might be of value in determining crop composition for the ASCS but would not be used in the land-use division. The orthophotoquads might be used by farmers to identify their fields, but again, they really offer little to the people in the Washington office.

US DEPARTMENT OF AGRICULTURE FOREST SERVICE
December 12, 1974

Attending: Marvin Meier
Alfred G. Darrach

In response to the CARETS Federal Agency user workshop, Marvin Meier sent CARETS user evaluation questionnaires but not the data packets to the

Forest Service's South Atlantic and Northeast regional offices, both including parts of CARETS. According to Meier, the Northeast Region's response was much more positive since the region does have need for land-use data in its Delmarva River basin study. The South Atlantic region, which includes the James River basin, responded in terms of potential use and found all CARETS products useful if provided by the Federal government. The currency of the data was considered adequate, the classification satisfactory, and the land-use data somewhat inaccurate but still useful.

The Northeast Regional Office viewed the high-altitude color infrared photography, ERTS imagery, Level II land use and land-use change, cultural features overlays, and computer plots and land-use area summaries as useful and expressed a willingness to obtain all such data on a cost-sharing basis, except for the raw data for which additional funds are needed. The land-use data were seen as being somewhat out-of-date and being somewhat inaccurate but still useful. The classification scheme was considered satisfactory. An update would be required no less than every 10 years. To date, a desired level of accuracy has not been determined.

When discussing the Forest Service's forest survey, which is based on a sample, Meier remarked that his agency is living with definitions that preclude the use of high-altitude photography and that redefinition will not occur overnight. Current practice uses timber volume--a Level III category--in defining and choosing sampling locations. High-altitude photography could be used in a general way to determine area covered by forest land. Moreover, the forest survey is designed to produce information of a desired level of accuracy at the State and national levels, but at the county and local level, for which it was not designed, its accuracy is poor. For the Forest Service the distinction between coniferous and deciduous is more important than that of crown cover percentage, which is considered a finer level of distinction. Any area with 10 percent tree cover is defined as a forest. One place where the USGS classification breaks down is for urban forestry, where the Forest Service would like to know is a forested area is primarily used for housing or any other function. Need for forested wetland data also exists.

USDA SOIL CONSERVATION SERVICE
December 13, 1974

Attending: Harold Scholl
Ted Ifft
Harold Krell
Harold Stevens
John DeGroot

The representatives of the Soil Conservation Service were basically project-oriented and concerned with the SCS's Delmarva river basin study for which land use and land-use area summaries are needed. Although the CARETS Level II land-use map in scale and detail of classification would suffice for the study, the unavailability of area summaries by drainage basin has led the SCS to seek other sources, specifically Maryland's computerized MAGI system and the proposed land-use mapping of Delaware at 1:24,000.

The CARETS products seen as having value for SCS studies include high-altitude photography, land use and land-use change, orthophotoquads, and land-use area summaries. ERTS imagery or Skylab photography was not considered useful nor were the ERTS land-use maps or the cultural feature or census tract overlays.

Concerning the accuracy issue, the SCS representatives felt that a 90 percent accuracy level would suffice for river basin studies. For studies of smaller watersheds, which are normally mapped at 1:7,800, an error no greater than 2-3 percent could be tolerated.

COUNCIL ON ENVIRONMENTAL QUALITY
December 19, 1974

Attending: Edwin Clark

According to Edwin Clark, the Council on Environmental Quality (CEQ) has almost no direct use for the products presented at the Federal agency user workshop. Clark, however, does like what CARETS is trying to do and is particularly interested in CARETS as a source for land-use data area summaries. In the CEQ's 5th annual report of environmental quality, a section on land-resource related data is presented for the United States as a whole, and it is hoped that more specific sources for land-use data could be included in a national environmental statistical package, to be a part of the next annual report but published separately. CARETS and other USGS land-use products would thus provide a valuable source for such data.

The CEQ has identified land use as an item of major interest, which can be used in an index of environmental quality. CEQ is particularly interested in the environmental impact of land-use change--what is happening on flood plains; what kind of land use exists and how it is changing.

Clark does not feel that the USGS classification is adequate for his purposes. One of his objections is that it was designed for what can be detected by remote sensors rather than what type of land-use information is needed. Clark sees a need for a more detailed classification, in which not only the land's function or cover is indicated but also the characteristics of the land, which are so important to environmental quality. Clark has designed a land classification matrix on which one axis indicates the land function (agricultural, commercial, etc.) and the other axis indicates the land characteristics (slope, soil, plot size, contiguous uses, existence on a flood plain, parameters of location in respect to urban centers, density of development and others). Clark would like to see this classification system used in a sampling method to obtain an inventory of land use within the United States.

US BUREAU OF THE CENSUS
November 20, 1974

Attending: Robert Aageenbrug
Robert Durland
James Davis

Generally the representatives of the Census Bureau felt that the USGS/CARETS data could be of great value if they could be provided at the right time--specifically 2 or 3 years before the census of population is taken. The primary uses for the data fall into two categories: (1) field problems of immediate concern and (2) long term research and development efforts.

The raw data products were accepted fairly well. High-altitude aircraft photography was seen to be useful if it is timely as was the Skylab 190B Earth terrain camera photography. The Skylab 190A photography and ERTS imagery were seen as only marginally useful, although they could be of value for distinguishing between urban and rural areas. Davis believes the ERTS and Skylab imagery could well be used in foreign censuses. The overview provided by the smaller-scaled and less detailed data was considered important, but the representatives did not feel the Bureau of the Census should invest much money in these products unless they can obtain coverage for all urbanized areas.

