DEPARTMENT OF NATURAL RESOURCES
N.Y.S. Col. AG. & Life Sciences
Fernow Hall, Cornell University
Ithaca, New York 14850

PROGRESS REPORT

Evaluation of Skylab Imagery as an Information Service for Investigating Land Use and Natural Resources, (Skylab) NASA Contract: NAS 9-13364

E 7. 5 - 1 0. 0 1 8.

A preliminary version of a questionnaire for the Information/Data Requirements Survey has been developed and is attached to this progress report.

In order to provide an organizational framework for the survey, the potential users are viewed as units which acquire data and information, then process and/or analyze it, and finally transmit new data and/or information. The information transmitted may be in the form of reports, decisions or actions. This output may be the input of another unit.

The questionnaire has been organized into five sections in order to expedite the analysis of the survey findings.

1. Agency/Organization Characteristics—

    Distinguishing characteristics include: function, subject area, geographic jurisdiction, organizational relationships, personnel and kinds of activities.

2. Data/Information Needs—

    Factors include: categorical specificity, resolution and required frequency.

3. Data/Information Acquisition and Storage—

    Factors include; the methods of acquisition and storage, and the transmission of data and information between various agencies.

4. Data/Information Processing and/or Analysis—

    Factors include: the extent and methods of analysis, and the use of computing equipment. These factors should have a strong influence on the kinds, quality, format and amounts of data/information required.

5. Agency/Organizations Products and/or Services—

    Factors include: products and services (output) and users and beneficiaries (including the links between them and the agency or organization).

As a preliminary step in the survey of information and data require-
ments of local and regional agencies, discussions were held with extension
agents from Orange, Ulster and Dutchess Co nties in the lower Hudson Valley
study region and from Suffolk County on Long Island.

Extension education, along with teaching and research, is one of the
prin ipal responsibilities of the statutory colleges of Cornell University.
The county agen s provide the link between the University and the citizens
of the state. Consequently, the county agents have first hand knowledge of
those local and regional agencies and organizations with interests in land
use and natural resources, as well as considerable insight into local prob-
lems and needs. Because this extensive network of contacts exists, it was
felt that meetings with county agents would be an appropriate preliminary
step in the survey procedure.

As a result of these discussions, several additional survey contacts
were suggested. In a number of instances, the county agents have established
working relationships with these agencies and organizations and will make
the preliminary contacts and serve as a continuing liaison between them and
the Resource Information Laboratory.

Photographic procedures using readily available darkroom equipment and
films coupled with diazo transparencies is under further investigation in an
effort to assure accurate, reproducible results with each set of NASA negatives
or positives. Developments to date indicate that given D-log E curves,
(available from the manufacturer of films, plates, and papers for specific
developers) the exact parameters of work may result. This calls for com-
pletion of our work to compare gamma, contract index, density ranges and
other factors that influence the final product.

A trial test has been made comparing ERTS-1 and Skylab SL-3 imagery of the Hudson River Valley. Both missions were "imaged" within a few days of each other and the final color infra-red composites at a scale of 1:250,000 were judged nearly identical (within the limits of resolving power of the original satellite equipment). The laboratory procedures followed included a refinement as outlined in Philips (1974)* and a single step process for the Skylab imagery. A more detailed description of the e refinements will be forthcoming.

The color prediction model for selecting the bands, hues and exposure setting combinations appears to be working quite well. A final major change in the program has been made so that perceptional color differences are taken into consideration in addition to the maximum quantitative color separation band on the CIE color coordinate system. A total of 10 points of different density values can be compared on each of three bands, both positive and negative. A maximum of three points are compared for each composite generated. Total cost for composing five points is approximately $12.00.

A brief description of the computer program is as follows:

I. Read in the necessary data tables
    A. Transmittances of diazo materials
    B. Ch. acteristics of the D5000 standard light source
    C. The number of band combinations to check
    D. Densities of the points to check (up to 10 points)

II. Set up additional tables
    A. Compute (interpolate) transmittances to the densities of each point
    B. Compute adjacency data for the cell model
    C. Initialize the optimum to 0.

III. Run through the possible band combinations (3 bands, all different)
    A. Vary hue ⟷ band connections
    B. Vary exposure level in each band
    C. Evaluate the assignment of hues and exposure by checking out the separation of 2(3) points. Retain the best of each pair or triplet of points.*

IV. Print out the results.

* Phillips, E.S., (1974), "Photographic Enhancement of ERTS Imagery", Resource Information Laboratory, NASA Contract-NAS 5-13886,

A. For each pair of points the distance is computed as

    $D \longrightarrow \sqrt{(\Delta X)^2 + (\Delta Y)^2}$ in euclidian space.

