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Summary Report
Fifth International Remote Sensing Workshop
September 5 - October 3, 1975

by
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and
Ronald E. Beck

Workshop
EXCELLENT REPORT
LOOKS LIKE
1- MORE INFO
2- MORE EXERCISES
3- MORE CASE STUDIES
4- MORE COVERS
5- MORE TECH. ST.

EROS Data Center
Applications Assistance Branch
U.S. Geological Survey
Sioux Falls, South Dakota

This is a preliminary report and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

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Introduction

The Fifth International Remote Sensing Workshop was held at the EROS Data Center, Sioux Falls, South Dakota, from September 5 to October 3, 1975. The workshop was a cooperative program developed by the Office of International Geology (OIG) and the Earth Resources Observation Systems (EROS) Program of the U.S. Geological Survey.

With the completion of this workshop, a total of 133 foreign scientists have been trained at the EROS Data Center through this joint relationship. As a result of the successful completion of two workshops during 1975, the decision was made to offer two international workshops yearly, one in May and one in September.

The objective of the Fifth International Remote Sensing Workshop was to teach the use of remote sensing data, principally that acquired by the Landsat satellite (formerly called ERTS, or Earth Resources Technology Satellite), for the inventory and evaluation of Earth resources. Emphasis was placed on multidisciplinary uses of remote sensing data, and participation was guided by the principle of "learning by doing". Workshop exercises provided the participants with the opportunity to work with image examples that reinforced the techniques taught as part of the various discipline presentations (e.g., geology, hydrology, agriculture, etc.). Several exercises focussed on the Black Hills area where field-checking was done as part of a 4-day field trip. Landsat imagery of each participant's own study area was also analyzed as part of the workshop program.

Although financial support by the Agency for International Development (AID) had been a major part of earlier workshops, only 5 out of 31 attendees were supported by AID. The remainder were sponsored by their own government, with the exception of one participant who was sponsored by UN-FAO and a second who was supported in part by the National Academy of Sciences.

Acknowledgements

The overall success of the Fifth International Remote Sensing Workshop was largely due to the excellent cooperation given from many sources. EROS Program staff, represented by Col. A. P. Colvocoresses and Dr. John DeNoyer, provided excellent organizational and instructional assistance. Personnel of the EDC Data Production and Technical Support Branch, especially Ms. Kay Langin in the Data Reference File, gave exceptional support--in assistance to participants, ordering of imagery products, and in the conduct of daily activities.

Mrs. Phyllis Wiepking, EDC Community Affairs Representative, and Mrs. Geraldine Cadigan and Mrs. Olga Marinenko, USGS Office of International Geology, arranged, coordinated, and participated in the orientation of the course attendees.

Mr. Dick Kelly and the staff of the Town House Motel provided extra attention to make the participants' stay in Sioux Falls a pleasant one. Many families in the Sioux Falls community also hosted and entertained the participants, giving them some insight into Midwestern family life.

Mrs. Margo Flagg of Ron Jensen Travel Agency graciously and professionally assisted in arranging travel schedules. Mr. Dick Munce of Northwestern National Bank gave a thorough presentation of the banking arrangements available to the participants, and assisted many of the students with fiscal arrangements during their stay.

Workshop Instructors

The names and staff positions of the Workshop instructors appear in Table 1. The EROS Data Center staff was supplemented by two speakers from the EROS Program Office.

Table 1.--List of Instructors for the
Fifth International Remote Sensing Workshop

<u>Name</u>	<u>Position</u>
Mr. William H. Anderson	Applications Scientist, Agriculture/Soils
Mr. Ronald E. Beck	Training Coordinator
Mr. Timothy C. Bidwell	Librarian
Dr. David M. Carnegie	Principal Applications Scientist, Rangeland
Dr. Alden Colvocoresses	Cartography Coordinator, EROS Program (Reston, Virginia)
Dr. William C. Draeger	Principal Applications Scientist, Agriculture/Soils
Dr. John DeNoyer	Director, EROS Program (Reston, Virginia)
Mr. Gary Jones	Supervisor, User Services
Mr. David D. Greenlee	Data Analyst
Dr. Albert G. Hahn	Media Training Specialist
Mr. Dennis R. Hood	Applications Scientist, Land Use
Ms. Kay Langin	Data Reference File Technician
Mr. Donald T. Lauer	Acting Chief
Ms. Cheryl Mitchell	Library Assistant
Mr. Gerald K. Moore	Hydrologist, USGS, Water Resources Division
Ms. Charlotte I. Muchow	Data Analyst
Mr. James A. Nickerson	Training Assistant
Mr. Donald G. Orr	Principal Applications Scientist, Geology
Mr. Lawrence R. Pettinger	Information Officer

Table 1.--List of Instructors for the
Fifth International Remote Sensing Workshop--Continued