The land-use maps were also viewed positively. The CARETS Level II maps were seen as having value to the Census Bureau as examples of what might be accomplised for the whole country. Again, these maps could be of value in defining urbanized areas. Davis liked the 1:250,000 LUDA maps as a map inventory and delineation of unincorporated places, the former available only on topographic sheets, the latter not available. Land-use change data from 1970 to 1972 are of little value to the Census Bureau, but such maps of change from 1970 to 1977 or 1978 would be of great value. The Census Bureau, in fact, could use such a change map every 10 years. The ERTS land-use map was seen as too lacking in detail to be of great value. The photomosaics could be useful if provided for the 1980 census. Their scale is appropriate and the Bureau of the Census would be willing to obtain them on a cost-sharing basis. The photomosaic would also be of value for research and development efforts to help determine the most equitable method of counting people for revenue sharing.

The census tract maps were seen as somewhat valuable to the Census Bureau, for use with the land-use maps, although these overlays are already available to the Census Bureau. The cultural feature overlays were also believed to have potential value for providing information not found on census tract maps.

The geologic maps were found to be of no use; the ERTS gridded mosaic was considered too coarse to be of much value. The orthophotoquads could be of value in urban areas if they are current during the 2 or 3 years preceeding the taking of the census.

Finally, considerable interest was expressed in land-use area summaries. Durland stated that if the USGS doesn't publish LUDA area summaries, the Bureau of the Census might be willing to pay for their publication.

The representatives felt that the land-use classification scheme was satisfactory, although urban areas were not treated as well as they might be.

The principal uses of the CARETS data were seen as for specific study and analysis for the Bureau's own internal use for background information to aid in making specific recommendations to decision making authorities. The Bureau of the Census can use CARETS data in such operations as census taking and updating maps as well as for analysis and display.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
January 3, 1975

Attending: Paul Stang

The Office of Coastal Zone Management of the NOAA has the basic function of granting money and technical assistance to the 30 participating States and four territories in the administration of the Coastal Zone Management Act. According to Paul Stang, the Office would therefore not be a direct user of CARETS data but should be in a position to know what coastal zone data are available to the States. The Act requires States to define their coastal zone (vaguely, from 3 miles out to sea to the uplands) as well as to inventory land and water resources within the coastal zone. Stang sees a need for two different mapping scales in coastal zone management. For broad planning, a scale in the order of 1:100,000 is valuable, and, in fact, NOAA has just completed a prototype coastal zone management map at that scale, covering an area of 1 degree in longitude by 30 minutes in latitude (one fourth of the USGS 1:250,000 topographic sheet). For management itself, however, a much larger scale in the order of 1:10,000 is needed.

Those CARETS products that Stang believes would be useful include the high-altitude photography, Level II land-use and land-use change maps, and the 1:24,000 orthophotoquad and orthophotoquad land-use overlays. Most of the other products are considered too small in scale or detail for present needs (ERTS Level I land use and imagery, Skylab photography) or somewhat sophisticated (computer plots of land use). Computer data listings could be relevant, but "how much" is considered secondary to "what" and "where."

Because of the rapidly changing character of the coastal zone, currency and frequent updates are considered a very real need for coastal zone data.

US ARMY CORPS OF ENGINEERS - BALTIMORE DISTRICT
January 8, 1975

Attending: Noel Beegle (telephone)

According to Noel Beegle, Chief, Study Coordination and Evaluation Section of the Baltimore District's Chesapeake Bay Study Group, the Corps of Engineers is primarily concerned with the relation of land use and land-use data to water-resource related problems. The high-altitude photography is useful on a limited basis, but low-level oblique photography is considered of much greater value.

The CARETS Level II land-use maps, however, were used by the Corps for preparing a set of plates to display the land use of the Chesapeake Bay region. At the time of acquisition of the Level II land-use maps, the Corps was not aware of the CARETS plan to map Level I land use from ERTS imagery. Because a general land-use map at a scale of 1:250,000 was desired, the CARETS maps were reduced to that scale, and the Level II categories were converted to a modified Level I. Beegle considered the CARETS land-use information excellent for providing a good visual presentation and displaying how land use relates to other factors. Land-use area summaries would also be valuable, and if available, they will be presented in the Chesapeake Bay Study Group's report to be released in about a year.

Beegle saw the 1970 land-use data as adequate in currency, with a need for updating on a 5-year basis. The CARETS land-use accuracy was considered adequate and the classification satisfactory. The main use of the data has been for analysis in correlating land use with water-resource problems and display for the purpose of public information in water-resource reports.

DEFENSE CIVIL PREPAREDNESS AGENCY
January 2, 1975

Attending: John Vacarra

John Vacarra of the Defense Civil Preparedness Agency concluded that his agency had no real application for the CARETS data products. Vacarra had originally foreseen the data as useful for post-disaster damage assessment, but he believes their scales are too small since detailed damage assessment is usually made at a scale between 1:9,000 and 1:12,000. The use of ERTS computer compatible tapes is too expensive, and the most reliable assessment is obtained from on-site inspection. Moreover, the agency has ready access to low-altitude aerial photography flown specifically for damage assessment. Vacarra also originally foresaw some application for obtaining agricultural and forest-resource data, but later he felt that reliance on local reports is the best route.

The Defense Civil Preparedness Agency keeps census population and housing data as well as extensive tape files on industries. It cannot, however, afford the expense of highly detailed maps of phenomena. Instead, it prepares lists of the phenomena of interest, which are organized by five easily identified geographic divisions.

Vacarra sees the CARETS project as a valuable research and development effort to advance the state of the art. Even though his agency cannot use CARETS data, he believes that the Federal government needs LUDA-type products.

DEFENSE MAPPING AGENCY
December 12, 1974

Attending: Luther Rhodes
Mike Mullins
Fred Neininger

Representatives of the Defense Mapping Agency stated initially that any of their remarks could not be considered a reflection of DMA policy. These men are working on special projects involving land-use data at a large scale and are not real users of CARETS products. Their involvement in the evaluation, rather, stems from interest in land-use products.