B. For each triplet:
1) locate each point in one of the ten cllls
2) using the adjacency graph, compute the cell distance between each pair in the triplet (i.e., (1,2),(2,3),(1,3)).
3) get the minimum of these cell distances then if the next pair is less than the minimum thus far seen, ignore the new pair. if it is bigger, (the resulting triangle being larger and more equilateral) then use it. if it is equal, (possible cell distances are 0,1,2,3,4) then go to the next interim.
4) compute the mean of those cell distributions;if a bigger mean, than larger distance(Δ) then use new pair;if a smaller mean, than smaller distance(Δ) then ignire it if equal; then check areas.
5) the computation of area measures at this stage will result in a greater tendency to generate equilateral triangles, which should correspondingly result in the best color separation,

Figure 1 shows the CIE chromaticity diagram which describes the arrangement of colors as illuminated by a standard light source. The heavy dark lines show the basic colors as described by Judd in Billmyer and Saltzman (1966)*. The medium weight lines are the outer limits of the diazo film capability to produce different colors using cyan, magenta and yellow dyes. The light weight lines describe the adjacency cell boundaries from which the model selects a family of CIE points so as to maximize the color differences among any three black and white density points translated into the three diazo hues.

A more complete description of this program as well as an evaluation of the interpretability of the color composites will follow in succedding reports.

* Billmyer, F.W. and M. Saltzman (1966) Principles of Color Technology, Interscience Publisher, John Wiley & Sons, New York, New York.

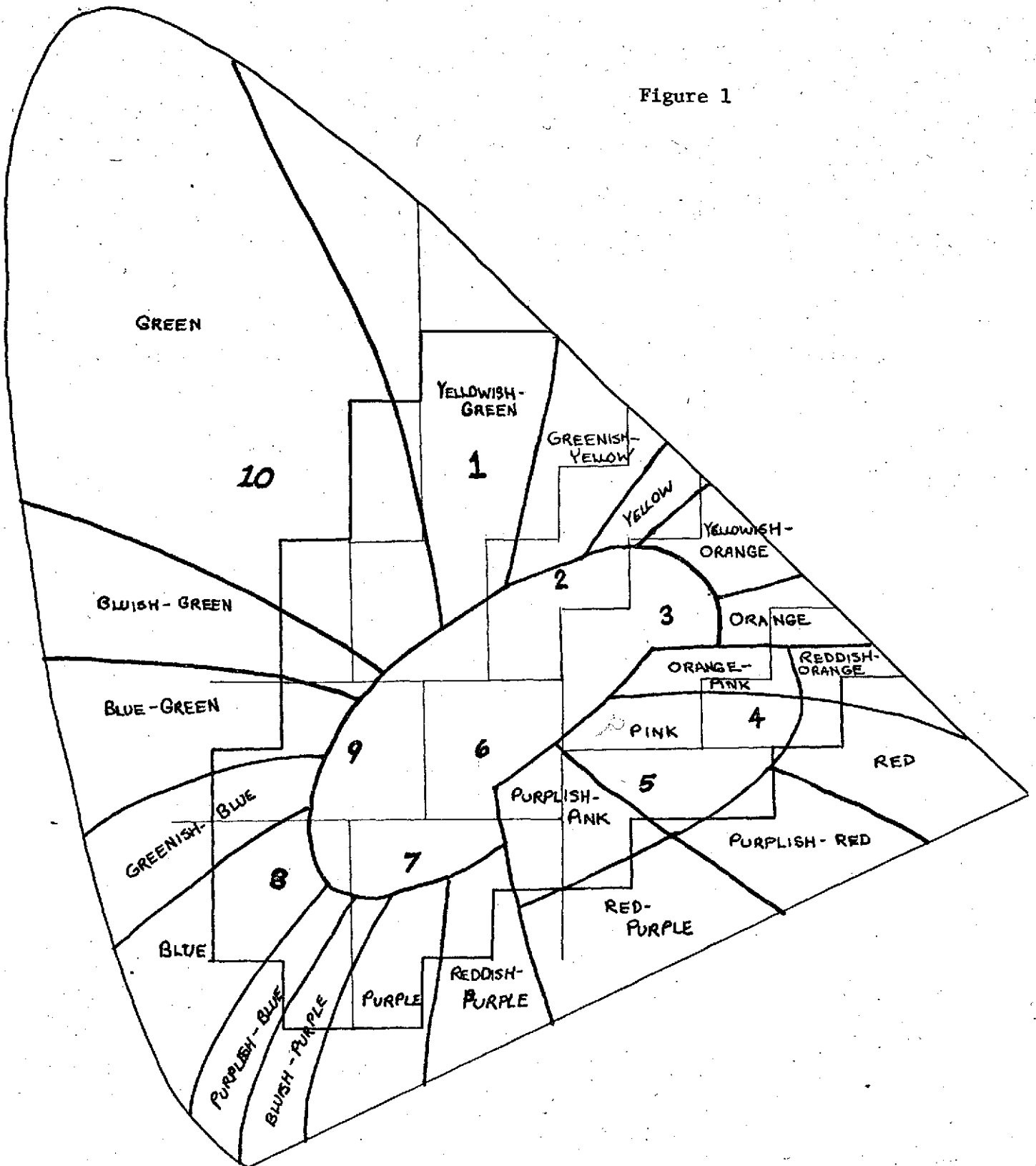Principal Investigator: Dr. Ernest E. Hardy