<u>Name</u>	<u>Position</u>
Mr. Wayne G. Rohde	Principal Applications Scientist, Forestry
Dr. James V. Taranik	Applications Scientist, Geology
Mr. William J. Todd	Applications Scientist, Land Use
Dr. Fred A. Waltz	Principal Systems Analyst

(note: all staff are from the EROS Data Center unless otherwise indicated)

Participants

Thirty-one scientists from nineteen nations, representing several different Earth science disciplines and related fields, participated in the Workshop (Table 2). Thirteen were geologists, seven were involved in agriculture or soils studies and the remainder, forestry or hydrology. Prior experience of the participants in remote sensing, particularly in regard to Landsat imagery, varied from none to substantial. The varied levels of experience in remote sensing created some problems in regard to emphasis and technical balance in the Workshop lectures. However, these problems were minimized by encouraging discussions and active participation of the experienced participants during lectures and workshop activities. In addition, the optional fourth week of the Workshop was scheduled so that each participant could pursue a number of activities at his own level of comprehension.

Workshop Description

The formal Workshop was three weeks in length. An optional fourth week was available for individual study and consultation with EDC applications scientists. Class hours were 8:30 a.m. to 4:30 p.m., five days a week. Field trips were arranged for parts of two weekends during the Workshop. Optional evening seminars covering selected topics were also offered. The detailed schedule is attached (Appendix A).

The Workshop schedule provided a balance between lecture and exercises on the application of Landsat data for resource analysis and management. Specific applications addressed included cartography,

Table 2.--List of Participants,
Fifth International Remote Sensing Workshop

<u>BRAZIL</u>	
Ronald Fleischer	Geology
<u>CANADA</u>	
James Seaton	Geology
<u>DOMINICAN REPUBLIC</u>	
Ivan Tavares	Geology
<u>EGYPT</u>	
Ibrahim Ali El Kassas	Geology
<u>ENGLAND</u>	
Trevor Beaumont	Transportation
<u>GHANA</u>	
Kwasi Barning	Geology
<u>INDIA</u>	
Durga Prasada Rao Dasika	Geology/Geomorphology
T. R. Srinivasan	Soils
Manohar Wasudeo Tak	Geology
Kaushal Prasad Tiwari	Forestry/Natural Resources
<u>IRAN</u>	
Farrokh Barzegar	Geology
Gholamreza Boghrati	Geology
Abdolkarim Darvishi Jazi	Agriculture
Ahmad Mohammad Pour	Soils
Massoud Rejaee	Hydrology

Table 2.--List of Participants,

Fifth International Remote Sensing Workshop--Continued

SWAZILAND

Noah Nkambule

Agriculture/Soils

SWEDEN

Jan Ehrenborg

Geology

THAILAND

Lertchai Ninsalab

Agriculture

agriculture, forestry, range management, geology, hydrology, and land use. Each student received a variety of EDC Landsat image products over a geographic area specified by him prior to his arrival in the United States, for use in the Workshop and to take back to his country for continuing analysis.

The two field trips were designed to supplement classroom work with field verification and analysis. An optional trip to Pipestone National Monument in western Minnesota allowed participants to study some of the geologic and social history of the region. A longer field trip (four days) to the Black Hills of South Dakota gave the students first hand opportunity for examination of land forms and field-checking of geographic, geologic, forestry, agriculture, and hydrologic image interpretations made earlier in the Workshop. A schedule for the field trip is attached (Appendix B).

Workshop Evaluation by Participants

Workshop participants were asked to fill out a Workshop evaluation questionnaire to provide feedback for planning and improving future Workshops. In order to encourage objective and constructive suggestions, they were not asked to sign the questionnaires. Sixteen questionnaires were returned. The summary (Table 3) includes the numeric totals from multiple choice questions as well as a summary of the comments related to questions. The order in which comments are listed is not based on frequency or relative importance.

A numeric total is attached to one comment. Category 4 of the Workshop exercises section asked "Which type of Workshop exercises do

Table 3.--Workshop Evaluation Questionnaire

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP

WORKSHOP EVALUATION QUESTIONNAIRE

September 5 - October 3, 1975

In planning for future international workshops, your comments on the content and conduct of the course are invited. Please be objective and complete in your answers. You may sign the questionnaire if you wish, but it is not necessary. Use the back side of any page for additional comments.

GENERAL

1. The Workshop objective has been to present a basic course on remote sensing principles and practical applications of data from remote sensing systems for land use and natural resources inventory in the broadest context. Indicate whether this workshop objective was accomplished:

(12) adequately (4) partially () not at all

Comment: Must be followed by advanced course; need more on Physics of Remote Sensing

too basic; too much traditional photointerpretation & application to local

agriculture & conditions; too much related to USA

2. (a) Please list below the goals or objectives you had when you came to the course at the EROS DATA CENTER: Historical review, physical principles of electromagnetic spectrum, application of remote sensing to geology & mineral exploration, use of computers & automatic processing in analyzing remote sensing data; learn methods of automated interpretation of imagery application to economic geology; general information; learn to select, interpret & purchase imagery; wanted complete course in digital image processing; study methodology obtaining spectral signatures, color enhancement techniques, methods of digital analysis for information on stratification of wildland resources; techniques for highway engineering & regional development, establish contacts; soil science & agriculture water resources; forestry, fishery, land use & minerals.

