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A CLOSER LOOK AT REMOTE SENSING EDUCATION

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I. ABSTRACT

Remote sensing is finding its way into the curricula of many colleges and universities, yet the rapid growth of the technology leaves many excellent faculty members at a disadvantage, unable to keep pace with developments and thwarted in their efforts to develop meaningful course work reflecting the breadth of the technology. A recent survey of 30 remote sensing instructors provided a closer look at several aspects of current remote sensing courses and helped refine the list of needs faculty members had previously stated.

II. BACKGROUND

In his presentation "Status and Context of Remote Sensing Education in the United States," Dr. Richard Dahlberg gave a comprehensive summary description of courses being offered in the mapping sciences, including remote sensing[1]. He reported that, at the time of the survey, 1979-1980, there were nearly 700 courses offered in remote sensing and aerial photointerpretation, with 34% of these (approximately 235 courses) in remote sensing alone. He reported that there is a much stronger concentration of these 700 courses in graduate schools, with only 10% of them offered at the undergraduate level. He also noted that the programs within institutions offered few opportunities for in-depth study, stating, "existing programs have failed to provide adequate attention to such topics as...advanced concepts in digital processing."

The need for remote sensing education was expanded upon by Dr. Thomas Lillesand in his report on the 1981 Conference on Remote Sensing Education[2]:

> It would appear to the critical observer that the instructional system, as currently configured, will not be capable of responding substantially to many existing and prospective resource management problems. For example, when one can count on one hand the number of remote sensing courses offered in an agricultural context, it appears that this might severely limit the role of remote sensing in meeting the needs of global agricultural management. Likewise, the inadequate treatment of land information systems and theory will limit the supply of graduates needed to design, implement, and operate multipurpose cadastre systems. At the same time, how can some 40 percent of accredited forestry programs nationwide lack adequate instruction in remote sensing?
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> There is a need to better prepare our students (and ourselves) in both visual and digital image analysis. There is a dire need to facilitate the education of our future remote sensing educators. There is a need to teach more students about remote sensing at all levels, and on a continuing basis.

The need for expanded and improved education in remote sensing has been voiced often and urgently. The attendance at CORSE-81 (the 1981 Conference on Remote Sensing Education) verified the high level of interest among faculty members who

wanted to expand and improve their teaching. Evaluations returned by CORSE-81 participants stated the need they felt to develop their own understanding of the technology, to find ways to keep up-to-date, and to be able to obtain inexpensive hardware, software, and data sets for classroom instruction[3]. Faculty members now may be even farther from finding a solution to their problems since federal funds previously available to assist them have recently been withdrawn, e.g., those available through the faculty assistance program offered at NASA's Eastern Regional Remote Sensing Applications Center. It falls, therefore, to those involved with remote sensing education to identify needs as precisely as possible and to seek creative ways to broaden and deepen remote sensing education to the level it deserves.

III. DESIGN OF THE SURVEY

During April 1982, staff at Purdue University's Laboratory for Applications of Remote Sensing designed and conducted a limited telephone survey to verify basic patterns of need identifiable among remote sensing faculty and, further, to refine the needs into a prioritized list of projects. The questionnaire that was developed for this survey focused on the teaching of digital aspects of the technology, with inquiries into the amount of course time devoted to digital concepts, the types of digital data introduced, and the hardware and software available for student use. Principal questions from the questionnaire are reprinted in Table 1.

The survey was conducted principally by Jeffery Madden, who drew names from a list of those who attended CORSE-81 and from a list of courses with their university departments, supplied by Dr. Dahlberg. Calls were completed to 30 faculty members, as many as could be reached during the four-week calling period. A few additional calls were made by Dr. Philip H. Swain and Dr. Roger M. Hoffer, both of Purdue University, to acquaintances of theirs who were deemed, by virtue of national-level activities, to be able to represent a broad perspective on the questions raised.

IV. RESULTS OF THE SURVEY

Because of the small number of responses sought, the survey results do not lend themselves to statistical summarization; however, the information and opinions acquired were adequate to meet the objectives of this brief study. They provide both a sense of the shape of remote sensing education today and a way to refine the list of the needs faculty had previously expressed.

Table 1. Selected Questions Used During the Survey

1. Course titles, level, number of students usually enrolled.
2. Which types of remote sensing data do you use?
3. Do you include digital concepts?
   If no, why not? If yes, for how many weeks of the course?
4. Which of these topics do you include: cover-type mapping; digital enhancements; registration/rectification of data; geographic information systems; modeling.
5. Does your course have a laboratory period? If so do you include hands-on computer experience for students?
6. What hardware, software, and image display systems are used by your students? What other computers are available on your campus?
7. How large an image do you typically use? Could you use a smaller image as effectively?
8. What textbooks and other published materials are you using?
9. What existing periodicals do you turn to to keep current about remote sensing education?
10. What would help you most improve your students' understanding of digital techniques?