Agency: New York State College of
                                      Agriculture and Life Sciences
                                      Cornell University
                                      Ithaca, New York 14853

Figure 1

GREEN

YELLOWISH-
GREEN

1

10

GREENISH-
YELLOW

YELLOW

YELLOWISH-
ORANGE

2

BLUISH - GREEN

3

ORANGE

REDDISH-
ORANGE

ORANGE-
PINK

BLUE-GREEN

PINK

4

9

6

RED

GREENISH- BLUE

PURPLISH-
PINK

5

8

7

PURPLISH- RED

BLUE

RED-
PURPLE

PURPLISH- BLUE

BLUISH - PURPLE

PURPLE

REDDISH-
PURPLE

RESOURCE INFORMATION LABORATORY

DEPARTMENT OF NATURAL RESOURCES

NEW YORK STATE COLLEGE OF AGRICULTURE AND LIFE SCIENCES

CORNELL UNIVERSITY

ITHACA, NEW YORK   14853

INFORMATION / DATA REQUIREMENTS SURVEY

Agency/Organization: _____

Address: _____

_____

Respondent:_____Title: _____

Telephone: _____

Questionnaire Outline

1. Agency/organization characteristics

2. Data/information needs

3. Data/information acquisition and storage

4. Data/information processing and/or analysis

5. Agency/organization products and/or services

The objective of this survey is to determine the areal data and information needs of governmental departments and agencies, and other organizations with regional and environmental interests. All replies to this survey will be confidential. The final report will omit findings which could be attributed to specific agencies or organizations.

Thank you very much for your cooperation.

1.1 What is the primary function of your agency/organization?
(e.g., research, planning, policy formulation, management)

1.2 What are the subject areas with which your agency is primarily concerned?
(e.g., agriculture, natural resources, environmental quality, housing,
transportation, etc.)

1.3 What is its regional jurisdiction? (Name or description, approx. size,
counties, minor civil divisions included, population, etc.)

1.4 What is the organizational relationship of your agency to federal, state,
or local government? (e.g., line, staff, quasi-governmental, advisory, none)

1.5 What is the annual budget of your agency/organization? (Exclude large
atypical expenditures)

1.6 What are the major sources of funding?

Source	Percentages
Federal	
State	
Local	
Other	

1.7 What is the size of the agency/organization staff? (Full-time equivalents)

1.8 What are the primary specialties/competencies of the professional/technical
staff?

_____ Operations research/systems analysis

_____ Civil/environmental engineering

_____ Air photo and/or remote sensing interpretation

_____ Computer programming

_____ Statistics

_____ Planning

_____ Economics

_____ Sociology/demography

_____ Landscape architecture and environmental design

_____ Ecology

_____ Geography

_____ Other (please specify)

1.9 What are the interests of your agency/organization in areal data/information? (Indicate all that apply.)

_____ Collection and recording of primary data

_____ Preliminary processing and storage of data and information

_____ Analysis and interpretation of data and information

_____ Use of data and analysis based on such data for decision making.

1.10 If data and/or analysis based on such data is used for decision making, are decisions directed to general policy, or to specific projects?

What is the size of the geographic area generally affected by such decisions?

1.11 What agencies, organizations or groups are affected by the activities of your agency/organization?

2.1 For each information item listed below, please indicate:

a. Whether or not is is presently contained in your agency's data/information file; and

b. How pertinent it is to the activities of your agency.