(b) Describe in what ways and to what extent the Workshop fulfilled these goals or objectives: Adequate except poor in application of microwave & thermal scanning, only limited by time factor; need to divide course into preliminary & advanced; not enough control, guidance over student interpretation; radar, thermal IR virtually ignored; realized need for ground data & large scale aerial photos; good for updating geological maps; my goals were too broad, have realized applications still experimented and/or theoretical.

(c) Describe the strengths and weaknesses of the Workshop program (subject matter, course sequence, etc.) as it relates to your objectives:

Strengths: Theories, trip to Black Hills; excellent staff; multidisciplinary approach; facilities, material; handouts excellent

Weaknesses: Practical application; not enough geology; too little about advanced techniques; too many lectures, some of them too elementary; multidisciplinary approach; not enough interpretation of data; waste of time, superficial treatment of subjects; better coordination, access to facilities; need more on water resources; need more independent time.

3. Do you feel the Workshop was:

() too long (2) too short (13) just the right length

Comment: Need two weeks for optional; more time with machines; more time with exercises; need to use week-ends, evenings; lack of depth.

4. Do you feel the content of the Workshop should have been:

(6) more rigorous (1) less rigorous (4) as it was

Comment: More detail in appropriate discipline, 1 hr. per day on own; field trips should cut down; souvenir shops; too much slack time.

5. In general, do you feel the quality of instruction was:

(9) excellent (6) good () average () poor

Comment: Excellent 'compromise' job; too short in quantity; too much visual aids, American examples; visual aids good.

6. The instructional materials supplied or displayed during the course (LANDSAT images, aerial photographs, maps, etc.) were:

(9) excellent (5) good (1) adequate () poor

How could they be improved? Earlier explanation of material; need agriculture samples outside South Dakota; more non-U.S. imagery; more on participants' countries; LANDSAT imagery over Black Hills not ideal for geological interpretation; materials could be from tropical areas; images poor.

7. Please comment on the course syllabus (too long, too short, content, organization, did you use it?). Materials should be added for each specialization; need time to study in detail; too much ground covered superficially; more option for detail needed; better in 2 volumes, too long; good reference; information on digital processing and multi-stage information extract procedures should be included; suggest separate binder for photographs and workshop exercises.
8. Do you feel homework exercises would help you better understand lectures in the discipline areas? 7 yes, 2 no

Students have much to read at night; need more advanced exercises; perhaps optional evening exercises.

9. The order of presentation (sequence) of subjects was:

(6) satisfactory (2) unsatisfactory

Suggested changes or improvements: Divide in 2 groups after principles (Geology, Earth Sciences & Ag/Forestry); after principles established, break into discipline groups; development of remote sensing techniques expanded & more emphasis on integrated aspects of resource surveys, i.e. less emphasis on individual disciplines on a day to day basis; technical talks good before application.

10. In regard to balance between lectures and workshop exercises, do you feel there should be:

(7) no change
 (1) more lectures, fewer exercises (needed at night)
 (8) More exercises, fewer lectures

11. Please comment on the following aspects of workshop logistics. Indicate by number whether you thought each was:

(1) excellent (2) satisfactory (3) marginal (4) unsatisfactory

and make any other comments or suggestions for improvement:

Town House Motel: () 14 excellent, 2 satisfactory

expensive; avoid evening meals; discount on meals?

Bus Service: () 9 excellent, 6 satisfactory

too rigid of a timetable; need EROS International Hotel

EROS DATA CENTER Cafeteria: () 7 excellent, 7 satisfactory, 2 marginal

poorly balanced diets; more variety needed; need foreign dish during course

EROS DATA CENTER Library: () 6 excellent, 6 satisfactory

Very active librarian ; material related to ground aspects of remote sensing needed.

EROS DATA CENTER Data Reference File (computer search, microfilm viewer, and imagery ordering service): () 8 excellent, 7 satisfactory,

1 marginal; they must be helped by computer & photo lab people;

inaccurate computer listings; will be helped by introduction of maps with images plotted.

Travel and Program Arrangements Made for You through Office of International Geology (USGS), AID, etc.: () 4 excellent

5 satisfactory; flexibility & communication needed

Other Services: Fine hospitality; time restrictions for banking & post office caused problems

DISCIPLINE AREAS

In the following discipline areas covered in the workshop, indicate your preference for the following aspects by checking the proper box in each column:

1. Time Spent: indicate whether you would have preferred more, less, or the same amount of time on each subject.
2. Rigor(Comprehensiveness): indicate for each subject area whether you would have preferred more, less, or the same degree of depth or rigor.