Among those surveyed, the amount of time spent in the classroom and laboratory on digital concepts of remote sensing varies with the level of the class. Students in the introductory remote sensing classes (sixteen courses represented) spend from one to four weeks on digital concepts, an average of 2.5 weeks, but with little or no hand-on experience. Students in the more advanced remote sensing courses (seven sampled) spend between four and eight weeks on digital concepts, an average of six weeks, and get some hands-on computer experience during this time. Students in the digital image processing courses which deal exclusively with remote sensing, of which three were sampled, spend the entire term studying digital techniques through both lecture and hands-on work. While the tendency in the introductory courses is to discuss classification schemes, in the advanced courses students usually learn about digital enhancement techniques as well, while those enrolled in digital image processing courses select a scene of interest, register several types of data, enhance, classify, and basically do a comprehensive analysis of the area, including some modeling.

In all of the sampled courses taken together, aerial photography and Landsat imagery were used twice as much as radar and aircraft MSS data (including thermal imagery). Most of the instructors who participated in the survey expressed a desire to introduce data from additional sensors, but low availability and high cost of these data were major deterrents to doing this.

The hardware and software configurations used among the institutions are quite diverse. There appears to be no clear-cut leaning toward either mainframe, mini or microcomputers, and software had been written locally or acquired from many sources.

In addition to providing factual information about their courses, those who were called were also asked to identify what would help them most in seeking to improve their students' understanding of digital techniques. While responses varied greatly, two specific areas were frequently reiterated: 1) the need to keep informed themselves about developments and new approaches in the technology and 2) the need for educational tools, both data sets and computer facilities. These two points are discussed more fully below in the hopes that the responses reported here may spark an idea that can lead to needed developments.

Professors who contributed to the survey feel a strong need to keep pace with developments both in the technology and in remote sensing education. Many regretted the lack of funds to attend short courses and conferences and felt isolated in their universities, sometimes as the only person with a teaching interest in remote sensing. Several expressed their own desire for hand-on experience with computer-aided techniques so that they could teach the technology from a broader base of understanding and eventually introduce hands-on exercises for their students. Requests were again made for a centralized exchange of teaching materials so that those who are starting to draw up plans for new courses may build on the previous work of their colleagues in other schools. Over 90% of the respondees would like to see either a column in a remote sensing journal or a newsletter devoted to remote sensing education.

The opinions summarized above focus on the instructor. An equally strong cluster of ideas identified needs as related to teaching facilities. The single greatest need stated is for packaged data sets, especially ones that contained registered data from many sensors, some multitemporal data, and ancillary data. Lack of familiarity with sources of data and high costs seemed to be a common concern. The second strongest concern about teaching facilities was the high cost associated with establishing a remote sensing computational facility that students can use. University-maintained computers are often overused and lacking the software for remote sensing. High-resolution image display devices, valuable tools for interaction with digital image data, are expensive and not widely available for students. The current proliferation of minicomputers and even microcomputers, they feel, may help bring some solutions, but the selection of software available for these systems is limited. Some debate exists about the minimum size a data set should be to be useful for educational purposes; for use by an individual in a laboratory, it would appear that 100 x 100 pixels is generally considered a working minimum, but many feel that even that is inadequate. Solutions to the hardware/software problem are yet to be found, particularly at the low cost required by the reduced teaching budgets of most faculty.

V. CONCLUSIONS

Remote sensing education is lagging far behind the development of the technology and its acceptance as a major resource management tool around the world. While local conditions may thwart the development of remote sensing in some institutions, there are many instructors who would expand and improve their course offerings if they felt better informed about the technology and had access to more teaching materials for their classes. The time has come for concerned individuals, organizations and corporations to join with faculty and thereby ensure that students have the best opportunities possible to understand the utility, and limitations, of remote sensing.

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Shirley M. Davis is Senior Education and Training Specialist at Purdue University's Laboratory for Applications of Remote Sensing. Mrs. Davis received the A.B. degree with honors in English in 1958 from Sweet Briar College and the M.A. degree in English from Case-Western Reserve University in 1962. Her major contributions to remote sensing education have been as co-author and editor of the LARSYS Educational Package; co-author and contributing author of the textbook Remote Sensing: The Quantitative Approach; Chairman of the 1981 Conference on Remote Sensing Education; and creator/coordinator of the videotape series Introduction to Quantitative Analysis of Remote Sensing Data. Her recent work has involved the development of educational materials for digital image processing.

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