Of the raw data products, only the high-altitude photography was seen as useful. The ERTS imagery does provide a valuable overview, but with the possible exception of very small-scale mapping, they are too lacking in resolution and detail. The Skylab Earth terrain photography had been tested by Mike Mullins and also found not detailed enough for urban land use.

The high-altitude land-use maps were seen as useful for obtaining a general picture--a quick overview--but were again too lacking in detail. The representatives were not interested in the photomosaic, land-use change, cultural features, or census tract overlays. The LUDA maps of a scale of 1:250,000, however, were considered valuable in providing nationwide coverage that has not previously existed. Luther Rhodes felt a real need for such data exists.

The only other products seen as having value were the generalized surficial geology maps, for which a definite need was stated, and the 1:24,000 orthophotoquads, which do provide the type of needed detail. The representatives had not seen the 1:24,000 land-use overlays to the orthophotoquads, and they thus reserved judgment on them.

In response to the USGS land-use classification, the DMA representatives stated a need for greater detail. For example, the DMA has 76 categories for forest land, including information concerning deciduous, coniferous, mixed, crown cover, height of forest, underbrush, and various other factors.

Generally, these men felt that CARETS land-use maps could be of value in providing a generalized overview, but only for that. An accuracy level of 80 percent was thus considered adequate.

ENVIRONMENTAL PROTECTION AGENCY
January 3, 1975

Attending: Robert Holmes

According to Robert Holmes, his office has not used any CARETS data yet, but such data are of value and will be used. Some of their applications for water-resource studies include the analysis of drainage basin and pollution input from non-point sources and lake eutrophication studies.

In such studies the water quality of lakes is correlated with surrounding land use. If 50 percent of lake nutrients are found to have come from non-point sources, tertiary water treatment facilities might not be effective in controlling pollution.

Holmes reported some usefulness for nearly all of the CARETS data products, although he emphasized that much of the data would be useful only if provided by the Federal Government. The EPA regional offices generally prefer obtaining free data. High-altitude photography, Skylab photography, and ERTS imagery were listed by order of descending usefulness because of the resolution problem. The 1:100,000 land-use maps and overlays were all considered useful. The generalized geologic map, although not presently useful, could be of value in EPA's new drinking water and ground water programs. Finally, the computer data listings were seen as having value for drainage basin and eutrophication studies.

Those products seen as having little or questionable value include the ERTS Level I land-use maps, ERTS gridded mosaic, and the orthophotoquads.

In respect to data characteristics, Holmes viewed the CARETS products favorably. He reported that any data from 1972 to the present are adequate and that any data are valuable for looking at trends. Holmes believes that the land-use data should be updated on at least a 5-year cycle. Holmes felt the accuracy of the CARETS land-use data is probably pretty good. An accuracy level of 85-90 percent is adequate, and any higher level is not worth the additional expense to obtain. Holmes found no problems with Levels I and II of the USGS classification, although he found the scale of 1:100,000 not satisfactory in that it fails to conform to the scales of the standard mapping program. A Level III map at a scale of 1:24,000 would be of much greater value than the CARETS maps.

EPA - OFFICE OF RESEARCH & DEVELOPMENT
January 30, 1975

Attending: Charles N. Ehler

As program manager for the Washington Environmental Research Center, Charles Ehler identified three EPA programs in which some of the CARETS data might be useful. In the Air Quality Maintenance Program air quality projections for metropolitan areas based on land-use trends will be developed for a 10-year period. If air pollution levels are projected to violate clean air

standards, then a plan must be submitted to bring air quality up to standards. The Area-Wide Waste Treatment Management Program is similar to air quality maintenance but involves water quality. Finally, the Significant Deterioration of Air Quality program is a State-level plan that requires a State to zone its land into three classes: (1) areas of relatively pure air where no development can occur, (2) areas where moderate development can occur, and (3) areas where heavy development can occur. For this program Level II land-use information is adequate.

Ehler's response to the raw data products and the photomosaic was negative. Most EPA people are not trained to use such data in their programs, and thus the data need to be more interpreted. Also considered of little value are the census tract and cultural feature maps, which provide no needed information, and ERTS Level I land-use maps, which are too small in scale and too lacking in detail to be of much value.

The Level II land-use and land-use change maps were considered useful to some extent in the EPA programs previously mentioned. Of greater value, however, are the 1:24,000 orthophotoquads and land-use overlays, which would be of even greater value if developed with Level III categories.

A final product that Ehler found useful was the computer data listings of land-use area summaries, which could be used with EPA calculated coefficients to estimate pollution loads from area sources.

For planning purposes land-use data should be updated every 2-3 years. For enforcement and regulatory functions much more up-to-date data are needed. Very accurate data are always desirable, but for planning purposes accuracy is not a big issue. The Circular 671 classification was considered adequate, although for many purposes Level III would be more useful than just Level II. Ehler emphasized that for air-quality planning, the ability to estimate emissions or to relate ambient air quality to pollution sources has not been perfected. Also the specialized nature of many industrial sources is such that information needed for emission estimates must be obtained on the ground.

FEDERAL POWER COMMISSION, ENVIRONMENTAL ASSESSMENT BRANCH
December 12, 1974

Attending: John Isaacs
Tom DeWitt
Bill Douglas
Mary Ivory
Lynn Nakata

The representatives of the Federal Power Commission interviewed are involved in writing environmental impact assessments for the construction of interstate natural gas pipelines, hydroelectric transmission lines and pump storage reserviors. When a company applies to the FPC for a permit to build such facilities, this group will conduct a study and submit its results to the Commission to aid it in its decision making.

Because many of the FPC studies are not within the CARETS region, the representatives responded more generally concerning their data needs. The high-altitude color IR photography, photomosaic, Level II land-use and land-use change, census tract and political boundary overlays, generalized geologic maps, orthophotoquads (1:50,000), and computer plots of land use were all found to be very useful on a project-by-project basis. Although a more detailed classification would make the data more useful, the USGS classification is considered satisfactory. The land-use data's accuracy was not checked, but in urban areas an accuracy of 95 percent was deemed necessary. An interval of 5 years will suffice for updating the data, depending on the project.

Those data products considered not useful include the ERTS imagery and gridded mosaic, and Skylab photography, for which no need exists. The researchers also believe that they can compile better cultural feature maps on their own and that any land-use area summaries can be obtained from the jurisdictions involved. ERTS Level I land-use maps were considered too small in scale and lacking in detail to be of value.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
New Communities Administration
November 25, 1974

Attending: Gerry Coan
Lessley Wiles
Roy Gast

In response to the request for an evaluation of CARETS products, representatives of the HUD New Communities Administration (NCA) compiled a list of functions that might have a need for land-use data. These include:

Appraisal
Environmental impact analysis
Market analysis (growth trends)
Project monitoring
Relationships of new community projects to surrounding areas

The NCA's response to CARETS products was quite positive. The representatives felt that they could use both detailed and generalized data, and only the ERTS imagery and Level I land-use maps were deemed of marginal value. Private developers prepare most of the map data for new communities, but the NCA could use land-use data and photography to monitor the work of the developers. Important to this group is the detection of growth patterns and rates and impact of growth for determining if new communities create growth or continue trends already begun.

In respect to the currency of the data, the land-use maps were seen as somewhat out-of-date, but the aircraft and ERTS data were seen as adequate. Land-use change data would be particularly desireable if they could be obtained on an annual basis. The accuracy requirement varies depending upon the use

for which the data are needed. A fairly high level of accuracy would be desired.

The USGS land-use classification system is compatible with other data but is incomplete. A Level III classification would probably be more useful, especially for urban areas.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Comprehensive Planning and Management
November 22, 1974

Attending: Walter Prybyla
Ray Sherry

The user evaluation interview with Prybyla and Sherry was concerned basically with land-use data requirements for Section 701 of the Housing Act of 1949 as amended in 1954. Prybyla emphasized that his office would not use the data itself, but that he was speaking for those who might be seeking 701 aid, especially the two elements of the 701 program requiring land-use data. He also emphasized that HUD is people-oriented rather than resource-oriented, and consequently much of the CARETS data is not useful. His office is basically interested in HUD regions or SMSA's.

Most of the CARETS data products were not seen as having value because of the scale, which was considered inappropriate for urban areas. The high-altitude photography is one exception, although a larger scale would be desirable. Other products seen as useful include the orthophotoquads and the generalized geologic maps. Prybyla also felt that many HUD applicants would be potential users for computer data listings and land-use area summaries.

To be of value, the land-use maps need not be extremely accurate, for scientific precision is not needed for generalized data to be used as raw material for policy making. The currency of the data desired depends upon the amount of changes occurring in the area. The data should be updated, however, every 3 to 5 years.

The Level II land-use classification scheme was reported to be useful for nationwide mapping, but it needs to be readjusted to become more operable in urban areas. Standardization is needed but so are more detailed categories, including some providing an indication of density. Planners are also interested in qualitative issues--redevelopment, direction of growth, potential for growth and deterioration, and others. There may be a need for reconceptualizing the land-use classification.

The main problem of the CARETS data products is that of scale. Scales appropriate for city planning should be no smaller than 1:12,000, and for regional planning (SMSA's), 1:24,000. CARETS data are just not sufficient for urban areas.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
National Flood Insurance Program
November 25, 1974

Attending: Charles Lindsay
Mel Crompton

Lindsay and Crompton, though interested in the CARETS products, found that, with the exception of the orthophotoquads and the high-altitude photography, the data are much too small in scale and lacking in detail. The Flood Insurance Program, involved in mapping flood hazard areas for 100-year flood plains, is more interested in large-scale aerial photography, ideally 1:5,000 and larger, which can be reproduced cheaply and distributed to men in the field. Many of the flood hazard areas are now mapped by ground survey, using street base maps that have been obtained locally. Land-use maps cannot fill the bill, and there seems to be little use for the small scale data, either raw or processed.

US DEPARTMENT OF THE INTERIOR
Bureau of Outdoor Recreation
December 3, 1974

Attending: Ruby Smith
John Kumb
Jerry Kazmierczak
Sam Hall
Neil Stout
Bernie Collins

Representatives of the Bureau of Outdoor Recreation saw very limited use for the CARETS data products. The BOR is highly involved in specific projects requiring high-resolution data. One representative inquired about the possibility of using data to determine terrain and relief and the nature of rapids for wild and scenic river projects. Most of the attendees had not previously examined the data and were not interested in spending time discussing the more processed land-use products for which they saw little use. A great amount of the discussion centered around the capabilities of high-altitude photography, which was seen as the most useful product. The orthophotoquads were also viewed quite favorably as were computerized land-use area summaries and plots of land use. None of the other products were considered of value.

John Kumb, involved with State recreation planning, remarked that CARETS data appeared to be of limited value because they cover such a small portion of the United States. He felt, however, that the data products were interesting enough to distribute to the seven different regional field offices, only one of which (Philadelphia) covered the CARETS region. He therefore requested copies of the sample products, which he could distribute to the regions.

US DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
January 10, 1975

Attending: Paul Nickerson, Division of Technical Assistance

Though not personally involved in research, Nickerson is very enthusiastic about the possibilities for the use of CARETS data in the Fish and Wildlife Service. He sees numerous applications for remote sensing and land-use data, including monitoring the changes in acreage under cultivation, estuary changes, extent of snowfall within an area, and the health of forest areas, all of which have an impact on the amount and species of wildlife. The USGS land-use classification could be more detailed. For example 20 categories of wetlands have been devised by the service as opposed to the 3, Level II wetland categories on the CARETS maps.

Because of his lack of familiarity with remote sensing, Nickerson sent the CARETS data packet and referred the interviewer to Richard Curnow, who had been Fish and Wildlife's coordinator with the EROS program.

Richard Curnow, Division of Cooperative Research
January 16, 1975

Richard Curnow of the Division of Cooperative Research reported that the Fish and Wildlife Service has become involved in the National Wetlands Inventory and CARETS data can be of value in classification and inventory, involving monitoring, impact assessment, and mapping.

Most of the CARETS data were considered useful in support of agency functions, providing they are available for a specific area. High-altitude photography is useful for monitoring land-use changes such as dredge and fill operations and for environmental assessment of such activities as stream channel alteration. The photomosaic was seen as useful in wetlands classification and inventorying, but the Level II land-use map was seen as somewhat less useful. The land-use change maps were also seen as useful in monitoring river basins and wetlands. Other products considered useful include the cultural and locational feature overlays, generalized geologic maps, orthophotoquads, and computer data listings, of importance for documentation.

The Fish and Wildlife Service for many purposes needs data more specific and finer in resolution than that provided by Level II. Level III or IV would be desirable, but Level II is good for a start. All of the CARETS data were considered adequate in currency, since the agency is concerned with changes occurring in the past 15 years. The data for wetlands should be updated every 3 years and for major habitat classification, every 5 years. An accuracy level of 90 percent or better would be desireable as would a resolution of 2 acres or less.

US DEPARTMENT OF THE INTERIOR
Office of Land Use and Water Planning
November 27, 1974

Attending: Charles Meyers
Frank Carlson

The Office of Land Use and Water Planning (OLUWP) does not see itself as a user of CARETS data but rather as a clearinghouse to which local, State and regional agencies can turn for direction, assistance, and advice. Without enactment of Federal land-use planning legislation, the office is limited in the level of assistance it can provide. Currently, these activities include identification of State technical assistance needs, preparation of guidebooks in response to planning and program needs and review of research proposals to the Federal government.

The OLUWP's evaluation of CARETS products is thus more of a reflection of the desires and needs of State land-use/resource planning and management agencies with which the office has had contact.

According to Meyers, State agencies have a strong affinity for raw data, which may reflect an agency's desire to develop its own capabilities. Many agencies have responded positively toward high-altitude photography, although Meyers is not sure how genuinely this response reflects real management needs as opposed to the feeling that the agencies should be using such photography. Most users don't know how to utilize ERTS data except for very limited applications, e.g., hanging photos on their walls. But even serving in this manner, ERTS provides a valuable reference source. The response to Skylab photography has been nonexistent. Users don't know how to use or obtain it, why it is of value, or how it differs from ERTS imagery. Many users have been terribly frustrated attempting to obtain photography and imagery from Sioux Falls. EROS Data Center service has sometime been characterized by time delays and poor production quality. Meyers feels that there is a need for educating potential users, particularly providing information concerning the existing and/or known capabilities of the different remote-sensor data for extracting specific required land-use information.

Concerning the photomosaics and land-use maps, Meyers talked in terms of scales and categories rather than specifically evaluating the products. One problem with the photomosaics is their use of the UTM grid as opposed to the State plane coordinate system used by many States. In addition, State agencies would like a photomosaic covering their entire State. The scale of 1:100,000 appears good for many users, being close to 1:125,000, the scale that TVA, HUD, and AEC found to be most applicable for regional land-use mapping. A scale of 1:250,000 was seen as being to gross by many land management State agencies.

Meyers pointed out that USGS Circular 671 is not meeting the needs of many State agency users primarily because land use/land cover categories in the revision do not reflect adequately the input of many potential users who have responded to emerging State land use, management data needs

since the original version. The basic problem is that categories are based on what can be detected rather than the type of information actually needed by State level planning and management programs. Specifically these needs are for: (1) land-use activity oriented categories, separate from land cover and (2) categories that are more specific (Level III in Anderson's classification) or meet the recognized data requirements for land and resource management.

Meyers and Carlson viewed the generalized geologic maps as extremely valuable products, which could evoke very positive responses from State users. The orthophotoquads were also seen as very popular and valuable. There is a definite need for data on change, for which many look to ERTS. Even the amount of change in tabular form would be of value to many. Spatial census data will probably evoke major interest in the future as States develop natural resource data bases and move from an inventory to an analysis and management mode.

In response to the question concerning computer plots, Meyers told of his office's examination of State Critical Environmental Area Programs use of the Maryland's MAGI system, of which the many users wanted only the raw base map information rather than computer plots of different phenomena. These system requests were primarily from applications of resource identification, not resource management or analysis. The major use of the system by these agencies was as a bibliographical reference for sources of information.

Throughout the interview, both questioned the basis of the LUDA mapping proposal. Aware of the interests in complete land-use mapping of the United States, Meyers and Carlson felt such might be accomplished most cheaply and quickly using ERTS imagery but questioned its need. Once the overview has been obtained, efforts could be made to fulfill other user needs. Besides problems in scale and classification, the LUDA program needs greater flexibility built into it.

DEPARTMENT OF TRANSPORTATION
Federal Highway Administration
December 3, 1974

Attending: James Koka
Walter Manning
Norm Mueller
Frank Perchalski
Harold Rib

Norman Mueller prefaced all comments of the group with the statement that FHA should not be considered a user of the land-use data but is rather an agency concerned with uses and applications by State highway departments to which the FHA is administering Federal highway aid.

The general message conveyed by the FHA was that CARETS had little to offer State highway departments. Most such agencies have their own aerial surveys flown and do not need additional photography. The land-use data are much too gross and do not provide the type of information in which highway planners are most interested--intensities of residences, retail sales, and employment. Even in rural areas, the information provided is not of much value.

Some data were seen as having value although not really needed; these include the orthophotoquads and the high-altitude photography. The Skylab photography was considered too sporadic and limited, and the ERTS imagery, though repetitive, is not detailed enough. There are a very few opportunities when ERTS might be of value--when a broad picture, unconfused by details, is desired.

