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REMOTE SENSING TECHNOLOGY TRANSFER AT THE
NASA TECHNOLOGY APPLICATION CENTER,
UNIVERSITY OF NEW MEXICO

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ABSTRACT

For over a decade the Technology Application Center (TAC) has been transferring remote sensing technology to both the private and public sectors. This has been in the form of a quarterly literature review entitled, "Remote Sensing of Natural Resources." The journal covers nine topics as well as information resources, recent releases, upcoming conferences, symposiums, workshops, short courses, and training programs. The nine topics covered include sections on previous meetings, symposia, proceedings, and reviews; a section on Geology divided into three categories: Descriptive, Exploration, and Engineering and Natural Hazards Assessment; a section on Environmental Quality, also divided into three categories: Water Quality, Air Quality, and a miscellaneous category describing Mine Reclamation, Nuclear Plant Siting, and Environmental Studies; the fourth section covers Hydrology; section five provides data on Vegetation, divided into the following three categories: Agriculture, Forestry and Wildlife Studies, and Natural Vegetation; section six encompasses Oceanography; section seven Regional Planning and Land Use; eight Data Manipulation, such as image processing, models, etc., and; the final section covers Instrumentation and Technology. An author index is also provided.

More recently, in an effort to transfer this technology to domestic and foreign countries, TAC has established and is sponsoring an international training program on remote sensing. Scientists and managers can learn the applications of remote sensing to monitoring natural resources and environmental impact analysis. The program is a personalized on-the-job training utilizing remote sensing techniques and equipment. The visiting

scientist receives training in remote sensing data retrieval, digital image processing, image interpretation, and Landsat photo mosaic mapping. Another more recent program developed at TAC includes executive briefings and training workshops. It was developed to provide low cost hands-on training, and state-of-the-art reviews in a 2 or 3 day seminar held at TAC's training facility. Disciplines covered include: Fundamentals of Remote Sensing, Geology, Wildlife, Water Resources/Hydrology, Geographic Information Systems, Hydrocarbon and Mineral Exploration, and Vegetation Mapping.

I. INTRODUCTION

This paper presents the technology transfer of remote sensing applications currently provided by the Technology Application Center (TAC) at the University of New Mexico in Albuquerque, New Mexico. Technology transfer may be defined as the process whereby information and applications of a certain discipline are gathered, analyzed, practiced, and then distributed. In this case the discipline is remote sensing. TAC has been transferring remote sensing technology to both the private and public sectors in the form of a journal entitled, "Remote Sensing of Natural Resources." It is published four times a year and covers a wide span of knowledge in nine sections. Two other programs which have been established at TAC are the visiting scientist program and executive briefings and training workshops. These programs were designed for scientists and managers in an effort to transfer remote sensing technology to both domestic and foreign countries. They were designed to provide hands-on training utilizing remote sensing techniques and equipment. The visiting scientist/managers are provided with a personal office with all support facilities including: in-house image

processing on a VAX 11/750 computer, supported by all the essential input/output peripherals. They also have immediate access to this equipment and a variety of software packages. In addition, TAC has a trained staff who can provide assistance with cartographic drafting, image interpretation, clerical and word processing services. Image reproductions and image/document retrieval services are also provided.

The Technology Transfer applications at TAC include many projects which require digital image processing of Landsat multispectral scanner and Thematic Mapper data, aerial and satellite photointerpretation, the development of a geographic-based information system, and the dissemination of NASA generated photography. A detailed account of TAC's technology transfer programs are given below.

II. REMOTE SENSING OF NATURAL RESOURCES

For over a decade the Technology Application Center (TAC) has been transferring remote sensing technology to both the private and public sectors. This has been in the form of a quarterly literature review entitled, "Remote Sensing of Natural Resources." The journal covers nine subject categories as well as information resources, recent releases, upcoming conferences, symposium, workshops, short courses, and training programs. The nine topics covered are illustrated by the table of contents as follows:

Literature Review:

1. General: Meetings, Symposia, Proceedings, and Reviews
2. Geology
 - a. Descriptive: Geomorphology, Surficial Geology, Tectonics, Lineaments, and Spectral Reflectance Studies
 - b. Exploration: Mineral, Hydrocarbon, and Geothermal
 - c. Engineering and Natural Hazards Assessment: Highway Studies, Landslides, Faults, and Volcanoe Monitoring
3. Environmental Quality
 - a. Water Quality: Pollution, Sedimentation, and Oil Spills
 - b. Air Quality: Pollution, Gases, Particulates
 - c. Miscellaneous: Mine Reclamation and Monitoring, Nuclear Plant Siting, and Environmental Studies
4. Hydrology: Ice, Snow, Glaciers, Lakes, Rivers, and Precipitation
5. Vegetation
 - a. Agriculture
 - b. Forestry and Wildlife Studies
 - c. Natural Vegetation
6. Oceanography: Wave Morphology, Icebergs, Coastlines, Flora and Fauna
7. Regional Planning and Land Use
8. Data Manipulation: Image Processing, Models, Algorithms, and Simulations
9. Instrumentation and Technology: Systems, Applications, and Innovations

An author index is also included. In addition to the journal, TAC also provides comprehensive studies pertaining to any topical area in remote sensing. These can include information via a literature search or a state-of-the-art evaluation.

III. VISITING SCIENTIST PROGRAM

The visiting scientist program is designed to give U.S. and international scientists and managers a personalized hands-on training in image processing and photointerpretation of satellite and aerial imagery. The program serves as a processing facility for carrying out project applications in remote sensing, and can host scientists who know little about remote sensing techniques and equipment, as well as those who are experienced in the field. In either case visitors receive as much technical assistance and training as desired. Scientists or resource managers who wish to initiate or advance their skills in the areas of image analysis and geographic information systems are also encouraged to participate. Professionals in the following fields may take advantage of this program:

- University Personnel: Professors and/or graduate students
- Natural Resource Managers
- Environmental Consultants
- Mineral and Hydrocarbon Exploration Companies/Consultants

- Urban, Regional, and Land Use Planners
- Earth Scientists and Engineers
- Forestry and Agriculture Scientists

V. SUMMARY

Recent visiting scientists at TAC came from Tunisia and Bangladesh. They received grants for hands-on training in natural resources. The group from Tunisia received training in the fundamentals of remote sensing and aerial photogrammetry for vegetation mapping. Currently, visiting scientists from Bangladesh are conducting mission oriented projects dealing with a number of domestic problems (Figure 1).

One project compared 20 year old maps of the Ganges/Lower Maghna river with Landsat scenes from 1972 and 1980. The study was undertaken to assess bank stability in determining future bridge developments and urban expansion. Another project classified the land use along the Teesta river in northern Bangladesh, and yet another classified the many different land uses and agricultural practices for a large portion of northwest Bangladesh. This study can now be compared with the current land survey for accuracy, time, and cost. Band ratioing techniques were also utilized for mineral exploration and fault detection in the heavily vegetated areas.

IV. EXECUTIVE BRIEFINGS AND TRAINING WORKSHOPS

More recently, a program to transfer remote sensing applications to natural resources managers, scientists, consultants, and technicians was developed to provide executive briefing and training workshops. The program provides a low cost, hands-on training, and state-of-the-art review in a 2 or 3 day seminar held at TAC's cartographic lab. The briefings/workshops are limited to 10 attendees providing the participants with a personalized approach in the training of their discipline. Day one consists of an 8 hour state-of-the-art review of the upcoming training workshop topic. The following two days are scheduled for the workshop, and all materials are included in the registration fees. Disciplines covered include the following:

- Fundamentals of Remote Sensing
- Geology
- Wildlife
- Water Resources/Hydrology
- Geographic Information Systems
- Hydrocarbon/Mineral Exploration
- Vegetation Mapping

In summary then, the activities at TAC in the area of technology transfer have proven a useful way of providing users with a way of maintaining an up-to-date review of remote sensing technology and also a means of improving their knowledge and skills in an ever increasing scientific discipline. These activities are summarized below:

- Remote Sensing of Natural Resources, a quarterly literature review
- Visiting Scientist Program
- Executive Briefings and Training Workshops

AUTHOR BIOGRAPHICAL DATA

Robert W. Gonzales. Robert W. Gonzales holds a Bachelor of University Studies Degree from the University of New Mexico. He has been the editor of Remote Sensing of Natural Resources for the past four years and is currently an instructor/coordinator of the Executive Briefings and Training Workshops. His research interests center on geologic applications of remote sensing techniques. Particularly, as a tool in hydrocarbon and mineral exploration programs, and has several publications in this area.