<u>Subject/Discipline</u>	<u>Time</u>			<u>Rigor</u>		
	<u>More</u>	<u>Less</u>	<u>Same</u>	<u>More</u>	<u>Less</u>	<u>Same</u>
Image measurement (scale, areas, parallax, etc).	3	2	7	2	2	7
LANDSAT system .	4	2	7	2	0	8
Use of EROS Data Center services.	6	2	5	4	0	7
Instruments for remote sensing (sensors).	7	1	5	6	0	5
Instruments for image analysis.	8	2	5	7	1	5
Basic principles of interpretation.	2	4	9	1	1	9
Applications to cartography.	0	6	7	2	2	9
Applications to agriculture.	3	6	5	2	4	5
Applications to soils.	4	4	5	3	3	5
Applications to rangelands.	1	5	6	1	3	8
Applications to forestry.	3	5	6	4	3	7
Applications to hydrology.	8	2	5	6	1	5
Applications to geology.	11	0	4	7	1	4
Applications to land use.	3	1	6	4	0	8
Discussions of photography.	6	2	4	8	1	4
Discussions of IR scanners and thermal imagery	6	2	5	7	0	6
Discussions of radar and radar imagery.	7	2	5	8	1	5
Other: (Specify) _____	2	0	0	2	0	0

Comment: data processing & classification geological structures should include information from other satellites; task was very difficult; too much emphasis on agriculture & North America; the absence of a more organized and comprehensive familiarization on instruments for image analysis was initially lacking.

Table 3.--Workshop Evaluation Questionnaire--Continued

Which subjects that were not covered in the course would you like to have been presented: Thermal scanning & microwave; thermal imagery;

geomorphology, landform analysis, some lectures on the gap between theoretical interpretation and operational systems with system approach analysis would be useful; urban & economic LANDSAT studies; economics of hardware expenditures

WORKSHOP EXERCISES

1. Did the Workshop exercises make your understanding of the applications presented (agriculture, forestry, land use, geology, etc.) more complete?

(13) yes (2) no (1) no effect

Comment: More time on own discipline; more examples; most exercises were just line/boundary drawing; most chosen from ideal situations

2. Did you feel that the time spent on each of the individual workshop exercises was:

() too long (7) too short (8) just right

Comment: More exercises, discussions; more emphasis on students solving problems

3. How might the structure and content of the workshop exercises be improved in future courses? Group by interest, discipline, different

parts of world, modern (latest) experiments needed; economic input would be desirable so that exercises can involve cost benefit analysis & written work; optional second homework exercise needed

4. Which type of workshop exercises do you think was most effective for demonstrating or reinforcing the lecture principles? List exercises by discipline (agriculture, hydrology, etc.) and exercise name, if possible (you may list more than one if desired):
Hydrology; Agriculture exercises; geology; land use; rangeland, forestry

1. Trip to the Black Hills

(a) Describe to what degree the field trip helped you to understand the lecture and workshop exercises and to learn how to field-verify image interpretation: Excellent; very well; most effective in the field of agriculture, insufficient time was allocated to field verification of geological interpretations; to a very low degree; very little-mainly a tourist coach tour.

(b) What were the most and least interesting parts of the trip?

Most Interesting: All interesting; the results of comparing interpreted maps with ground truth data; general geology of Black Hills; not Rushmore; geology or hydrology; history, customs; field observations; agricultural exercises

Least Interesting: Murdo; Homestake Mine parking lot; Mitchell, Wall Drug; Rapid City hotel; sitting in bus; agricultural plainlands

(c) Comment on the length of trip and the amount of work accomplished during the four days: Excellent; last stop was unnecessary; make it shorter & concentrate on lectures; did not accomplish any work; whole exercise a bit of a shambles; something should be done to reduce the ratio of travel time to study time.

(d) Make any comments you like regarding trip logistics (bus, meals, motels/hotels, instructors, schedule, etc.): Excellent; Badlands stop too short, Wall Drug stop too long, visit to Homestake Mine should be arranged; too much dead time; logistics chaotic and disorganized.

Other Activities

Please comment on the various social activities which took place during the workshop (picnic, cocktail party at Town House Motel, dinner in home of Sioux Falls family, bus trip to Pipestone National Monument, etc.). Any comments regarding which activity you liked most or least, and suggestions for improvement, will be appreciated.

All were excellent; suggest seminar by each participant on his own country concerning social activity as well as their work in the field of remote sensing picnic, hospitality enjoyable; perhaps a visit to the Morrell packing plant; dinner with host family very good

Optional Week

If you participated in the optional week's program, please make any comments regarding what you accomplished, the helpfulness of the staff, or suggestions for making the week's programs more profitable.

Discussions with Don Orr very helpful; scheduling important; the arrangements to use the ISI 170 over the week-end was much appreciated; good for working in DAL; instructors scarcely available - though Don Orr very helpful; lengthen optional week to 2 weeks; Wayne Rohde very cooperative.

Table 3.--Workshop Evaluation Questionnaire--Continued

Overall Comments

Please give your overall evaluation of the course (topics to be added or eliminated, organization, and suggestions for improvement). Use the back of this page if necessary.

Individual responses were made by each participant.

you think was most effective for demonstrating or reinforcing the lecture principles?" Seven of the responses singled out Dr. Taranik's ground water hydrology exercise as being especially effective.

For the final item (overall comments), individual responses are included under the specific question to which they apply. In addition, the following comments were made during the Workshop:

1. The development of the Workshop as multidisciplinary in nature was criticized by some who would have preferred more work in their selected disciplines.
2. A number of students suggested that homework and/or more exercises would have proven useful.
3. Others wanted more training in advanced techniques.

Workshop Evaluation by Instructors

As has become customary, the Applications Assistance staff instructors met shortly after the completion of the Workshop to evaluate its strengths and weaknesses, and to make suggestions for improvements in future Workshops. The following sections summarize the main findings of this evaluation.

In general, the format used in the sections that follow includes a discussion of each major aspect of the course, a summary of staff comments on each aspect, and recommendation(s) for future Workshops (which in some cases are the result of additional meetings and discussions that followed the full staff evaluation).

Workshop Agenda.--Although the Workshop was judged to be generally successful by both participants and staff, a number of issues were raised

regarding the overall content, format, and organization of the workshop program. Staff comments can be summarized as follows:

- There was a lack of true multidisciplinary approach. In reality the course consisted of several disciplines, presented in sequence.
- With the preponderance of participants with geology/hydrology interests, the course had excessive emphasis on vegetation applications (agriculture, forestry, and rangelands).
- The use of Landsat image examples from a variety of environments (temperate, tropic, arid and boreal, for example), both in lectures and in exercises, beyond just the American examples currently used by the staff, would strengthen the demonstration of applications.
- The opportunity for participants to analyze their own imagery more thoroughly with respect to their own discipline interest (perhaps 3 days) would reinforce the principles, especially if adequate guidance were provided. The optional fourth week (not planned for 1976) was partially successful in this regard. However, the more outgoing participants benefitted more than the quiet, reserved participants, who were sometimes reluctant to ask for assistance.

Although these comments seem overly critical, it must be appreciated that, in general, the objectives of the Workshop were met and an adequate body of information was apparently transferred. The recommendations which follow are made in response to these comments.

Recommendations

1. Replace the present discipline presentations (lectures, discussions, and Workshop exercises on geology, hydrology, agriculture, forestry) with briefer discipline overviews. Break the group into smaller groups by major interest area (e.g., geology, hydrology, vegetation, land use) and use approximately 3 days for more extensive presentations, including workshop exercises and individual analysis of Landsat imagery of each participant's country. The overviews would provide the entire group with some appreciation of the breadth of applications, while the discipline groups would permit detailed study of a single field.
2. Use a team problem approach (i.e., a group of 3-5 participants with varied backgrounds) to analyze imagery of a single geographic area (e.g., a portion of the Black Hills). Resource overlays would be prepared by each team, and a real problem (e.g., dam location) would be solved. This activity would strengthen the multidisciplinary aspect.
3. If feasible, develop some Workshop examples for non U.S. areas. If Workshop analyses performed by participants can be thoroughly documented by AA staff, then these analyses can be used as examples in future Workshops.

Role of Advanced Analysis Techniques and Data Analysis Lab (DAL).--

Although the scope of the Workshop was clearly stated so as to exclude the presentation of advanced, computer-assisted analysis techniques,

examples of DAL analyses were presented by several instructors as part of their discipline presentations. As a result, a few participants whose level of experience and expectations that the Workshop would cover computer applications were quite high, gained access to the DAL equipment through private arrangements with the staff. Equipment was demonstrated during off hours (evenings and weekends) and a few participants thus had the opportunity to perform an analysis of their own Landsat imagery. During the optional week, the three DAL systems (GE Image 100, LARSYS terminal, and ISI system) were scheduled for use by most of the group. This became a complex scheduling issue and required a good deal of staff time in both system demonstrations and assistance to participants in data analysis.

Although a few participants benefitted significantly, it was concluded that these activities detracted somewhat from the overall Workshop objectives and required inordinately heavy instructor participation. During the evaluation, the following suggestions were made to avoid the problem in future Workshops.

- Give two separate courses at once, or at least provide those capable of grasping advanced techniques with a separate program during the regular Workshop program.
- Screen the applicants more carefully so as to further minimize the number of participants who would find the basic Workshop too elementary.
- Exclude considerations of advanced techniques from the Workshop entirely.

- Introduce the DAL role earlier in the workshop so that system use by individuals during the optional week is more significant.
- Leave advanced technique discussions until the very last day or two of the workshop.
- Announce that no use of DAL systems would be possible but that analysis examples would be presented within the context of the Workshop.

Recommendations

1. The DAL should be "off-limits" to Workshop participants (the optional week will not be available in 1976 for DAL activities by individuals; the Workshop will be restructured so that the full four week period contains programmed Workshop activities).
2. The role of advanced techniques should be outlined in the discipline presentations through examples of applications and discussion of techniques.
3. Serious consideration should be given to the offering of a separate advanced Workshop only for foreign participants (probably not feasible for 1976, but possible in 1977).
4. Applicants should be more carefully screened so as to further reduce the possibility of attendees (1) finding that the Workshop is too elementary in scope, and (2) demanding advanced training concurrent with the main Workshop program.

Workshop Exercises.--Workshop exercises were used extensively as a means of reinforcing classroom principles and giving participants actual

interpretation experience. In order to strengthen the multidisciplinary aspect of the course, at least one exercise from each discipline was selected from a common area, the Black Hills of South Dakota, which was visited during the field trip. It was agreed that there was little relation or interdependence among these exercises and that the multidisciplinary aspect was rather weak. Comments were also made regarding the lack of depth--that is, real "problem-solving" approach--to several of the exercises. Of course, it was acknowledged that many of these exercises were not meant to present extensive problems.

Recommendations

1. Workshop exercises should generally be more extensive and intensive, and present a realistic problem to be solved. The use of multidisciplinary teams of 3-4 participants could effectively be used to solve these exercises or team problems.
2. Several of the existing individual Workshop exercises might be used as homework exercises. Since they address a single subject (e.g., crop type identification) and can often be completed with a minimum of supervision, they would be ideal for completion outside the normal class hours.
3. All exercises should be reviewed by the instructor and comments and corrections made as appropriate. This feedback will help reinforce the subject matter and encourage interaction between staff and participants.

Field Trip.--A field trip to the Black Hills was made during the third week of the Workshop (see "Workshop Description" and Appendix B). The main objective was to gain experience in relating field observations to image interpretation. As a sidelight, some of the scenery and tourist attractions en route were visited.

The main shortcoming of the trip was the lack of both coherence in purpose and the multidisciplinary approach. Although it was agreed that this field trip had more substance than previous trips, it was concluded that a better trip could result if the field trip was planned as the culmination of a team analysis problem using Black Hills imagery. With a real interpretation problem that centered on a single geographic area in the Black Hills, the field checking for geology, hydrology, agriculture, land use, etc., could be made more effective.

The possibility of air travel between Sioux Falls and Rapid City was raised. If this were feasible, the long bus ride across South Dakota could be avoided.

Recommendation

1. Develop a real multidisciplinary team analysis problem during the Workshop that would lead to a more rigorous field program.

Syllabus.--As in previous Workshops, a syllabus was provided to each participant. The syllabus was organized according to discipline sections (fundamentals, principles of interpretation, geology, agriculture, etc.). The material for each section was subdivided as follows: (a) lecture notes, (b) Workshop exercises, (c) bibliography, and (d) selected readings. The

syllabus served both as (1) organized storage for materials used during the Workshop, and (2) a reference document for use both during the Workshop and in the future.

As usual, a great deal of time was required to manually collate and assemble each syllabus (50 copies were made for this Workshop). Several sections had very long selected readings, which contributed to the effort required.

In addition, the following textbooks and references were also provided:

- (1) Interpretation of Aerial Photography (Avery)
- (2) Terrain Analysis (Way)
- (3) The Surveillant Science (Holz)
- (4) Remote Sensing - A Better View (Rudd)
- (5) Using Remote Sensor Data for Land Use Mapping and Inventory:
A User Guide (USGS Interagency Report - 253)

Since a variety of reference texts is provided, the question was raised as to the need for extensive selected references. Although there seems to be no single source that covers all subjects, it was felt that carefully selected references could replace the bulk of the selected readings.

Recommendations

1. The content and intended uses of a Workshop syllabus as well as reference texts should be reconsidered.
2. Perhaps the new Manual of Remote Sensing will fill the void that has previously necessitated the provision of a lengthy collection of readings. If so, the syllabus could

be reserved only for outlines, Workshop exercises, bibliographies, and other handouts.

3. Even the preparation of an abbreviated syllabus would require a good deal of advanced preparation. The content of the syllabus for 1976 Workshops should be laid out early so that it can be carefully assembled.



United States Department of the Interior

GEOLOGICAL SURVEY
EROS Data Center
Sioux Falls, South Dakota 57198

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP

September 5 - October 3

SCHEDULE - ORIENTATION

IN REPLY REFER TO:

Date/Time

September 5 (Friday)

Breakfast in Sioux Falls

8:15 a.m. Board bus at Town House Motel

9:00 a.m. Arrive EROS Data Center; Welcome: Allen H. Watkins,
Chief, EROS Data Center (EDC)

9:10 a.m. Greetings: Donald T. Lauer, Acting Chief,
Applications Assistance Branch, EDC

9:25 a.m. Briefing on the history and culture of the upper
midwestern United States: Ron Beck, EDC

10:00 a.m. Briefing on Sioux Falls, including hospitality events
planned: Phyllis Wiepking, Community Affairs
Representative, EDC

10:15 a.m. Currency exchange, monetary items, etc.: Dick Munce,
Northwestern National Bank

10:30 a.m. Coffee break

10:45 a.m. Administrative processing and registration:
Geraldine Cadigan, Office of International Geology,
USGS, Denver, Colorado

12:30 p.m. Lunch at EROS Data Center cafeteria

1:30 p.m. Introduction to course - objectives, procedures,
staff: Larry Pettinger, EDC

2:30 p.m. EROS Data Center Library services: Cheryl Mitchell, EDC

Date/Time

2:45 p.m.	EROS Data Center - functions, operations, and equipment: Don Carney, EDC
3:45 p.m.	Tour of EROS Data Center
4:30 p.m.	Return to Sioux Falls

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP SCHEDULE, continued

Date/Time	Subject	Instructor(s)
<u>September 8 (Monday)</u>		
8:30 - 10:30 a.m.	Image forming process - electromagnetic spectrum, energy flow, reflectance, recording, processing	Orr
10:30 a.m. - 12:30 p.m.	Collection and analysis of spectral reflectance data, including field operation of radiometer	Rohde/ Orr/ Anderson
1:30 - 2:30 p.m.	Multispectral viewing and verification of spectral data	Rohde/Orr/ Anderson
2:30 - 4:30 p.m.	Airborne sensor systems	Orr
<u>September 9 (Tuesday)</u>		
8:30 - 10:30 a.m.	LANDSAT system - components and operation	Taranik
10:30 a.m. - 12:30 p.m.	LANDSAT image characteristics	Taranik
1:30 - 2:30 p.m.	LANDSAT image availability	Nickerson
2:30 - 3:00 p.m.	Introduction to Data Reference File and User Services at the EROS Data Center	Jones/ Langin
3:00 - 4:30 p.m.	Instruments for image interpretation (demonstration)	Pettinger
<u>September 10 (Wednesday)</u>		
8:30 - 10:00 a.m.	Field study of LANDSAT pixel print enlargement of EROS Data Center grounds	Lauer
10:00 a.m. - 12:30 p.m.	Principles of image interpretation	Lauer
1:30 - 4:30 p.m.	Workshop exercises: principles of image interpretation	Lauer
8:00 p.m.	Evening seminar: Vegetation phenology with implications for remote sensing analysis	Anderson

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP SCHEDULE, continued

Date/Time	Subject	Instructor(s)
<u>September 11 (Thursday)</u>		
8:30 - 11:00 a.m.	Cartographic principles and applications	Colvocoresses
11:00 a.m. - 12:30 p.m.	Principles of mosaic preparation	Hahn
1:30 - 3:00 p.m.	Regional landscape analysis/ land systems' interpretation	Pettinger
3:00 - 4:30 p.m.	Legend concepts for land use and natural resources classification	Hood
7:30 p.m.	Evening seminar: Worldwide mapping programs	Colvocoresses
<u>September 12 (Friday)</u>		
8:30 - 10:30 a.m.	Introduction to remote sensing in agriculture	Draeger
10:30 a.m. - 12:30 p.m.	Workshop exercises: crop identification; agricultural land stratification; irrigated cropland analysis	Draeger/ Anderson
1:30 - 2:30 p.m.	Introduction to remote sensing in soils mapping and evaluation	Westin
2:30 - 4:30 p.m.	Workshop exercises: soils mapping; agricultural land use	Draeger/ Westin
<u>September 13 (Saturday)</u>		
8:30 - 10:00 a.m.	Application of remote sensing in range and wildlife habitat management	Carnegie
10:00 a.m. - 12:30 a.m.	Workshop exercises: LANDSAT interpretation of rangeland environments; plant community mapping (color infrared aerial photography); measurement of vegetative parameters (large scale color photography)	Carnegie

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP SCHEDULE, continued

Date/Time	Subject	Instructor(s)
<u>September 15 (Monday)</u>		
8:30 - 10:00 a.m.	Applications of remote sensing to forest land management	Rohde
10:00 a.m. - 12:30 p.m.	Workshop exercises: Vegetation mapping from conventional aerial photography; forest land classification on high altitude and satellite imagery	Rohde
1:30 - 2:30 p.m.	Remote sensing applications for land use analysis	Hood
2:30 - 4:30 p.m.	Workshop exercises: land use analysis of LANDSAT imagery of South Dakota and of participants' countries	Hood/ Todd
<u>September 16 (Tuesday)</u>		
8:30 a.m. - 4:30 p.m.	Prepare agriculture, forestry and rangeland overlays of LANDSAT imagery of participants' countries	Draeger/ Anderson/ Carnegie/ Rohde
7:30 p.m.	Evening seminar: An operational use of LANDSAT for mapping land cover types in Mexico	Lauer
<u>September 17 (Wednesday)</u>		
8:30 - 10:30 a.m.	Principles of image interpretation applied to geology	Orr/ Taranik
10:30 a.m. - 12:30 p.m.	Workshop exercise: geologic analysis	Orr/ Taranik
1:30 - 4:30 p.m.	Workshop exercise: geologic analysis	Orr/ Taranik

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP SCHEDULE, continued

Date/Time	Subject	Instructor(s)
<u>September 18 (Thursday)</u>		
8:30 - 10:00 a.m.	Principle of image interpretation for hydrologic applications	Taranik
10:00 - 11:00 a.m.	Remote sensing for surface water hydrologic applications	Taranik
11:00 a.m. - 12:30 p.m.	Remote sensing for ground water hydrologic applications	Moore/ Taranik
1:30 - 4:30 p.m.	Workshop exercise: targeting of ground water exploration effort in arid environments	Moore/ Taranik
7:30 p.m.	Evening seminar: Remote sensing applications (including LANDSAT and radar) in tropical environments	Draeger/ Pettinger
<u>September 19 (Friday)</u>		
8:30 a.m. - 3:30 p.m.	Prepare geologic and hydrologic overlays of LANDSAT imagery of participants' countries	Orr/ Taranik
3:30 - 4:30 p.m.	Prepare for field trip	Staff
<u>September 21 (Sunday)</u>		
8:00 a.m.	Depart by bus from Town House - Visit Badlands National Monument (geology interpretation) - Overnight in Rapid City	
<u>September 22 (Monday)</u>		
	- Field stops for geology, rangelands, and forestry interpretation - Visit to Mt. Rushmore National Memorial - Field stops for geology, forestry, and land use - Overnight in Deadwood	

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP SCHEDULE, continued

Date/Time	Subject	Instructor(s)
<u>September 23 (Tuesday)</u>		
	<ul style="list-style-type: none"> - Field stops for agriculture and rangelands - Overnight in Murdo 	
<u>September 24 (Wednesday)</u>		
	- Return to Sioux Falls	
<u>September 25 (Thursday)</u>		
8:30 a.m. - 12:30 p.m.	Summary of field trip	Staff
1:30 - 4:30 p.m.	Introduction to advanced remote sensing techniques, including demonstration in the Data Analysis Laboratory	Waltz
<u>September 26 (Friday)</u>		
8:30 - 10:30 a.m.	EROS program - present and future	Fischer
11:00 a.m.	Closing ceremony	
1:30 - 4:30 p.m.	Turn in equipment; pack course materials for shipment	
<u>September 29 - October 3 (Monday - Friday)</u>		
	Optional week - individual study to be coordinated by applications scientists	

Appendix B.--Field Trip Schedule

FIFTH INTERNATIONAL REMOTE SENSING WORKSHOP
FIELD TRIP TO THE BLACK HILLS, SOUTH DAKOTA

September 21-24, 1975

September 21 (Sunday)

(breakfast on your own)

8:00 a.m. (sharp!)

Depart from Town House Motel
Stops en route for soils interpretation

11:30 a.m.

Arrive Chamberlain, South Dakota
. Examine shale and chalk
formations along the Missouri
River
. Early lunch at Al's Oasis

1:30 p.m. (MST)

Arrive Badlands National Monument

3:30 p.m.

Arrive Wall, South Dakota
. Visit Wall Drug Store

6:00 p.m.

Arrive Rapid City, South Dakota
. Stay at Hotel Alex Johnson
(dinner on your own)

September 22 (Monday)

(breakfast on your own)

8:00 a.m.

Depart from Motel Alex Johnson

8:30 a.m.

Visit Dinosaur Park -- geology and
land use discussions

10:00 a.m.

Arrive Custer State Park
. Geology and land use discussions
en route
. Stops for forestry interpretation

12:00 noon

Arrive Mt. Rushmore National Memorial
. Lunch on your own

3:00 p.m.

Arrive Lake Pactola area, with
stops en route for geology and
forestry interpretations

3:30 p.m.

Arrive Rapid City area, with land
use discussions en route

4:00 p.m.

Arrive Sturgis, South Dakota with
land use discussions en route

5:00 p.m.

Arrive Deadwood, South Dakota, with
land use and geology discussions
en route
. Stay at Franklin Hotel

September 23 (Tuesday)

8:00 a.m.

Depart from Franklin Hotel

9:00 a.m.

Arrive Bear Butte area
. Stops for agriculture
interpretation

1:30 p.m.

Arrive Hayes, South Dakota
. Lunch at Hayes Lake
. Agriculture interpretation

6:00 p.m. (CST)

Arrive Murdo, South Dakota
. Stay at Graham Motor Lodge
(dinner on your own)

September 24 (Wednesday)

8:30 a.m.

Depart from Graham Motor Lodge

10:00 a.m.

Arrive Chamberlain, South Dakota

1:00 p.m.

Arrive Sioux Falls