LAND USE ACTIVITIES	ON FILE		PERTINENCE		
	YES	NO	REQ'D	USEFUL	NO USE
Residential	—	—	—	—	—
Housing Type	—	—	—	—	—
Density	—	—	—	—	—
Manufacturing	—	—	—	—	—
Transportation	—	—	—	—	—
Communications	—	—	—	—	—
Utilities	—	—	—	—	—
Commercial	—	—	—	—	—
Services	—	—	—	—	—
Governmental	—	—	—	—	—
Educational	—	—	—	—	—
Professional	—	—	—	—	—
Other	—	—	—	—	—
Cultural/Entertainment	—	—	—	—	—
Parks/Recreation	—	—	—	—	—
Resource Production & Extraction	—	—	—	—	—
Agriculture	—	—	—	—	—
Forestry	—	—	—	—	—
Extractive Industry	—	—	—	—	—
Other	—	—	—	—	—
NATURAL CHARACTERISTICS					
Topography	—	—	—	—	—
Slope	—	—	—	—	—
Elevation	—	—	—	—	—
Geology	—	—	—	—	—
Soils	—	—	—	—	—
Vegetation Type	—	—	—	—	—
Water Areas	—	—	—	—	—
Hydrology	—	—	—	—	—
Climate	—	—	—	—	—
Rainfall	—	—	—	—	—
Snow Cover	—	—	—	—	—
Wildlife Habitats	—	—	—	—	—

	ON FILE		PERTINENCE		
CULTURAL AND OTHER FACTORS	YES	NO	REQ'D	USEFUL	NO USE
Land Ownership	___	___	___	___	___
Public	___	___	___	___	___
Private	___	___	___	___	___
Institutional	___	___	___	___	___
Zoning and Other Legal Restrictions	___	___	___	___	___
Zoning Districts	___	___	___	___	___
Agricultural Districts	___	___	___	___	___
Forest Districts	___	___	___	___	___
Utilities	___	___	___	___	___
Water	___	___	___	___	___
Sewage	___	___	___	___	___
Solid Waste	___	___	___	___	___
Land Value	___	___	___	___	___
Taxation	___	___	___	___	___
Assessment	___	___	___	___	___
Rate	___	___	___	___	___
Agricultural Viability	___	___	___	___	___
Social and Demographic Characteristics	___	___	___	___	___
Economic and Employment Characteristics	___	___	___	___	___
Housing and Other Building Conditions	___	___	___	___	___
Intensity of Use	___	___	___	___	___
Transportation	___	___	___	___	___
Capacity	___	___	___	___	___
Origin-Destination	___	___	___	___	___
Accessibility	___	___	___	___	___
Environmental Quality	___	___	___	___	___
Air	___	___	___	___	___
Water	___	___	___	___	___
Visual Qualities	___	___	___	___	___
Other	___	___	___	___	___

2.2 Does your land use classification system conform with any of the following:

_____ New York State Land Use & Natural Resources Information System
_____ Standard Land Use Classification System
_____ Other (Please specify)
_____ None

Is your land use classification system comparable with those of neighboring jurisdictions?

With those of wholly contained jurisdictions?

2.3 How specific must the categorical breakdown of land use information be? (e.g., 1, 2, 3 or 4 digit level in the SLUC system)

2.4 How precise must the geographic referencing system be, i.e., what degree of locational accuracy is required?

	One Meter	Ten Meters	100 Meters	Other
Urban areas	___	___	___	___
Suburban and/or rapid change areas	___	___	___	___
Agricultural areas	___	___	___	___
Rural non-farm	___	___	___	___
Areas of environmental concern	___	___	___	___

2.5 How frequently should areal data be updated?

	One Year	Two Years	Five Years	Ten Years	Other
Urban areas	___	___	___	___	___
Suburban and/or rapid change areas	___	___	___	___	___
Agricultural areas	___	___	___	___	___
Rural non-farm	___	___	___	___	___
Areas of environmental concern	___	___	___	___	___

2.6 What is the length and staff requirements of the average study (man-months)?

What proportion is devoted to data collection?

What proportion is analysis?

2.7 Are studies repeated at regular intervals?

2.8 What is the size of the typical study area?

If the size varies significantly, what is the range?