Mark A. Fink. Mark A. Fink is a recent graduate from the University of New Mexico with a Master's Degree in Geography. Mr. Fink's major emphasis of study was physical geography and remote sensing. For the last three years he has been employed at the Technology Application Center working as a remote sensing technician; digitizing maps for the New Mexico Natural Resources Information System and currently is coordinator for the Visiting Scientist Program for Remote Sensing. His research interests are in the digital image processing of natural resources, such as land use inventory, geomorphology, agricultural studies, and change detection.

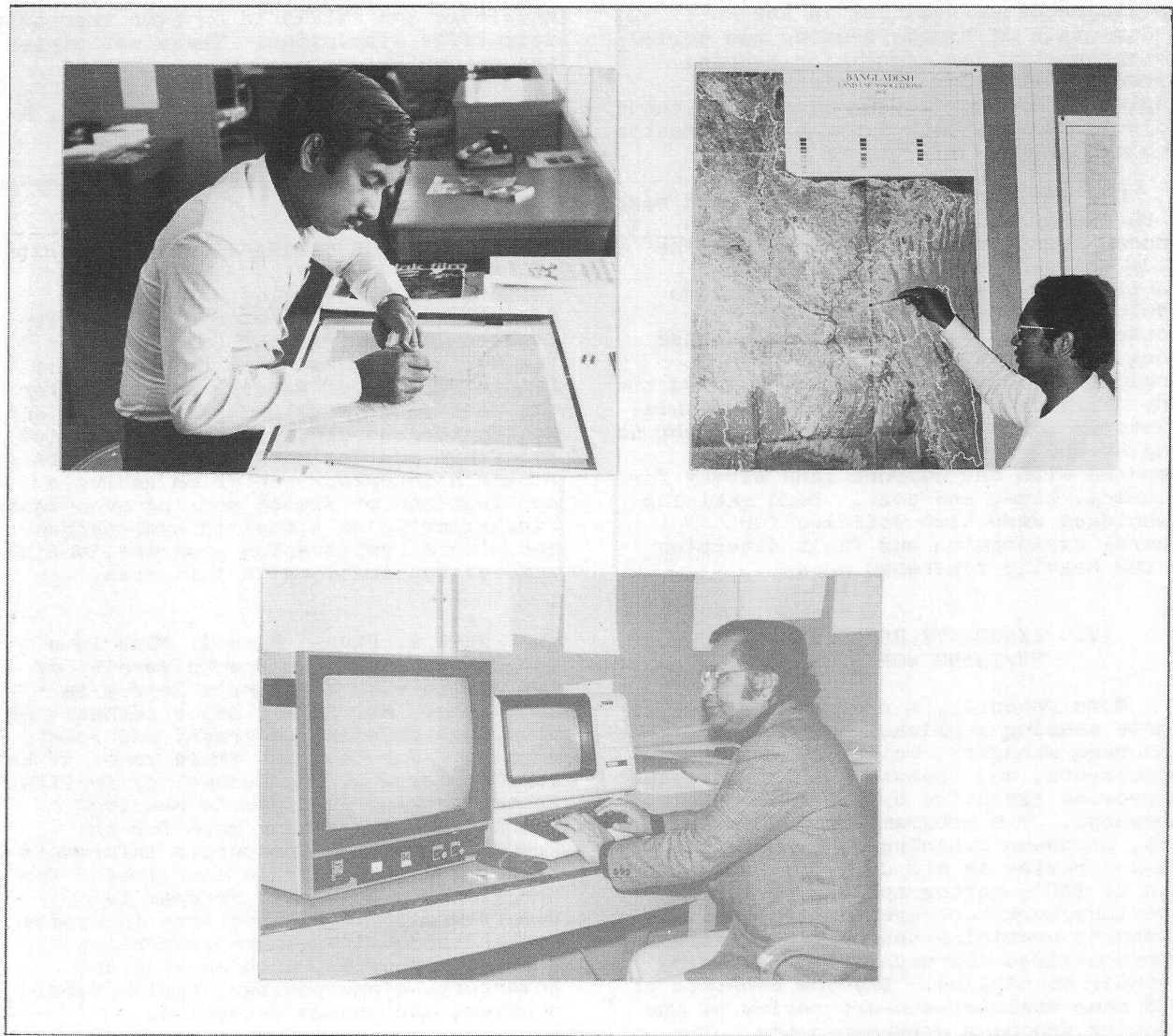


Figure 1. Hands-On Training in Photointerpretation of Satellite Imagery and Image Processing by Current Visiting Scientists from Bangladesh.