Although highway departments need information concerning Earth materials and surficial geology, the CARETS geology maps were found to be insufficient and "backwards" in following a format that highway departments could not use. The location of specific deppsits of sand and gravel suitable for highway construction is needed information that the CARETS geology maps do not provide. The representatives felt that highway departments should have been consulted concerning such geology maps, since they need them and have been making similar maps for at least 30 years.

Perchalski also pointed to the problem of the accuracy of CARETS maps. Although his only concrete examples of misinterpretation errors involved barren and urban land on the ERTS maps, he felt that both ERTS and aircraft derived land-use maps were inaccurate, poorly drafted, and inadequately edited. He felt the product would have been improved if "professional, well-rounded" interpreters had been included on the 1:100,000 scale maps.

In conclusion the FHA representatives felt that there was probably not a single CARETS product for which the State Highway Departments do not have a better source already at their command.

NASA EARTH RESOURCES PROGRAM GOODARD SPACE FLIGHT CENTER
January 9, 1975

Attending: John Barker
Charles Bohn

Barker and Bohn are interested primarily in the CARETS ERTS land-use maps and thus directed their comments exclusively to this product. Barker remarked that his program is working on demonstration projects with a number of State and local users that are trying to demonstrate how to use ERTS data. His program's main thrust is to discover what does and doesn't work and what can be expected from ERTS data.

Barker's main comment concerning the ERTS, Level I maps, which he had originally believed to be automatically produced from ERTS computer compatible tapes (CCT), was that they are harming the cause of ERTS by giving the impression that they are the best ERTS could do in respect to land-use data. Barker believes that ERTS land-use maps, prepared non-digitally, would not find many users.

Barker assumes the need for the extraction of the maximum amount of resolution from ERTS, accomplished through the use of the CCT. He has been experimenting with the tapes and believes the best starting point for any CCT work is the production of a "pseudocolor pixel print" for each of the four bands, which represent all possible reflectance values of pixels in different colors and thus indicate maximum possible resolution.

In response to questions concerning accuracy and the USGS classification, Barker felt that accuracy is very data dependent, and the USGS classification results in inaccuracies by not applying to categories of mixed land uses. The classification seems to be devised by non-ERTS people, unaware of the problems of using ERTS. Urban areas seem to cause the most problems with ERTS, and it may be that ERTS data are not very useful in urban areas.

Charles Bohn felt that the CARETS system is too expensive in producing ERTS land-use maps whose main value is for display and are of marginal value in providing highly accurate statistical summaries. According to Bohn, the best route might be to publish manually compiled ERTS land-use maps for display purposes but at the same time use the CCT's for obtaining area measurements, which can be made available upon request from users.

Barker saw this double use of ERTS as non cost effective, but rather preferred the production of ERTS digital information as a substitute for the photographic color composites now produced.

NASA WALLOPS STATION
January 27, 1975

Attending: Paul Alfonsi
Dick Dowd
Mike Conger

Alfonsi, Dowd, and Conger showed considerable interest in the CARETS products, primarily because of their involvment in the Chesapeake Bay Regional Data Center (CBRDC) at Wallops, where 125,000 frames of imagery have been cataloged and made available for public inspection. Although the more processed CARETS products would not be of much use to these men's research efforts, many of the products are believed to be of potential value to the users of the CBRDC. The questionnaire responses represent, therefore, potential needs of users rather than NASA research needs.

The NASA products--high-altitude aircraft, Skylab, and ERTS--are considered of value and are already a part of the CBRDC. The photomosaics were seen as particularly valuable as well as the land-use and land-use change maps derived from high-altitude photography. Also of great potential value are the orthophotoquads and orthophotoquad land-use overlays. Computer plots of land use were seen as useful and data summaries useful to a somewhat lesser extent. The cultural feature and census tract overlays were considered of little value, and the ERTS land-use maps were seen as being too generalized to meet the needs of most users. The generalized surficial materials maps were considered of limited value, although they might meet the needs of users untrained in the use of source materials.

The NASA representatives found the Level II land-use maps to be somewhat out-of-date but still useful. The ERTS land-use map, because of its scale and level of generalization was found to be adequate in currency. Land-use data at a scale of 1:100,000 should be updated every 5 years, whereas data at a scale of 1:24,000 should be updated every 2-3 years.

No accuracy evaluation was made for the CARETS data. An accuracy level of 90 percent, however, was deemed acceptable. Accuracy requirements vary depending upon the use of the data. The USGS classification was found to be satisfactory, but an improvement in the land-use maps would be to have them color coded, which would facilitate reading and understanding such maps.

In conclusion, Dowd remarked that the CARETS program was valuable in showing how to put photography and imagery to good use.

NUCLEAR REGULATORY COMMISSION
January 16, 1975

Attending: Stan Echols

As Environmental Project Manager for the Nuclear Regulatory Commission (NRC) (formerly in the Atomic Energy Commission), Dr. Echols is charged with management of the review of the applicant's environmental report. When a utility wishes to construct a nuclear generating plant, it submits an environmental report to the NRC, who conducts its own investigation and assesses the utility's environmental report. The NRC evaluates the proposed site for several parameters, including land use within 50 miles of the proposed site, population, surface and ground waters, ecology and others. As well, proposed power transmission line routes are examined for their environmental impact. Much of this work is conducted in the field by the national laboratories.

Dr. Echols sees considerable value in some of the CARETS products, but primarily for utility initial site selection--narrowing down site choices. High-altitude aircraft, Skylab, and ERTS photography and imagery could be useful as could Level II land-use maps, cultural feature overlays, and surficial geology maps. Land-use change data might also be of value on

a case-by-case basis to identify trends within an area. The 1972 ERTS Level I land-use map, however, was seen as having much less value than its Level II counterpart. Orthophotoquads and larger-scaled photography are generally supplied by the utility. Echols did not see computer plots of land-use as being useful, although computer data summaries could be useful as a quick way to see if the land-use information supplied by a utility is reasonable. The rest of the CARETS products were not found to be valuable.

Echols found the CARETS data sufficiently accurate for its intended use. He also felt that the CARETS land-use data and overlays were fulfilling a needed function. One type of additional data that the NRC needs but CARETS does not provide is that concerning commercial and private flyways.

Dr. Echols noted that discussions with representatives of the national laboratories might prove more fruitful in determining which services offered by the USGS are helpful in environmental analyses of nuclear power plant sites.

AMERICAN UNIVERSITY DEPARTMENT OF BIOLOGY
January 10, 1975

Attending: Dennis McFaden
Richard Anderson

McFaden and Anderson are under contract to the National Park Service to conduct experiments using remote sensing to determine the type of information that can be of value to national park managers. For their first year they have been funded to examine two parks--Catoctin Mountain Park and Assateague Island National Seashore--to find out what work is needed and to establish relationships with managers.

In responding to the CARETS user evaluation questionnaire, Anderson and McFaden discussed basically the data that they had used in their research for the National Park Service. They did not feel qualified to evaluate any of the land-use maps or overlays because they had not actually used them in their research. Other data products, however, were considered quite useful. ERTS analog and digital data were found useful, and ERTS diazochrome reproductions and NASA's ERTS Analysis Program vegetation and water quality analysis algorithms have been used. Skylab data were found valuable in wetland research. A color-infrared composite of three black and white bands of the 190A photography

enlarged to 1:250,000 was found more useful in some respects than the color infrared band from the multispectral camera. The S-190B photography, enlarged to 1:63,360, was found to hold its resolution quite well. The orthophotoquad was seen as somewhat useful but an excellent way to introduce the potentials of remote sensing.

Anderson did feel that a CARETS data center would be valuable for anyone conducting research in the region and that there is a real need for such a regional information center.

CENTER FOR NATURAL AREAS
January 17, 1975

Attending: David Kunhardt
Anthony Neville

The Center for Natural Areas was established in July, 1972 with grants from the Nature Conservancy and the Chesapeake Bay Foundation, matched by funds from the Smithsonian Institution's Office of Environmental Sciences to conduct research on the natural areas of the Chesapeake Bay. Though originally within the Smithsonian Institution, it is now a private, nonprofit corporation affiliated with the Smithsonian Institution which is involved in several projects concerning critical resources, land planning and natural areas.

According to David Kunhardt, when CNA makes use of remote-sensor data, they are most likely to be low-altitude black and white or color-infrared photography used in conjunction with map and field work. Several of the CARETS products were seen as useful, however, among them the high-altitude photography, ERTS imagery (if provided by the Federal government), land-use change and cultural features maps, surficial geology overlays, orthophotoquads (as updates to topographic sheets), and computer listings. The other products were seen as having marginal value at best. The Level I and II land-use maps were considered both "too interpreted" and "not interpreted enough." The polygon line maps were found to be difficult to read and hard to use for the location of specific land uses or land-use patterns. Color coding the maps would facilitate their use considerably. Also the scale of 1:100,000 is difficult to work with because it does not fit the formats of any of the standard mapping scales. The currency of all the data was deemed adequate, although the need for currency is dependent upon the type of work being done. The frequency of updating would also be dependent upon the needs of a particular project. Kunhardt stated that an accuracy level of greater than 90 percent at 1:24,000 would be desired and asked when the more highly detailed remote sensing work of the Federal government will be declassified.

Kunhardt and Neville expressed considerable criticism of the Circular 671 classification, basically because no values are allowed for categories. Center for Natural Areas researchers are interested in the "quality" of a land use such as agricultural land, the potential for the land, and the interpretation of natural systems and interactions.

CHESAPEAKE RESEARCH CONSORTIUM, INC.
February 21, 1975

Attending: Dr. Theodore Chamberlain (telephone)

According to Dr. Chamberlain, the Chesapeake Research Consortium is particularly interested in two problems in the Chesapeake Bay region for which projects have been proposed. One project would involve synoptically viewing currents in the Chesapeake Bay using a series of data collection platforms. These platforms would relay current information to a central location where it could be analyzed. The second project, for which CARETS land-use data could be of great value, is determining the time rate of land-use change in the Chesapeake Bay region, which would allow the drawing of curves to predict future land-use change and suggest how changes in zoning laws might help prevent undesirable changes.

Another project in which the consortium is interested is producing a coastal zone atlas of the Chesapeake Bay modelled after the Environmental Geologic Atlas of the Texas Coastal Zone (with maps at a scale of 1:250,000) compiled by the University of Texas Bureau of Economic Geology. These charts display environmental geology, physical properties, land use, active processes, rainfall, topography, and other phenomena. Many of the CARETS products would be quite valuable for the production of such an atlas.

Chamberlain was considerably more interested in the CARETS processed data than he was in the raw data products. Of the raw data only the high-altitude photography was of interest and even it was considered of marginal value for most purposes. All of the land-use, land-use change, and overlay sheets were considered valuable, as were the computer plots and area summaries.

Chamberlain felt that the land-use data were adequate in currency and should be updated every 2 to 5 years. An 80 to 90 percent accuracy level was deemed satisfactory as was the USGS classification.

UNIVERSITY OF DELAWARE COLLEGE OF MARINE STUDIES
January 21, 1975

Attending: Dave Bartlett

The College of Marine Studies of the University of Delaware is involved in the large-scale (1:24,000) mapping of tidal wetlands for the State Department of Natural Resources and has both ERTS and Skylab contracts to conduct wetlands research. For the large scale wetland mapping CARETS data are not of much value because of scale problems. For the ERTS and Skylab research, however, some products have or could be of value.

Dave Bartlett reported that all the raw data products were of value and were used in his research. The photomosaic, which he had not yet seen, was also considered potentially useful. The Level II land-use maps have been used along with aerial photography as ground truth for research using the ERTS computer compatible tapes. For Bartlett's purposes, the photography is much better as a source of ground truth than the processed land-use maps because the photography allows for more flexibility in interpretation. Level II land-use change maps could be of value as ground truth for ERTS change detection studies, providing the change covers the desired period of time. The remainder of the data were not considered useful for Bartlett's ongoing research.

Bartlett considered the CARETS data somewhat out-of-date but still useful. Annual updating would be preferred, but an update every 2-3 years would still be useful. A 90 percent level of accuracy is also desired. Bartlett reported that in the Lewes-Rehoboth Beach area interpretation errors were found where shrubby-sandy land was misclassified as nonforested wetlands.

The USGS classification system was found to be satisfactory. Although Level II alone would not suffice for the wetlands land-use map, a combination of Level III or IV for the wetlands (going down to species composition) and Level I for most other land uses was developed and found to be satisfactory.

UNIVERISTY OF VIRGINIA PROJECT FOR STUDY OF COASTAL ENVIRONMENTS
December 5, 1974

Attending: Jeffrey Heywood

The data needs of the Project for the Study of Coastal Environments (PSCE) are very project oriented. The goal of the National Park Service-funded research is to supply information to the Park Service to help in decision making. The present project--measuring the change in the coastal overwash penetration line or vegetation line--requires very large-scale aerial photography, and consequently the PSCE has limited use for the USGS/CARETS products with the exception of the 1:24,000 orthophotoquads and perhaps the Level II land-use overlays to the orthophotoquads. The researchers have little need for most of the data products such as the land-use maps and overlays, and the product that might fill a need--the high-altitude photography--is too small in scale to be used in the present study's methodology of enlarging all available photography to 1:5,000 on a Kargyl reflecting projector.

Heywood reported that the present land use in the National Park Service-controlled land is fairly well known. Future projects of the PSCE may find needs for other raw or processed products, particularly an ERTS project to begin next spring.

VIRGINIA INSTITUTE OF MARINE SCIENCE
December 9, 1974

Attending: John B. Pleasants (telephone)

John Pleasants of the Virginia Institute of Marine Science concluded from the CARETS products examined that very few could be of value, primarily because most of the data are too gross and lacking in detail and too expensive for the information provided. VIMS is concerned with coastline changes and the location of sewage outfalls, harbors, electric power plants, and other detailed phenomena. Some use might exist for high-altitude and Skylab photography, orthophotoquads, and land-use area summaries, such as studying sedimentation and the extent of flooding, but VIMS would have little use for most of the other data. VIMS does need a highly accurate delineation of wetlands to such detail as species composition, but Pleasants sees little help from CARETS products.

Appendix F

Proposed Revision of CARETS User Evaluation Questionnaire

CARETS USER EVALUATION QUESTIONNAIRE
[Proposed Revision]

This questionnaire is designed to allow users of land resource information to participate in the evaluation of a Federal government program and to provide recommendations concerning how such projects as the Central Atlantic Ecological Test Site (CARETS) can be more responsive to their needs.

Please examine this questionnaire carefully but do not fill it out until you are interviewed by a representative of the CARETS user evaluation program.

Respondent Information

Agency or Organization:_____

Contact Person:_____

Address:_____

Telephone:_____

Date:_____

I am participating in this evaluation because of my interest in

_____the CARETS project

_____the Central Atlantic region

_____land resource data derived from remote sensors

_____land resource information systems

_____environmental impact studies

_____other (specify)_____

Types of CARETS products of primary interest to me are:

_____"raw" remote sensor data products (e.g. ERTS imagery, aerial photos)

_____processed graphics (e.g. land use maps, orthophotoquads)

_____data listings and statistical summaries (e.g. amount of land in uses)

_____interpretive reports (e.g. analysis of regional land use trends)

I Evaluation of Raw Data, Imagery, and Maps

1. Please check the appropriate spaces below.

Indicate potential value for your application.	Publication recommended	Useful	Somewhat useful	Not useful	If not useful				
					Not detailed enough	Too detailed	No capability for use	Too interpreted	Other
High altitude color infrared photography 1:120,000									
ERTS imagery									
Skylab S-190 B photography (earth terrain camera)									
Photomosaic with UTM grid, 1970 black and white 1:100,000									
Land use map 1:100,000 1970 Level II, aircraft data									
1970-72 land use change 1:100,000 Level II, aircraft data									
Landforms and surficial materials map 1:100,000									
Drainage basin overlays 1:100,000									
1972 land use 1:250,000 derived from ERTS imagery - Level I									
Census tract overlay in SMSA's county boundaries outside SMSA									
Cultural and locational feature overlay 1:100,000									
Computer plots of land use									
Computer data listings									

2. Land Use Classification

The land use classification scheme used in the CARETS land use maps is:

_____adequate

_____useful but not detailed enough

_____incompatible with other data but still useful

_____not useful

3. What applications does your agency presently have for any CARETS products?

_____

_____

_____

II Recommendations for Future Program Efforts

1. Recommended classification detail

_____Level I

_____Level II

_____Level III

_____other (specify)_____

2. Recommended scale(s)_____

3. Recommended accuracy of land use maps

_____greater than 95 percent

_____90-95 percent

_____85-90 percent

_____other (specify)_____

4. Recommended research relating to environmental impact

_____air quality

_____water quality

_____microclimate

_____environmental hazards

_____others (specify)_____

5. Recommended regional or environmental emphasis for priority land use analysis

_____urban and metropolitan

_____rural

_____wilderness

_____coastal zone

_____ arid lands

_____others (specify)_____

6. Other recommendations:_____

_____

_____

_____