2.9 What is the usual unit of analysis used by your agency?

____ Individual parcel	____ Administrative district (specify)
____ Grid delineated cell	____ Natural area (specify)
____ Census tract	____ Political unit (city, town, county)
____ Planning district	____ Other
____ Block	

3.1 How does your agency/organization presently acquire areal data/information?

_____ Through field observation and surveys

_____ Through aerial photography or other remote sensing techniques

_____ Existing maps and other secondary sources

3.2 Who obtains the above information/data for your agency/organization?

_____ Staff

_____ Consultants

_____ Other agencies

What general categories of data/information are obtained from other agencies?

3.3 Is the data/information obtained from other agencies compatible with your needs in terms of definition, discrimination scale and/or format.

3.3 Do you use statistical sampling procedures in your studies?

For what kinds of data/information?

3.4 Is data/information generally collected for specific projects, programs or studies, or is it intended for repeated use?

3.5 Is any data/information updated on a continuing and periodic basis? Please specify.

3.6 Do you supply other agencies/organizations with data/information?

Which agencies?

In what form is the data/information supplied?

3.7

3.7 Do you use any of the following data/information sources?

_____ Air photos	_____ LUNR Overlays
_____ USGS Topographic Maps	_____ LUNR Computer graphics
_____ Tax maps	_____ Other

3.8 What aerial photographic or remote sensing techniques, if any, has your agency used in its work?

_____ Low/high altitude black and white panchromatic photography

_____ Color aerial photography

_____ Multi-spectral photography

_____ Color infra-red photography

_____ Thermal infra-red scanning

_____ Other

3.9 How is the data/information stored?

_____ Air photos   _____ Computer cards

_____ Maps and overalys   _____ Computer tapes and/or disks

_____ Printed summaries and tabulations   _____ Other (Please specify)

3.10 Is the agency's information system fully documented? That is, is there a systematic method for maintaining current knowledge of the content of the data file, and knowledge of where and how it may be accessed?

4.1 How would you describe the analysis phase of your agency's work?
(e.g., visual analysis of mapped information, quantitative analysis,
analytic evaluation and decision techniques.)

What techniques are employed? (e.g., locational analysis, economic
base studies, etc.)

4.2 Does your agency use computing equipment for data processing and analysis?
Indicate extent of application:

_____ Answering specific inquiries

_____ Quantitative and statistical analysis

_____ Summaries and tabulations

_____ Modeling or simulations

_____ Line-printer graphics

_____ Coordinate plotter graphics and/or cartography

_____ CRT displays

_____ Other

If your agency uses computing equipment, is the computing done:

_____ On "in house" equipment

_____ On equipment shared with other governmental agencies

_____ Through contract with an outside facility

_____ University computing center

_____ Industrial corporation

_____ Commercial service bureau

Does your agency have input/output equipment "in house?" If yes, please specify.

How is computer software obtained?

_____ Manufacturer supplied or generally available

_____ Leased or purchased software

_____ Consultant supplied software

_____ Internally developed software

_____ Software developed by or for other agencies (including those of
the Federal government.)

4.3 If your agency does not now use computing equipment in its activities, please indicate reasons:

_____ Present methods are adequate

_____ Cost is prohibitive

_____ Data volume is insufficient to warrant its use

_____ Lack of experienced personnel

_____ Lack of adequate software

_____ Lack of centralized equipment

If centralized computing equipment, software, data file and support personnel were available, would you consider using EDP?

4.4 Do you use consultants in the analysis phase? Indicate specialties.

Do they use computing equipment in their analytic work?

5.1 What is the primary format of your agency's end product?

____ Verbal

____ Quantitative

____ Graphic

5.2 What is its primary purpose?

____ Answers to special inquiries

____ Informational/educational

____ Specification of alternatives

____ Prediction of the consequences of alternative actions

____ Evaluation of the consequences

____ Recommendations

____ Policy-formulation

____ Action

____ Other

5.3 What degree of categorical specificity is required for the agency's end product?

5.4 Who are the primary users of your agency's products or services? (i.e., those users for whom the product or services are intended.)

Local: Region:

Town: State:

County: Federal:

Are there any other users?

5.5 How is the output disseminated? (e.g., do users request specific products or services or is it prepared and sent as a matter of routine.)

5.6 Have definitive policies been established for the release of data/
     information to other agencies and/or the general public?

     Please elaborate.

5.7 Does your agency make primary data available to other agencies?

     In what form? (e.g., maps, computer cards or tapes, etc.)

5.8 Is the general public made aware of the products and services of your agency?

5.9 How can the public gain access to information collected by or for your agency?

5.10 Who is the primary beneficiary of the activities of your agency?

     Additional Comments: