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AGRICULTURAL RESOURCES INVENTORY PROJECT MID-TERM EVALUATION REPORT

by

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The National Remote Sensing Centre of Nepal

The National Remote Sensing Centre of Nepal, Department of Soil Conservation and Watershed Management, was established in 1981 by His Majesty's Government of Nepal (HMG). Its formation was based on a grant agreement between HMG and the U.S. Agency for International Development (AID) to "apply remote sensing technology to [Nepal's] needs for natural resource inventory and planning."

The Centre's objective is to provide resource management agencies in Nepal with remote sensing training, new data and resource inventory information, and technical support. Its orientation is strictly toward practical applications of remote sensing technology.

The main thrust of the Centre's activities in providing new and better information is the production of maps and high-quality imagery for other HMG agencies. It also is dedicated to training remote sensing specialists in those agencies and to providing any other services requested by its users.

The Centre is receiving technical support from the Environmental Research Institute of Michigan. Administrative support and liaison is provided by the HMG Interdepartmental Advisory Committee, composed of high-level technical officers from several national user agencies and departments (Geology and Mines, Topographic Survey, Agriculture, Forestry, and the National Planning Commission).

The Centre's new facilities, which are expected to be completed in 1983, will include the installation of Nepal's first color and automatic film processing laboratory. In the years ahead the Centre is expected to continue developing and expanding its capabilities in response to the needs of its users. It also will attempt to enhance its cooperation with neighboring Asian countries, including hosting regional or international remote sensing conferences in Kathmandu.

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ACRONYMS USED

AIT	Asian Institute of Technology
ARIP	Agricultural Resources Inventory Project
ERIM	Environmental Research Institute of Michigan
FAO	Food and Agricultural Organization
GIS	Geographic Information System
HMG	His Majesty's Government
HMG/N	His Majesty's Government/Nepal
MSS	Multi Spectral Scanner
NRSC	National Remote Sensing Center
PID	Project Identification Document
RCUP	Resource Conservation and Utilization Project
RSC	Remote Sensing Center
UNDP	United Nations Development Program
USAID	United States Agency for International Development

1.0 EXECUTIVE SUMMARY

USAID's remote sensing projects worldwide were designed to assist developing countries in the development and assimilation of a new technology for gathering resource information for development planning and monitoring. This type of technology is seen as being applicable across a wide range of development problems including agriculture, forestry, hydrology, mineral exploration, etc. As such remote sensing is not a response to a particular development problem, but a powerful new data tool providing information which is (1) otherwise not available, or obtainable only at high cost, (2) available on a recurrent and frequent basis, and (3) applicable to a wide range of development sectors.

The Agricultural Resources Inventory Project (ARIP) in Nepal is an effort to establish an effective remote sensing center "to provide current information on the quantity and quality of water and land resources so as to allow for informed land-use decisions." In order to establish a National Remote Sensing Center (NRSC) in Nepal, the ARIP was designed to consist of four primary components:

1. The establishment of a photographic/cartographic laboratory:
2. The formation of an image interpretation laboratory;
3. The conducting of an extensive training program; and
4. The application of remote sensing technologies to specific functions and localities in support of HMG/N development projects in Nepal.

Now, more than three years into the five year project, USAID is conducting a mid-term evaluation of the ARIP and the establishment of the NRSC. This evaluation attempts to assess the progress to date in the four key areas listed above and it reviews the linkages between the NRSC and

international remote sensing agencies. In addition, the evaluation will look at the role of the NRSC Advisory Committee and its effectiveness in guiding the activities of the NRSC.

1.1 Components of an Effective Remote Sensing Program

Understanding the components of an effective system of acquiring, analyzing and using spatial information gathered through remote sensing provides a useful point of reference against which to measure the development, evolution and future direction of remote sensing in Nepal. Equal importance is attached to various aspects of the system by which remote sensing is acquired, disseminated, analyzed and finally incorporated into a country's spatial information base. There are five general components of an effective remote sensing system:

Data Acquisition;

Data Dissemination;

Technology Transfer;

Data Analysis and Spatial Information Systems; and

Integration of Remote Sensing Data and Information into User Information Systems.

1.2 Agricultural Resources Inventory Project (NRSC)

This section evaluates the progress to date of the ARIP based upon the eight questions outlined in the evaluation team's statement of work.

1.2.1 Impact of Physical Facilities on Project Development

(Determine the adequacy of physical facilities (Babar Mahal), the appropriateness of equipment in place and the effectiveness of its use.)

Findings: Progress has been made towards the provision of a permanent facility for the NRSC. In fact, the NRSC will eventually have four times the space envisioned by the original project paper. However, occupancy of the new building, while apparently imminent, is far behind schedule.

Recommendation: Steps must be taken to ensure that the facility is completed as soon as possible. This may require further USAID support.

1.2.2 Equipment and Facilities

(Determine the adequacy of the facilities and equipment for carrying out the work of the center, and make specific recommendations for additional facilities and equipment as required.)

Finding: Current physical facilities are woefully inadequate.

Finding: The majority of the equipment called for in the original project paper has been procurred. In addition, some additional equipment has also been procurred, including an Apple Computer and a Geoceiver.

Finding: Equipment procurred to date is in harmony with the mission of the NRSC as envisioned in the project paper. However, current equipment seems underutilized and some equipment has not been set up due to a lack of space in the temporary facility.

Recommendation: The acquisition of additional computing capability to implement a Geographic Information System (GIS) is an issue mentioned and deferred, in the original project paper. The team believes that a need exists for a GIS in Nepal, however, at the present time, it is recommended that Nepal should (1) utilize its current equipment and (2) evaluate HMG requirements, analyze alternative GIS equipment options and associated costs, and investigate the supportive infrastructure. Until these two things are done, Nepal should not procure further computer capability or a computerized GIS.

1.2.3 Training Programs

(Assess the relevancy and impact of the participant training program to date in meeting the staffing needs of the NRSC)

Finding: The participant training program is two years behind schedule. This delay may be attributed to (1) delays in the original starting date of the project and (2) the stated requirement of HMG agencies to provide training opportunities for personnel only after one year of satisfactory job performance.

Finding: Two of the original nine components of the training program have not been addressed to date. They are (1) two years of Masters Degree training for an earth scientist and (2) six months of managerial training.

Finding: The in-country training program has been effective in reaching a significant number of HMG personnel and agencies.

Finding: Training in earth sciences and management would be a significant addition to the NRSC.

Recommendation: NRSC should consider a survey of in-country trainees in order to ascertain the extent of the application of learned skilled within the trainee's user agency

1.2.4 Dissemination of Remotely Sensed Data and User Capability

(Assess the Project's progress in identifying substantive RSC projects, disseminating remote sensing information, and developing user-group capability and make recommendations with regard to what is needed to meet project goals and purposes.)

Finding: Generally, projects within the NRSC have been influenced by the Center's host organization. They do not reflect the inter-sectoral composition of the advisory committee.

Finding: Dissemination of remote sensing data has been hampered by (1) the relative newness of remote sensing technology to HMG/N user agencies and (2) the center has, to-date, focused on establishing itself rather than on developing user linkages.

Finding: The development of user group capability in remote sensing remains low, and in fact seems to be an ambitious proposition for the center to undertake in its formative stage.

Recommendation: The Center, in order to effectively work with users, must become established in the new facility.

Recommendation: Projects should be identified which have direct applicability to planning and monitoring Nepal's development.

Recommendation: The Center should be relocated in the National Planning Commission in order to ensure access to it by the widest possible variety of user agencies.

1.2.5 Linkages With Other Remote Sensing Centers

(Evaluate the progress of the Center towards establishing working linkages with Remote Sensing organizations and receiving stations in other countries and with international agencies.)

Finding: The NRSC has developed contacts and working linkages with remote sensing organizations and receiving stations in other countries and with international organizations.

Finding: There has been some difficulty in obtaining data in a timely manner from the Indian/Hyderabad receiving station.

Recommendation: Institutional linkages should be established to facilitate the acquisition of remote sensing data from Hyderabad. Until this happens, USAID may have to continue in its role as facilitator.

1.2.6 HMG Priority Needs Possibly Met by the Project

(Identify priority HMG needs which may in the future be met, but are not currently being met, by the project)

Finding: HMG/N has adopted a policy emphasizing the agricultural sector, conservation of natural resources and development of water resources. In addition, projects in the areas of forestry management, watershed management and hydro-electric development are considered of national priority.

Recommendation: Remote sensing projects related to agriculture and land use mapping would be particularly useful to HMG/N.

1.2.7 Project Modifications

(Recommend modifications, if any are needed, in the project work plans and in activities which may help the project to more completely realize to objectives).

Finding: The project is not in need of modification, rather it requires a change in emphasis from establishment to operations. This requires an emphasis on users, user linkages and user related projects.

Recommendations: The operational phase of the project should focus on (1) the continued build-up of an effective user center, (2) an upgraded awareness and outreach program, and (3) the initiation of pilot projects.

Recommendations. These pilot projects are crucial to the center's ability to develop more users and to attract further funding from donor agencies. In choosing a pilot project, the following criteria should be considered:

1) good quality data of the target area must be available;
2) the project should be related to a "real" need or on-going planning process;
3) the project should be of interest to high-level HMG personnel;
4) the project should try to link with one or more donor agencies;
5) the project must be feasible with local skills.

1.2.7.1 Future Spending

The team was asked to review the commitment of remaining grant funds with particular regards to the purchase of a computer GIS and the establishment of a meteorological satellite data reception facility.

Finding: The physical facility is not yet finished and must be for the NRSC to become fully operational.

Finding: Further study of the needs and alternatives for a computer GIS and the procurement of a meteorological satellite data reception facility is required.

Finding: The technical assistance contract may be facing some cost overrun.

Recommendations: Before any contingency funds are committed, a "cost-to-complete" analysis of the technical assistance contract should be made to determine what funds are remaining.

Recommendations: In absence of that analysis, the following tentative funding priorities are suggested:

1. Completion of the new facility;
2. Initiation of pilot project approach;
3. Continued purchase of up-to-date Landsat imagery and aerial photography;
4. Initiation of training for user agency staff;
5. Analysis of meteorological systems need;
6. Analysis of computer GIS need;
7. Further training of remote sensing staff.

1.2.8 NRSC Advisory Committee and Project Location

(Assess the effectiveness of the NRSC Advisory Committee and other mechanisms by which NRSC activities are determined.)

Findings: The Advisory Committee has met relatively infrequently and the composition of the committee has changed with each meeting. As such, no real guidance has been offered by the committee to the NRSC. This has led to minimal feedback between the NRSC and user agencies.

Finding: There is a strong perception within HMG that the NRSC is a component of the Forest and Soil Conservation Ministry. This has limited inter-agency coordination and cooperation.

Recommendation: The NRSC should be located under the National Planning Commission in order to put it more in touch with planners and to provide for greater inter-agency access.

Recommendation: The Advisory Committee should be replaced by a Co-ordinating Committee composed of either representatives of planning units of relevant ministries or of department heads. This committee would be responsible for determining and evaluating the NRSC annual work plan.

1.2.9 Remote Sensing, Technology Transfer and Future USAID Role in Nepal

Finding: Remote sensing is considered to be the most advanced technology which USAID is involved in transferring to developing countries. Due to its perceived "high-tech" nature and its consequent "prestige" factor, remote sensing programs are often technology driven rather than user or need driven.

Finding: Most USAID remote sensing programs are conceived of in a "top-down" fashion. It is assumed, in other words, that the existence of the data will generate the user demand needed to justify the program in the first place. This is rarely the case.

Recommendation: In considering its future role in Nepal's remote sensing program, USAID should consider the following:

1. Even though remote sensing is perceived to be "high-tech", many of the problems involved in its transfer to developing countries are similar to those of other development projects.

2. In project design, USAID should pay closer attention to project assumptions.

3. In project management, USAID should pay closer attention. Many of the difficulties facing the establishment of a remote sensing center are managerial and institutional, rather than technical.

4. Project design should be user or need driven, not technology driven.

Recommendation: USAID should continue to support the NRSC in Nepal in any of the following ways:

1. Provide periodic technical and management assistance to the NRSC.

2. Provide support for pilot projects -- particularly in resource related USAID development projects.

3. Facilitate linkages to HMG and other donor agencies.

4. Facilitate data acquisition from Hyderabad Landsat receiving station.

5. Provide funding for continual purchase of up-to-date Landsat data and aerial photography.

These are just a few of the ways in which USAID could continue to contribute to the development of remote sensing in Nepal. The team believes that a small, on-going investment in the NRSC could enable Nepal to reap enormous benefits through improved information for development planning and policy making.

2.0 PROJECT CONTEXT

USAID's remote sensing projects worldwide have been designed to assist developing countries in the development and assimilation of a new technology for gathering resource information for development planning and monitoring. This type of technology is seen as being applicable across a wide range of development sectors, including agriculture, forestry, hydrology, mineral exploration, etc. As such, remote sensing is not a response to a particular development problem, but a powerful new data tool providing information which is (1) otherwise not available, or obtainable only at high cost, (2) available on a recurrent and frequent basis, and (3) applicable to a wide range of development sectors.

The history of remote sensing in Nepal goes back at least 20 years. USAID involvement in remote sensing began in 1964 with the initiation of the Forest Resources Survey Project in the Ministry of Forest. This project made use of aerial photography and image interpretation techniques to map Nepal's forestry resources. The immediate impetus, however, for the establishment of the Remote Sensing Center through the Agricultural Resources Inventory Project (ARIP) was a 1976 remote sensing workshop conducted in Nepal. This workshop was attended by 17 HMG/N representatives who subsequently recommended the establishment of a National Remote Sensing Center.

Shortly thereafter, two people from the Remote Sensing Institute at South Dakota State University visited Nepal as part of a USAID/Washington remote sensing project. They arranged for the training for five Nepalese in the U.S. These five trainees, in conjunction with the Remote Sensing Institute then held another seminar on remote sensing in Nepal in April-May

of 1978. Interest in remote sensing continued to grow and led to a proposal, submitted by the Department of Soil and Water Conservation to USAID/Nepal, to establish a remote sensing center in Nepal.

The Project Identification Document (or PID) produced by USAID emphasized two phases. First, the establishment of a remote sensing center and the development of an equipment base for the necessary photographic and image interpretation laboratories, and the training of ministry personnel; and second, the establishment of a mini-computer facility in the remote sensing center. This PID was evaluated by Resources Development Associates in 1979 and was criticized at that time in three primary areas. First, it was felt that the institutional location within the Ministry of Forest and Soil Conservation might limit use of the center by other government agencies; second, that training should emphasize a substantive field in the biological and/or physical sciences, as well as remote sensing and; third, that the center should focus more fully on user applications in order to make use of remote sensing in actual development planning, and to ensure that the technology of remote sensing did not develop separately from its objective, that of providing information for development planning. These criticisms were incorporated into the project and the ARIP was initiated in January of 1981 after almost a year's delay.

2.1 Project Structure, Goals and Objectives

The Project Paper correctly identifies remote sensing as a particular type of information gathering technology involving "the collection and analysis of earth resource information through the use of aerial and satellite photography." It adds that "the products of remote sensing are useful primarily within the context of a natural resource management or environmental monitoring system." In order to establish an

effective remote sensing center "to provide current information on the quantity and quality of water and land resources so as to allow for informed land-use decisions", the project was designed to consist of four primary components:

1. the establishment of a photographic/cartographic laboratory;
2. the formation of an image interpretation laboratory;
3. the conducting of an extensive training program; and
4. the application of remote sensing techniques to specific functions and localities in support of HMG/N development projects in Nepal.

The project paper also recognized the importance of linkages between Nepal's Remote Sensing Center, The Asian Regional Remote Sensing Training Center and the Indian Landsat Receiving Station at Hyderabad.

Now, more than three years into the five year project, USAID is conducting a mid-term evaluation of the ARIP and the establishment of Nepal's Remote Sensing Center. This evaluation attempts to assess the progress to date in the four key areas listed above and it reviews the linkages between Nepal's Remote Sensing Center and international remote sensing agencies. In addition, the evaluation will look at the role of the NRSC Advisory Committee and its effectiveness in guiding the activities of the NRSC.

3.0 COMPONENTS OF AN EFFECTIVE REMOTE SENSING PROGRAM

An overview of the components of an effective system of acquiring, analyzing and using spatial information gathered through remote sensing provides a useful point of reference against which to measure the development, evolution and future direction of remote sensing in Nepal. Emphasis throughout this overview is placed evenly on the various aspects of the system by which remote sensing data is acquired, disseminated, analyzed and finally incorporated into a country's spatial information base. There are five general components of an effective remote sensing system:

1. Data Acquisition
2. Data Dissemination
3. Technology Transer
4. Data Analysis and Spatial Information Systems
5. Integration of Remote Sensing Data and Information Into User Information Systems.

3.1 Data Acquisition

It is important at the outset to clearly understand that when we refer to remote sensing data we are referring to both satellite imagery and aerial photography. Despite the fact that in the past decade the term remote sensing seems to have become associated with Landsat satellite imagery exclusively, it is essential to note that an effective remote sensing program utilizes data from both earth resources and meteorological satellites, as well as a variety of aerial photography or other ancillary data (existing maps, for instance).

The acquisition of aerial photography by a national remote sensing program is usually controlled by the national government. In other words, this data is collected either directly by the government through one

of its own agencies, or by outside sources with the consent of the government. The acquisition of aerial photography can be quite expensive, so that careful planning is required. The acquisition of satellite imagery has been quite a different story.

The acquisition of satellite imagery is controlled by the countries who have launched remote sensing satellites. To date, with respect to earth resource sensing satellites, the United States Landsat program has dominated the world scene. Five Landsat satellites have been launched, the most recent being Landsat 5 which was launched on March 1, 1984. These five satellites have produced a steady stream of data from July of 1972 until the present. Throughout this period these satellites have utilized the multi-spectral scanner (MSS) sub-system to obtain data. Only recently (Landsat's 4 and 5) has a new data generating sensor been introduced. Data from this new sensor (the Thematic Mapper) is not yet available to Nepal.

One of the primary weaknesses of the Landsat system was the early failure of data capture by tape recorder when the satellite was beyond the reach of tracking/receiving stations at various points in the world. A straight forward solution to this problem was the establishment of a worldwide network of ground receiving stations. Among these stations are the Thailand/Bangkok and Indian/Hyderabad stations which collect data covering Nepal. In setting up these ground stations, the countries involved guaranteed that they would adhere to the U.S. policy of openly disseminating data gathered by satellite to any desiring user. As such, data from Landsat has been openly disseminated around the world since 1972. However, there are various periods of time where no data is available for Nepal, due to technical difficulties at the Thailand and Indian remote sensing receiving stations.

Landsat MSS data will continue to be available from Landsat receiving stations throughout the life of Landsat 4 and 5. Beyond that, the continuation of the U.S. Landsat program is in doubt. At the moment, the U.S. government is in the process of transferring the technology to the private sector. If successful, there is likely to be continued data from U.S. satellites, but at a commercial price. In addition, many other countries are preparing to launch earth resources satellite programs. These include the French SPOT system scheduled for launch in 1985, the Indian Remote Sensing Satellite scheduled for launch in 1986, the Japanese Earth Resource Satellite, the Tropical Earth Resources Satellite (joint Indonesian and Dutch), the European Space Agency Earth Resource Satellite and others. It appears that for the forseeable future some form of satellite imagery covering land resources will be available. However, this data is likely to become increasingly expensive as the systems become more commercially oriented.

Meteorological satellite data generated from U.S., European and Japanese satellites has been widely and openly disseminated since the first weather satellite was launched by the U.S. in 1960. It is anticipated that data from weather satellites will continue to be made available to all countries and that the use of Data Collection Platforms (remote platforms which automatically collect data from remote locations and transmit the data to some central location via satellite) and meteorological satellite imagery will become increasingly important in crop yield modelling, weather disaster early warning programs and other application areas.

In addition to these two types of satellite data, the U.S. will be flying a variety of remote sensors on-board the Space Shuttle. In particular, data from the Large Format Camera and the Shuttle Imaging Radar

will be available. Any effective remote sensing program will take advantage of this wide variety of internationally collected satellite data in conjunction with its own nationally generated aerial photography.

3.2 Data Dissemination

Ranking in equal importance to data acquisition is data dissemination. For a remote sensing system to be effective, it must be able to respond quickly to user requests. This requires a set of support services which in turn requires equipment for quickly generating and handling potentially large volumes of data.

In addition to being able to respond quickly to data orders, a system must exist that provides users with an ordering service. A list of available data (including a visual image browse catalogue if possible) by location is essential. A more sophisticated level of user service is where resource analysts in the center can work with the user in analyzing the users problem and determining the best data or mix of data to be addressed to its solution.

3.3 Technology Transfer

There are at least two levels at which technology is tranferred. The first is the level of awareness of remote sensing principles and applications and the other is training and education in remote sensing techniques.

3.3.1 Awareness and Introduction to Remote Sensing Principles and Applications

To ensure maximal use of data gathered by satellite, the U.S. entered upon a major world effort to publicize the Landsat system and demonstrate a wide variety of applications. This effort, or outreach program, included workshops, conferences and cooperative demonstrations

with numerous countries around the world. Reports and research findings were presented at international symposia around the world. An effective remote sensing program should participate in these types of programs in order to keep current with the evolving technology of remote sensing.

In a like manner, a national remote sensing program must conduct a similar type of outreach program within the country in order to make user agencies aware of the potential of remote sensing in a wide variety of application areas. As such, an outreach program, by which the remote sensing program becomes known to users, is an important element of an effective program.

3.3.2 Training

A natural extension to an outreach program is the training of personnel to utilize remote sensing data. To meet training goals, appropriate institutional mechanisms must be established. Training can be achieved through the device of bringing members of a particular discipline together in rigorous "short courses" supported by "hands-on" sessions with appropriate equipment. More in-depth training would include the full integration of remote sensing technology into a program of study within a particular discipline. These programs might well be associated with university study toward an academic degree. However, this type of university training occurs only when a program is well established.

An effective remote sensing program must, therefore, participate not only as a recipient of technology transfer from international sources, but also in domestic technology transfer from the remote sensing program to user agencies.

3.4 Data Analysis and Information Systems

For remote sensing data to be useful in managing resources it must be related to the spatial nature of man s development activities. The need almost always exists to know the spatial distribution of a particular phenomenon to assess problems associated with location and the dynamic interaction of spatially related activities (for instance road construction and deforestation). The decision making agency responsible for managing a particular activity should therefore explore the use of remote sensing data, however gathered, to support or replace traditional means of gathering spatial information.

Careful decisions must be made about the type of data to be used in any decision to use remote sensing data. These decisions must be based on a set of factors including data availability, data cost, applicability of the data and possession of needed equipment and skills to analyze the data. Care must be taken to choose a data set which both meets user requirements and which can be successfully analyzed. A successful remote sensing system must then be able to analyze appropriate data sources and integrate the analysis into existing information systems. It must be able to work with users to determine their needs and to design an effective resources survey and analysis program.

Regardless of the source of data finally used and the type of analysis method, the value of remotely sensed data is maximized when the data is put into a spatial information system or as it is now popularly referred to, a geo-based or geographic information system (GIS). Most often, information generated through interpretation of aerial photography of satellite imagery is "registered" to maps so that various types of information (i.e. land use, forest cover, transportation networks) can be

evaluated concurrently with respect to a particular spatial area. In less sophisticated remote sensing systems, a manual GIS using hard copy base maps and thematic interpretation overlays is very effective. At more advanced stages of remote sensing development, a computerized GIS can be developed. Before moving to a computerized system, however, careful analysis of cost, training and support available to operate and maintain a computer facility, and the level of user need and sophistication in remote sensing should be made. This will ensure that a system is not developed which cannot or will not be used. In general, basic photo-interpretation and map-making skills should be developed along with manual GIS before moving to a sophisticated computer system.

3.5 Integration of Remote Sensing Data and Information Into User Information Systems

Accurate, timely and synoptic information derived from remote sensing sources should serve as a vital information source for policy planners and national decision makers. The ultimate success of a remote sensing system, then, is found in the end user and the end users utilization of the data in planning and decision making. The use of remotely sensed data and information in decision making, and the possibility that such data and information leads to "better" decisions, however, cannot only be the responsibility of a remote sensing program. The remote sensing program basically helps to integrate information into the existing system. Accordingly, although it can and should have a responsibility for "selling" the process to planners and decision-makers, it is essentially up to them whether the information is used. "Selling" may take the form of training, a newsletter, pilot projects, or other methods, but the form is less important than the purpose.

4.0 AGRICULTURAL RESOURCE INVENTORY PROJECT (NRSC)

This section evaluates the progress to date of the ARIP based upon the eight questions outlined in the evaluation team's statement of work.

4.1 Impact of Physical Facilities on Project Development

(Determine the adequacy of physical facilities (Babar Mahal), the appropriateness of equipment in place and the effectiveness of its use.)

Findings and Recommendations: Progress has been made towards the provision of a permanent facility for the NRSC. The space available to NRSC will be four times larger than envisioned by the original project paper (four floors as opposed to one). A floor plan for the use of the space was provided to the evaluation team (see Appendix 1) and the proposed use of space appears appropriate to the objective of NRSC. Figures 1 and 2 show the current temporary facility and the Babar Mahal facilities.

It is recommended that steps be taken to ensure that the facility is completed in a manner that will permit timely occupancy by NRSC. This should include financial support for the completion of the physical facility if necessary.

FIGURE 1:

Existing NRSC Facilty

FIGURE 2:

New Facility for NRSC (one wing)

4.2 Equipment and Facilities

(Determine the adequacy of the facilities and equipment for carrying out the work of the center, and make specific recommendations for additional facilities and equipment as required.)

Findings and Recommendations: Facilities for NRSC must be considered both in light of those available to date (inadequate by any measure) and those available in the future (nominally available by April 9, 1984). By comparison, the new facility at Babar Mahal will provide a more favorable location, more floor space, and an appropriate allocation of space. While the current leased space may be viewed as a detriment to the project, the new facility will serve to enhance the project and its image with HMG.

A complete list of equipment was provided by the Project Manager and Project Advisor (See Appendix 2). Figures 3 through 6 show some of the equipment now in use at the NRSC. While some concern was expressed regarding the delivery schedule of equipment, it appears that most of the equipment listed in the project paper has been acquired. In fact, some equipment not called for in the project paper (eg. Apple Computer, Geoceiver) has been acquired. Some equipment remains in leased storage space in Kathmandu awaiting the completion of the new building (color photo laboratory equipment). Equipment acquired to date is in harmony with the project paper and is sufficient to carry out the mission of NRSC as envisioned in the project paper.

FIGURE 3:

Interpretation Laboratory, Pocket Stereoscope and Scanning Stereoscope

FIGURE 4:

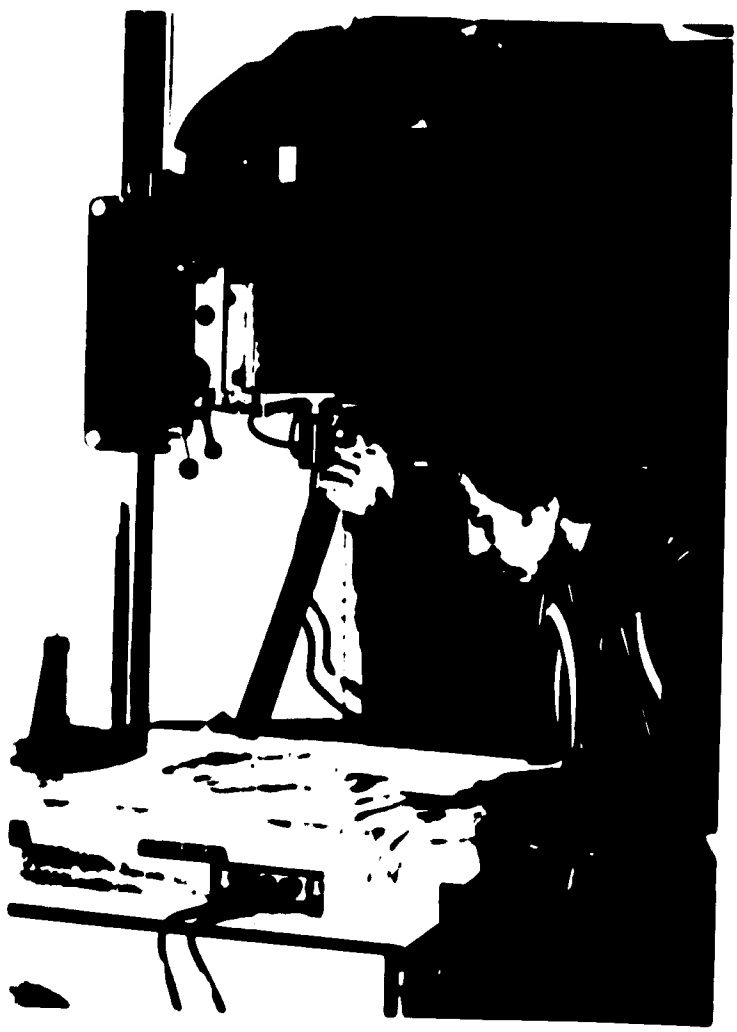
Densitometer

FIGURE 5:

Apple II Computer

FIGURE 6:

Black & White Enlarger



The acquisition of additional computing capabilities is an issue mentioned, and deferred, in the original project paper. Considerable interest has been expressed by HMG user agencies in the acquisition of a computer based "Geographic Information System" (GIS). A Technical Report on the subject was recently completed by ERIM and a subsequent letter which details the cost and several add-on options was examined. Experience shows that the usual progression in the acquisition of a remote sensing capability begins with visual interpretation, advances to a digital (computer) analysis capability, and leads to a GIS which provides for the digital (computer) integration of additional data for modeling resource parameters and reaching logical resource management decisions. The immediate acquisition of GIS capability, without the option of digital analysis capability (image analysis software) for the analysis of Landsat computer compatable tapes (CCT'S) would appear to interrupt the usual progression of technology transfer. However, the key point is that while a GIS is desirable, the development of proper infrastructure support should come first.

Based upon the quantity and variety of map products which were encountered by the evaluation team, there is little doubt that a GIS capability for Nepal would be desirable. Concerns about the development of a reliable infrastructure to support such a capability, however, were raised in several interviews. GIS technology, while valuable, must not be viewed as a panacea for problems involving the integration of map based data for the country. In fact, the divergent nature of available map data, and its variable accuracy, may cause as many problems as a GIS is designed to solve. This issue should be examined in detail before a commitment is made to procure a computerized GIS.

Equipment acquired to date is adequate to meet the objectives of NRSC as stated in the project paper. Much of the equipment appears to be under-utilized. This is a function of the nature of remote sensing project work and the currently inadequate space. It is also a function of the level of demand placed upon the NRSC by HMG users.

The Geoceiver, an investment of over $71,000, is a specialized piece of equipment whose use was envisioned in the context of geometric rectification of Landsat digital data. A further use was envisioned in support of the World Bank-GTZ image map project. As the later project will be completed with existing 1977 imagery, this justification is not valid. The Geoceiver has considerable potential for Nepal and it should be utilized in conjunction with other needs and agencies in the country (Topographical Survey, for example).

The issue of GIS acquisition requires further study and prioritization. One study, with one recommended system, costing from $295,000 to $438,000 (with options) has been made. NRSC and HMG requirements should be evaluated, alternative GIS equipment options and associated costs investigated, and the supportive infrastructure, from reliable power availibility to equipment preventive maintainence, investigated. Until this is accomplished, no recommendation is made by the evaluation team to move forward on the acquisition of a GIS.

4.3 Training Program

(Assess the relevancy and impact of the participant training program to date in meeting the staffing needs of the NRSC.)

Findings and Recommendations

The Project Paper proposed the following participant training program:

"The major project training component for RSC personnel will consist of short and long-term training in the U.S. Following is the proposed participant training program:

1) One photographic technician to be sent for twelve months of training to obtain operational skills for use in the photographic laboratory. This training will commence in October 1980.

2) One photographic assistant to receive three months of training, starting July, 1981.

3) One cartographic assistant to be trained for three months, commencing in January, 1981.

4) One earth scientist to receive two years of Master's Degree training starting in January, 1981.

5) Two earth scientists to receive six months of training each, starting in 1981. The training will encompass remote sensing techniques to be used in conjunction with their respective specialization.

6) One individual to receive six months of managerial training starting in January, 1981. This training is provided in order to ensure managerial capability important for the success of the project.

7) One librarian to receive three months of training beginning in January, 1981. This training is deemed necessary because the planned library is an important adjunct to the RSC and will be necessary as a repository for maps and reports.

8) One senior accountant to be trained for six months starting in October, 1980.

9) One aerial photographer to receive three months of training starting in October, 1980.

All of these participants will become members of the RSC permanent staff, with the possible exception of the earth scientists, trained for 6 months each. These individuals may elect return to their home agency once their "project" has been completed or stay on as permanent staff. This staff will assist in development of operational guidelines and manuals for RSC users."

To date the following training activities have been conducted or proposed:

1) Bhim Bahadur Thapa, Photo-Lab Technician, to Environmental Research Institute of Michigan for six months training, September 1982 - March 1983.

2) Sally Shahi, Draftsman, to Environmental Research Institute of Michigan and Eastern Michigan University for three months of training, August - October 1982.

3) Jageshwar Jha, Senior Geologist and Krishna Raj Basukala, Forest Officer, to Asian Regional Remote Sensing Training Center for four months training course, May - August 1983.

4) Arjun Gurung, Cartographer, to Environmental Research Institute of Michigan and Motorola (California) for three weeks of training on the "Geoceiver", December 1983.

5) Pradip Kumar Mool, Geologist to Laboratory for Applications of Remote Sensing for five months of training, March-July 1984.

6) Kamal Prakash Budathoki, Meteorologist, accepted for four to five months training at National Oceanic and Atmospheric Administration facility, Columbia, Missouri, April - August, 1984.

7) Krishna Prasad Pradhan, Agronomist and Kamal Shrestha, Soil Scientist, selected for five months training at Michigan State University or Purdue University, May - September 1984.

In addition, Mr. Krishna Bahadur Malla, Project Manager, has participated in a two week seminar in Japan in March 1982; training at the Environmental Research Institute of Michigan (digital processing of Bagmati Watershed data) in May 1983; and in an ESCAP Workshop in Sri Lanka in November 1983.

A separate, but equally important area of training is the in-country training of HMG agency personnel. Based upon information and attendance rosters provided by NRSC, the following training has occurred:

1) June 1981, one week seminar for DSCWM personnel, 8 trainees.

2) September 1981, three week seminar and training by outside consultants, 17 trainees.

3) February - March 1982, three weeks in-house NRSC training, 8 trainees.

4) November 1982, one week seminar, 10 trainees.

5) April 1983, one month seminar and training by outside consultants, 20 trainees.

6) April 1984 (proposed and scheduled), one month seminar and training by outside consultants.

These completed and proposed training activities will have provided over 43 man-months of training for 63 HMG personnel from numerous user agencies.

The participant training program, as set out in the project paper, is two years behind schedule. These delays may be attributed to (1) delays in the original starting date of the project and (2) the stated requirement of HMG agencies to provide training opportunities for personnel only after one year of satisfactory job performance.

Two of the original nine components of the training program which have not been addressed to date, and would benefit the project, are (1) two years of Master's Degree training for an earth scientist and (2) six months of managerial training for one individual.

The in-country training effort has been effective in reaching a significant number of HMG personnel and agencies. It is noted, however, that in 1982 there was no one month senimar and training program by outside consultants. One area which the evaluation team was unable to assess is the effectiveness of the in-country training effort. The NKSC may be well advised to survey trainees of the seminar and training program to ascertain the application of learned skills to the trainees area of responsibility within his agency.

4.4 Dissemination of Remotely Sensed Data and User Group Capability

(Assess the Project's progress in identifying substantive RSC projects, disseminating remote sensing information, and developing user-group capability and make recommendations with regard to what is needed to meet project goals and purposes.)

Findings and Recommendations

The National Remote Sensing Center commenced its operation in April 1981 from a temporary base. The Center is constrained both by poor location and inadequacy of physical space. The transfer to a new building being built by UNDP/FAO is 20 months behind the implementation schedule of the project due to delay in construction. There has also been some time overruns in delivery of equipment, although their optimal use remains theoretical until the Center moves to the new building. Training in the U.S. has been hampered by delays in nominating the trainees by the host country. In-country workshops and training programmes have been, however, conducted satisfactorily.

The first three years (1981-1983) of the Center has been focused on the establishment phase. This process will be complete only when the NRSC has shifted to its new building. Despite these initial problems, the Center has conducted its operation with a core of trained staff and essential tools. The Center has been able to create awareness regarding remote sensing information in certain areas. The operational aspect of the Center may be evaluated on the basis of (a) its on-going projects, (b) the dissemination of remotely sensed information and (c) development of user-group capability.

It is not clear who determines the substantive projects to be conducted by the Center. Although the Advisory Committee is supposed to guide the affairs of the Center, the minutes of their meetings do not include discussions on project plans. The emphasis on natural resources survey on the basis of watershed leads one to conjecture that the choice of NRSC projects is influenced by the priority perceived by the Center's host organizations, e.g., Department of Soil Conservation & Watershed Management and Ministry of Forest and Soil Conservation. The NRSC projects implemented so far, and proposed for the fiscal year 1984-1985, do not reflect the inter-sectoral composition of the Advisory Committee. For example, despite the project title Agriculture Resource Inventory Project, there has been little or no agricultural component in the in-house projects.

The dissemination function of the Center seems to have been handicapped by two factors. First, remote sensing technology, particularly satellite imageries, is a sophisticated element for Nepal where even the use of aerial photography is limited to a few technical departments.

Secondly, the physical establishment of a new institution has much engaged the Center's attention and thus provided less scope for wider contact. To-date, only half of a dozen outside agencies have made use of the Center's technical resources. Dissemination of remote sensing information remains modest as many potential users are unaware of the remotely sensed data characteristics and Center's facilities. It has recently launched a quarterly newsletter which should be helpful in introducing the Center, as well as remote sensing uses, to a wider audience.

Developing user-group capability seems to be an ambitious proposition for the period when the Center itself is in its formation stage. The feeling of most potential user agencies was that there was a lack of personnel trained in remote sensing. Some agencies that have sent individuals to in-country training seminars conducted by NRSC lack necessary equipment for remote sensing exercise. However, it was encouraging to note that trained personnel from some technical departments were making use of the Center's facilities.

The main objectives and purposes of the project are to enable the NRSC to receive, process and apply remote sensing information for resource planning. The processes involved are interpretation and production, diffusion of technology through training and dissemination of results to user agencies. In order to enhance the operational capability for these functions, high priority should be accorded to an early completion of the building and transfer of the Center. NRSC substantive projects should have potentials for application and emphasize resource assessment for planning and evaluation purposes. Remote sensing information should be made available to a wide variety of agencies and the Center newsletter should be issued in English and distributed regularly. Facilities for training, both within and outside the country, should be made available to potential agencies in order to enhance their capability in the use of remote sensing data. As the success of these functions depend largely on effective linkages, it is recommended that the NRSC be relocated in direct relation to the central planning agency rather than in its existing status as an appendage to one of the departments within a sectoral ministry.

4.5 Linkages With Other Remote Sensing Centers

(Evaluate the progress of the Center towards establishing working linkages with remote sensing organizations and receiving stations in other countries and with international agencies.)

Findings and Recommendations

The project paper called for the establishment of linkages, specifically with the Asian Regional Remote Sensing Training Center at the Asian Institute of Technology, Bangkok and with the Indian Landsat Receiving Station, Hydrabad. Since the inception of the project, the Thailand Landsat Receiving Station has also been established.

In establishing international linkages, the following activities are of note:

1) Two NRSC staff have participated in training at the ARRSTC at AIT.

2) Significant quantities of data has been procured from the Hyderabad, India Station

3) Data has been procured from the Bangkok, Thailand Station

4) Personnel from NRSC have visited counterpart institutions in India, Thailand, Japan, Bangladesh, Sri Lanka and the United States.

5) Personnel from World Bank, FAO, ESCAP, ARRSTC - AIT, NASA, and SPOT Image have visited NRSC in Kathmandu.

The NRSC has developed contacts and working linkages with remote sensing organizations and receiving stations in other countries and with international organizations. The existence of the center is known internationally. International organizations (ESCAP, GTZ, and World Bank for example) are providing support to the center for the conduct of workshops and mapping projects. The 5th Asian Conference on Remote

Sensing, to be hosted by NRSC in November 1984, will provide increased visibility of the center and it's capabilities within the Asian region, and consequently in strengthening these linkages.

One area of concern has been the effectiveness of data acquisition. The India and Thailand receiving stations do collect Landsat data of Nepal, and by virtue of their agreement with the United States (NASA) are obligated to make the data available. Administrative difficulties in acquisition of the data have required USAID pouch facilities to be utilized in order to expediate the receipt of data. Institutional mechanisms must be formulated between HMG-NRSC, and the India and Thailand governments-receiving stations to ensure timely and unrestricted flow of data.

4.6 HMG Priority Needs Possibly Met by the Project

(Identify priority HMG needs which may in the future be met, but are not currently being met, by the project.)

Findings and Recommendations

HGM Nepal has adopted a policy of emphasizing the agriculture sector, conservation of natural resources and development of water resources since the Fifth Plan (1975-1980). The basic principles of the proposed Seventh Plan (1985-1990) reiterates the same policies. Similarly, projects identified as of national priority for the Seventh Plan include development of pasture and farm systems, forestry management, watershed management and hydro electricity development. These are areas where remote sensing data can be directly applied.

There is an obvious divergence between the project title "Agriculture Resource Inventory" and the work plan of the Center. Presently, there seems an apparent bias to projects that cater to the Center's parent department and ministry. The adoption of watersheds as units of study, though more scientific, does not conform to HMG needs that emphasize administrative units in its decentralization plan. There is less emphasis on the evaluation of land and agricultural resources. Similarly, application of remote sensing technology in crop analysis and geological reconnaissance are only at a preliminary stage.

The first HMG priority is the need for a situation analysis of the existing land use. The future cannot be planned unless the present status is known. The on-going Land Resources Mapping Project using aerial photography does not cover the country in totality and it emphasizes capability rather than actual use of the land. Moreover, the data on the extent of different types of land use will become outdated by the time the analysis is available. Satellite imageries are useful for examination of current data and can be used for planning purposes at national and regional levels. They are particularly applicable to examine rapidly changing phenomena such as deforestation in the Tarai and spatial analysis of the High Himalaya where other means of information gathering are not easy or available.

Agriculture is another priority area where remote sensing technology should be applied. Activities under agriculture would include crop monitoring, extent of irrigation, range land inventory and weather forecasting. Application of remote sensing data in watershed management has applications both to irrigation and hydro-electricity development. Apart from examination of spatial elements at the national level, remote sensing information is particularly applicable in regional planning. Nepal

presently has seven foreign-aided integrated rural development projects covering 23 districts and more are being planned. Remotely sensed data should be utilized for formulation and evaluation of such area specific programmes. Conservation of natural resources has received increasing attention at the policy level. Remote sensing data can provide current information on the extent and pace of environmental stress and should be utilized for identifying areas of deforestation, soil erosion and environmental pollution.

4.7 Modifications in Project Plans

(Recommend modifications, if any are needed, in the project work plans and in activities which may help the project to more completely realize its objectives.)

This mid-term evaluation comes nearly 3/4 of the way through the project, and as such, it is too late to recommend major changes in the ARIP work plan. In fact, the team believes that the original project design was fairly sound and recommends instead a change in emphasis rather than a modification of the project plan at this time.

The general philosophy of the NRSC has been to develop in two phases. The first can be called the establishment phase consisting of creating the Center, procuring equipment, staffing up and training. This phase covers three of the four key components outlined in the original project paper (establishing a photographic/cartographic laboratory, establishing an image interpretation laboratory, and the conducting of a training program). The second phase can be called the operational phase in which remote sensing data is applied to HMG/N user agency needs. This includes the establishment of a user center, outreach and linkage to user agencies, and demonstration or pilot projects. This is the fourth component of the project plan.

Findings and Recommendations

To date, the Center has focused on the establishment phase. Earlier in this report a review of facilities, equipment and training was undertaken. In sum, there is a strong need to move into the new physical facility -- delay in availability of the new facility seems to have been the critical problem in completing the establishment of the Center.

In addition, it does not seem appropriate at this time to procure a computerized GIS. Generally, the Center ought to establish itself in the new facility and more fully utilize its present equipment and capabilities. In addition, training of staff personnel, while coming later in the project than originally planned, has been quite adequate. In sum, the establishment phase of the project should focus on the completion of and move to the new facility.

This move, which is likely to occur in May or June of 1984, will require much of the Center's attention for a period of two to three months. This does not diminish the necessity for the project to focus more fully on the operational phase (component 4 of the original work plan). Despite what will be a disrupting physical move, the NRSC must build stronger linkages to user agencies, to establish outreach programs and develop a demonstration or pilot project program. This shift in emphasis from the establishment phase to the operational phase is essential to the success of the Center. In addition, the team has some general recommendations regarding other issues brought up during our interviews, including the use of meteorological data and the need for a computerized GIS.

4.7.1 The Operational Phase

Component 4 of the Project Plan calls for "the application of remote sensing techniques to specific functions and localities in support of HMG/N development projects in Nepal." This component is essential to the ultimate success of the project as without it, the technology and the Center take on a disembodied character--the technology becomes separated from its use. In other words, the establishment of the Center becomes an end in itself, rather than a means to an end -- that being applications to development planning. After completing interviews with a wide range of potential donors and users the team recommends three areas on which the operational phase should focus:

1. the continued build-up of an effective user Center;
2. a user awareness and outreach program
3. pilot projects.

4.7.1.1 A User Center

The NRSC has already begun the establishment of a user Center and should continue this effort. Ideally, a user should be able to come to the Center and discuss his/her problem with a resource specialist. A catalogue of available data, by area and data type, should be readily accessible. It would be even more helpful if a manual browse catalogue were established so that the user could see the different types of data and its quality (including resolution and cloud cover). Finally, the staff of the NRSC could work with users to design an appropriate and effective resource analysis program. In order to be successful, however, any user Center requires a certain amount of decentralization of responsibility. Each resource specialist must be able to work directly with users as to the design and implementation of resource analysis projects.

4.7.1.2 User Awareness and Outreach

To date, the NRSC has conducted several user awareness and outreach activities including its seminar and training programs, the establishment of a newsletter and interviews with user agency personnel. On the basis of the teams interviews with both user and donor agencies, it seems critical that these efforts be redoubled. Unfortunately, many users seemed unaware of the Center's capability or of what services and products the Center is capable of providing. The following steps might prove useful in establishing fuller working relations with users:

1. A program to discuss one-to-one with user agencies the Center and its capabilities;
2. A quarterly newsletter with updates on products and services available;
3. Awareness seminars for high level policy makers and discipline oriented training programs.

During the three year life of the Center, personal visits by the Director and ex-patriate advisor to user agencies have been made. These visits were early on in the project and do not seem to have been adequately followed up. It is appropriate, as the Center focuses on its operational phase, to conduct another series of personal visits to users and donors. This is especially important in that when USAID funding terminates in 1985, contact with potential donors will be critical in finding new sources.

In addition to personal visits, the Center should develop and disseminate a quarterly English language newsletter for potential users and donors. This newsletter could contain information on

upcoming events, on-going projects and available services and products. Such a newsletter will keep users and donors informed and establish an on-going means of communication between the Center and user agencies.

Finally, the Center should continue its training and seminar series for HMG and donor agency personnel. It is recommended that the seminar be directed at high level decision makers who are in a position to institute the use of remote sensing in a particular agency. In addition, it is essential to continue with discipline oriented training sessions in which a particular type of resource problem is addressed. For instance, a future training program might focus on forest cover mapping and during the course of the training, a useful demonstration project of the application of remote sensing to forestry mapping could be undertaken. This type of training could dovetail with the development of demonstration or pilot projects.

One final suggestion is that the NRSC might try to institute a joint program with the University by establishing a remote sensing component within some of the discipline oriented courses being taught. Tribhuvan University and several professional colleges offer graduate degree programs in various natural and engineering sciences. The NRSC could offer to help staff an introductory course in remote sensing or offer parts of courses which might benefit from remote sensing applications. If students learn about the advantages of remote sensing in their academic training, they will take this knowledge with them to whatever job in the private or public sector they enter into.

4.7.1.3 Demonstration or Pilot Projects

The demonstration/pilot project approach has been demonstrated as a useful manner in which to successfully transfer remote sensing technology to user agencies and to incorporate information

generated from interpretation of remote sensing data into user agency planning activities. The pilot project approach involves the identification of a particular user need for spatial information which can be developed from remotely sensed data. Once such a need (preferably a need for information for a particular planning exercise) is identified, then a program is developed by which the members of the user agency work with the NRSC in designing the project, acquiring and analyzing the data and finally putting it into a form suitable for planners and decision makers. As suggested earlier, such a project could be designed to interact with a discipline oriented training program. Such a pilot project might entail the development of a set of land use and land cover maps for an area covered by an upcoming integrated regional development project or the mapping of forest cover for a particular set of districts in order to develop a forest management plan for those districts.

This approach has the potential to highlight the Center's capabilities. However, the Center must be careful in selecting a project or projects to undertake at this stage of its development. If a project is selected which has a low chance of success, the adverse reaction to failure could be devastating to the Center's reputation. As such, the following criteria should be considered prior to the selection of a pilot project:

1. project area must be covered by good quality data -- either aerial photography or satellite imagery or both;
2. the project should be related to a "real" need, or on-going planning process.

3. the project should be of interest to personnel high enough in the HMG so that if the project is successful it will be noticed and the products of the project will be used;

4. the project should try to link with a donor agency which could provide some funding for data purchase (if necessary) and for technical assistance to help with the analysis and with the establishment of linkages between the user agency and the NRSC; and

5. finally, the project must be feasible, in other words, the project must be one in which data and analysis are such that the information required can in fact be generated with local capabilities.

The team believes that this type of approach is needed in order to establish linkages and the use of remote sensing data by user agencies. In addition, donor agencies, in combining the roles of donor and user, would not only benefit from better information, but at the same time, they would increase the indigenous capability of HMG to provide resource information. If successful, then, it is possible that the pilot project approach could be used not only to meet the end goals of creating the NRSC, but also to attract continuing donor support.

4.7.2 Future Spending

The team has been asked to comment on the commitment of remaining grant funds (outside the scope of the current ERIM contract) with particular regards to the purchase of a computer GIS and the establishment of a meteorological satellite data reception facility.

With regard to a computer GIS, section 4.2 spells out the evaluation's findings. As indicated, the Center must, at a minimum, do a more thorough analysis of information sources and needed outputs, as well

as the different types of computer systems available, prior even to considering the purchase of such a system. In addition, it is felt that more complete use of existing equipment should be made prior to contemplating the purchase of still more sophisticated facilities. Finally, an analysis of the costs of supporting a computer system should be made. The costs of maintenance and training of computer technicians would increase the purchase cost of such a system considerably. In addition, recent discussions with non-USAID U.S. Government personnel have talked about the possible addition of a meteorological data reception and processing facility. If implementation of a computerized GIS and the installation of a meteorological data reception facility were to proceed, purchase should be undertaken together so that the equipment acquired is complementary.

There definitely is a long-term need for meteorological satellite data in Nepal in a wide variety of applications. If and when there is the thought to proceed, an analysis should be made of the need for weather satellite data and a set of alternative means of meeting those needs should be developed. An analysis of alternative system configurations, costs and cost-effectiveness in meeting actual needs should be undertaken. In addition, the team believes that if the purchase of Data Collection Platforms were linked to a pilot project of some sort (one related to crop yield modelling, flood control, climatology and disaster warning, etc). This would provide a context for such a purchase to be considered. We realize the danger of "studying a problem to death" but feel that in the case of meteorological data reception and processing facilities and computer GIS there is a far greater danger of buying

equipment which will not be effectively utilized. As such, careful study of various system configurations for meeting the needs for both a GIS and for meteorological data is warranted.

The further expenditure of funds should also consider a range of other requirements which are of importance to the success of the NRSC. The team has undertaken to tentatively prioritize these requirements, and believes that they are of equal importance to those two areas discussed immediately above. They include:

1. completion of the new facility (probably of greatest importance);
2. initiation of pilot project approach;
3. continued purchase of up-to-date Landsat imagery from Bangkok and Hyderabad remote sensing stations and acquisition of up-to-date aerial photography;
4. initiation of training for user agency staff;
5. analysis of Meteorological system needs;
6. analysis of Computerized GIS purchase;
7. further training of remote sensing staff.

Finally, it should be noted that the costs associated with the current technical assistance contract between HMG and ERIM should be reviewed. Because of the nature of a cost-plus-fixed-fee contract (one in which the customer is billed only for actual costs), initial budget estimates have changed with changes in equipment purchases, training and travel costs, and unplanned activities which have arisen. The purpose of a cost and fee contract is to accommodate such changes. However, an analysis at this time of "costs-to-complete" the current technical assistance contract ought to be made and considered amongst the above priorities. In any case, the above priority list must be seen as tentative--and is meant largely as a means for initiating discussion within HMG and USAID.

4.8 NRSC-Advisory Committee and Project Location

(Assess the effectiveness of the RSC Advisory Committee and other mechanisms by which RSC activities are determined.)

Findings and Recommendations

In order to guide the affairs of the Center, the project paper uses the terminologies "Advisory Committee" in the text and "Coordinating Committee" in the organization chart. The government decision was for an Advisory Committee with only a recommendatory role. This is well-reflected by the terms of reference discussed and finalized by the Committee during their second meeting on 22 November 1982 as follows:

1. To provide advice and guidance in recommending HMG policies concerning cooperative research programs on remote sensing;
2. To provide advice and guidance in recommending HMG policies for the dissemination of maps and satellite imagery;
3. To provide advice and guidance in disseminating knowledge about remote sensing techniques and application, and in organizing remote sensing training courses in Nepal;
4. To provide advice and guidance in preparing a research plan for the Nepal Remote Sensing Center in cooperation with other international centers and agencies;
5. To help co-ordinate the exchange of information on remote sensing as well as provide facilities to governmental agencies requiring such facilities;
6. To periodically review the progress of the Remote Sensing Center and
7. To help recommend the necessary equipments, facilities and program for the Remote Sensing Center."

The Advisory Committee meetings have a low frequency that averages once a year despite a decision made at the second meeting (1982) to have it quarterly. The composition has varied widely from time to time and the minutes do not distinguish between designated representatives vis-a-vis invitees or observers. (See Appendix 3) The number of participants varied from 8 to 13. Even more irregular has been the agency and representative attendance. For example, the Department of Agriculture has been represented once by Livestock Section and Agronomy Section at another time. Department of Roads, Planning Commission, Department of Forest and Tribhuvan University representatives attended only once. Geology, Meteorology (including Irrigation and Hydrology) and Agriculture Department representatives attended two meetings each. Other than those directly related to the NRSC (DG-DSCWM, Manager-NRSC, Advisor-NRSC, USAID), it is significant that the Topographical Survey Branch has shown consistent interest with regular attendance. Another significant feature of the Advisory Committee is in the flux of individuals representing designated agencies. Apart from the DG of DSCWM (chairman), NRSC representative (Secretariat), LRIM advisor and USAID representative, other agency representatives have attended the meeting only once.

Such an informal representatation is fully revealed in the proceedings of the Committee meetings whereby the members are uninformed about of remote sensing and thus fail to "advise" regarding the agenda. The minutes of the Advisory Committee meetings repeatedly record cases where the Committee members have admitted they do not know about the subject. This pattern of casual representation has not only hampered proper guidance to the NRSC's activities but has resulted in minimal feed-back to the representative departments. Therefore, while the idea of cooperative projects was agreed to in the third meeting (September 1983), there has

been little response from representative departments. There is also a general feeling that NRSC is a component of DSCWM within the Forest & Soil Conservation Ministry. This impression is reinforced by the nature of substantive NRSC projects presently pursued that generally caters to the priority of the parent department and ministry.

It is premature to conceive of NRSC and its Advisory Committee to function as an autonomous unit. But the present location within a sectoral ministry has hampered its direct linkage with other departments. It is therefore recommended that the Center be located under the National Planning Commission as an independant unit similar to the Central Bureau of Statistics and National Computer Center. The linkage of the NRSC with the central planning organization will not only facilitate better interaction with potential user departments, but remote sensing information will be directly utilized for programme formulation and evaluation at the national level. The Advisory Committee should be replaced by a Co-ordinating Committee composed of either representatives of Ministry planning cells or of departmental heads of user agencies and headed by one of the members of the National Planning Commission. The Co-ordinating Committee should not only recommend but also determine and evaluate the work plan of the center on a regular basis. There should also be a distinction between designated representatives and invitees/observers at the Co-ordinating Committee meetings. The meeting should be held regularly at quarterly intervals.

5.0 REMOTE SENSING, TECHNOLOGY TRANSFER AND FUTURE USAID ROLE IN NEPAL

While not specifically called for in the evaluation, the team has taken the liberty of including this section in the hopes of contributing to HMG/N and USAID understanding of the transfer of remote sensing technology. This section consists of two parts; first a discussion of remote sensing technology transfer and second a discussion of a possible future USAID roles in remote sensing in Nepal.

5.1 Remote Sensing and Technology Transfer

Remote sensing technology is considered the most advanced technology in which USAID is involved through transfer to developing countries. As such, USAID makes little or no pretense that the subject directly relates to poor beneficiaries who are the traditional target of USAID programs. Instead, remote sensing is only one data source among many that feed into information and analysis systems. These systems, in turn, feed into sectoral and then overall development planning activities. While improved data and information can effect decisions which concern large numbers of people, it is very nearly impossible to draw direct linkages between remote sensing and direct benefits to the general population.

The perceived "high-tech" nature of remote sensing also lends to it a prestige factor which may provide motivation for acquiring remote sensing technology which have little or nothing to do with development. This should alert both USAID and host governments to the fact that the transfer process may be driven more by the technology itself than by the need for information for development planning. As such, diffusion of information generated by the interpretation of remotely sensed data may be limited.

Another impediment to the application of remote sensing data by user agencies is that due to the perceived high-tech nature of remote sensing, the transfer process between USAID and host governments has normally be treated in a "topdown" fashion. In other words, it has been assumed that the establishment of remote sensing facilities would generate the user demand needed to justify the creation of the facilities in the first place. Unfortunately, this is rarely the case. In general, because the establishment of remote sensing facilities is not integral to users, the adoption and usage of remote sensing is not inherent in initial project design. The two phase character of USAID remote sensing projects has led to an underutilization of the technology by end users.

It should be clear that the team is very impressed with the overall progress which the NRSC has made over the course of the last three years in spite of problems with facilities, staffing up and lack of direction from the Advisory Committee. In addition, it seems that the institutional location of the Center has hindered its efforts to develop user linkages. The purpose of reviewing some of the peculiarities of transferring remote sensing technology to developing countries in this report is to encourage the NRSC to focus more fully on user applications, otherwise it will find that it will not accomplish its primary objectives. Steps must be taken in the remaining one and a half years of the project by the NRSC and HMG user agencies to ensure that stronger user linkages are developed. The Center has made excellent strides in the establishment phase -- now it must focus on the operational phase.

5.2 Future USAID Role in Remote Sensing in Nepal

In lieu of the above discussion, USAID, when contemplating its future role in remote sensing in Nepal, should consider the following points:

1. Remote sensing technology should not be considered exclusively as "high-tech." While the use of satellites and computers to process data is certainly high technology, most of the work going on in remote sensing in developing countries involves mapping and map making techniques which are not high-tech at all.
2. In project design, closer attention should be paid to assumptions. Within USAID's logical framework, several key assumptions should have been more closely examined. These involve the selection of HMG/N candidates for training and the inferred use of the data by HMG agencies once the data is available, and that such data will be automatically assimilated into project development and planning. These assumptions should have been treated as objectives.
3. USAID could have paid greater attention to the ARIP. (Our review of the implementation schedule in Appendix 4 indicates that several audits and reviews have not been done.) Because the transfer of remote sensing technology is outside of the normal purview of USAID projects, there is a tendency for USAID not to pursue that objective. This occurs because the projects by size do not demand great attention, a factor reinforced by the fact that the technology is not well understood. Particularly with a host country contract, however, many of the difficulties facing the establishment of a remote sensing facility are not technical, but are managerial.

4. In line with points 2 and 3 above, USAID could provide some management assistance from time to time to review and to evaluate the NRSC. It in no way suggests a lack of regard for the scientists involved at the Center to suggest that just as they have outside technical assistance, that occasional outside management assistance would also be useful.

5. USAID could have played a more effective role in helping the NRSC to establish links to user agencies and donors in Nepal. Through its "good offices", USAID might have been able to act more as a facilitator and could still certainly do so.

6. Project design can not be technology driven simply because the technology is perceived as "high." USAID should continue with its traditional analysis of backward and forward linkages and the institutional arrangements necessary for their effective functioning.

One must ask, however, that given the small size of the project, what justifies increased USAID attention? The answer is that the potential benefit from improved information for development planning effects development projects of all kinds. The potential benefits from building an information infrastructure are therefore enormous when weighed against the small costs. The team believes that Nepal's NRSC has the potential to be extremely useful. However, it may well require a continuing USAID role, albeit at a lower level of funding.

An interesting parallel can be drawn there between the current project and the Forest Resources Survey Project of the 1960's. This earlier project provided substantial amounts of then high technology equipment to the Ministry of Forestry in order to perform a forest

resources survey. However, once the survey was completed, the equipment and the trained manpower was no longer utilized. Today the equipment is literally a dusty relic. The team believes that the NRSC is a long way from this end, but never-the-less, a danger exists that the Center will not reach its full potential if USAID does not play a continuing role. This is not to say that USAID should be fully responsible for continued funding of the Center, but USAID should set an example for other donor agencies and continue to play an important role in the future of remote sensing in Nepal.

What follows are some suggestions as to areas in which continuing USAID support would be useful:

1. USAID could provide periodic technical assistance in areas that arise from time to time within the NRSC. Periodic reviews by technical and management personnel could be very useful to keeping the NRSC on track;
2. USAID has a number of resource related development projects in progress or upcoming in Nepal. Both the RCUP project and the RAD project (RAPTI-ZONE Project) have spent considerable time putting together baseline planning information. A relatively small amount of funds could be set aside for technical assistance projects to link the Remote Sensing Center to such projects. USAID projects would gain by planning and implementation on the basis of improved information and at the same time, would serve as an example to HMG user agencies and other donors.
3. USAID could facilitate linkages between other donor agencies and the NRSC not only by serving as an example to the donor community, but also by helping to coordinate the wide variety of

remote sensing activities in Nepal. In addition, USAID could help to make linkages between HMG agencies involved in USAID resource related projects and the NRSC.

4. USAID can continue to facilitate data acquisition from the Indian Landsat Receiving Station. While it would be most desirable for HMG to manage this data acquisition on its own, continued USAID assistance in this area will probably be necessary for the immediate future.

5. USAID could provide low level funding for the purchase of up-to-date Landsat data from both Thailand and India, as the cost of this data is increasing over time. At the same time there will be a need for funding of various minor pieces of equipment from time to time. These purchases could be part of the projects discussed in point 2 above.

These are just a few of the ways in which USAID could continue to contribute to the development of the Remote Sensing Center. The team believes that a small, on-going investment in the Center could enable Nepal to reap enormous benefits through improved information for development planning and policy making.

6.0 LIST OF PERSONS CONTACTED

Government and Agency Officials Met

By

EVALUATION TEAM

HMG:

1. M.M. Sainju, Vice-Chairman
   National Planning Commission

2. U.M. Malla, Member
   National Planning Commission

3. J.L. Maskey, Secretary
   Ministry of Forest & Soil Conservation

4. M.D. Joshi, Director-General
   Department of Soil Conservation & Watershed Management

5. M. Haque
   Chief, Conservator of Forest

6. M.N. Rana, Director-General
   Department of Geological Survey & Mines

7. Shiva Bahadur Pradhananga, Chief Engineer
   Department of Roads

8. T.N. Pant, Joint-Secretary
   Ministry of Food & Agriculture, Planning Division

9. Devi Prasad Chapagain, Executive Director
   National Computer Center

10. Uttar Bahadur Shrestha, Deputy
    Conservator of Forest

11. Ek Raj Sharma, Chief
    Forest Resources Survey
    Department of Forest

12. J.M. Tater, Deputy-Director
    Department of Geological Survey & Mines

13. K.B. Malla, Project Manager
    National Remote Sensing Center of Nepal

14. P.P. Oli, Deputy Director General
    Topographical Survey

15. M.L. Malla, Member
NRSC Advisory Committee
Department of Agriculture

16. K.D. Bhattarai, Member
NRSC Advisory Committee
Department of Geological Survey & Mines

17. R.P. Marhatta, Member
NRSC Advisory Committee
Topographical Survey Unit

USAID-NEPAL:

18. Dennis J. Brennan, Director

19. Janet C. Ballantyne, Deputy Director

20. George E. Lewis, Program Officer

21. Jack Huxtable, Project Officer, ARIP and RCUP

22. Charles T. Hash, Chief, Agriculture and Resource Conservation Division

23. Mr. Richard Nishihara, USAID Rapti Zone Project

24. Mr. Eugene Philhoure, USAID Rapti Zone Project

ERIM:

25. Donald S. Lowe, Vice President
Application Division

26. Thomas W. Wagner, Project Advisor
National Remote Sensing Center of Nepal

DONOR/USER AGENCIES:

27. Toshiyuki Newa, Resident Representative
UN Development Program

28. George Axinn, Representative
FAO

29. Grant Slade, Representative
World Bank

30. Alfred Frischknecht, Director
Swiss Association for Technical Asistance

31. Heinz-Peter Spanier
German Agency for Technical Co-peration (GTZ)

32. Peter Gueller, Regent
International Centre for Integrated Mountain Development

33. Laxman Lal Rajbhandari, Project Manager
Resource Conservation & Utilization Project

34. Jan Jansonius, Agronomist
UN-FAO Early Warning Program

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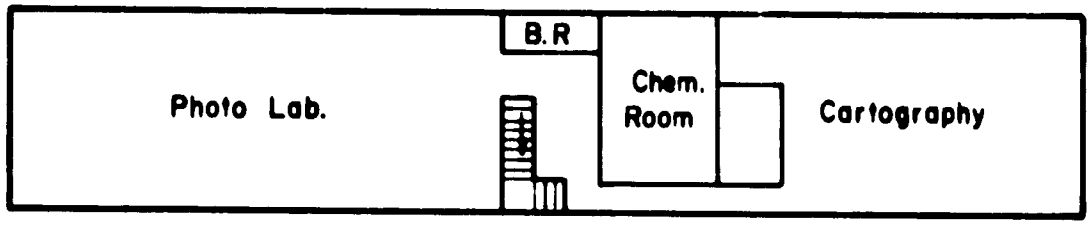
APPENDIX 1:

REMOTE SENSING WING

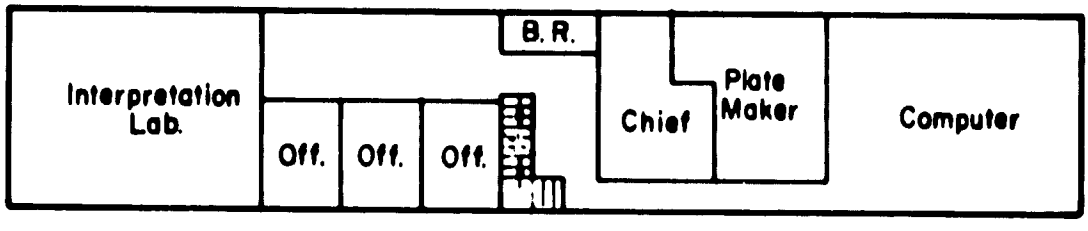
NATIONAL CONSERVATION BUILDING

BABAR MAHAL, KATHMANDU

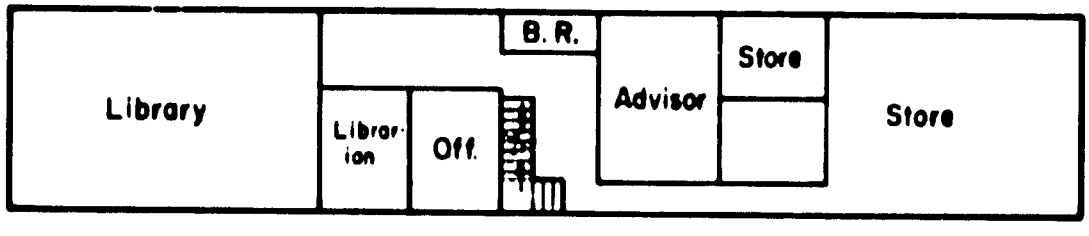
Remote Sensing Wing
National Conservation Building
Barbar Mahal, Kathmandu



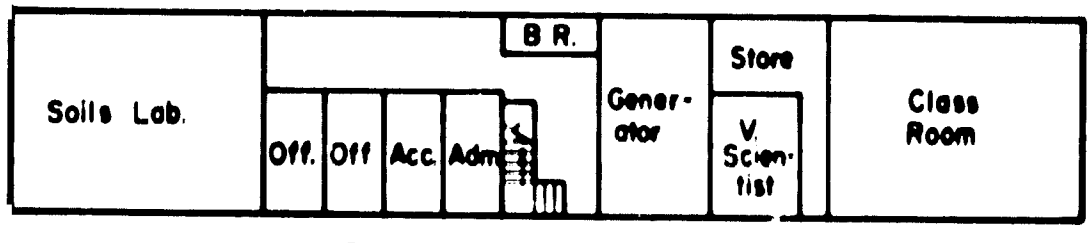
3rd Floor



2nd Floor



1st Floor



Ground Floor

APPENDIX 2:

EQUIPMENT LIST

NATIONAL REMOTE SENSING CENTER

EQUIPMENT LIST

NATIONAL REMOTE SENSING CENTER

00001	10001	12JUN 81		PROJECT CAR (HORIZON)		6605.00
00002	10002	22JUN 81		CAMERA,2BINOCS, 2PROJECTORS	GOOD	1673.82
00003	10003	23JUN 81		PHOTO SUPPLIES, BRACKET,IMAGES	GOOD	6462.31
00004	10004	14JUN 81		3AIRCOND,2FILES, PHOTOCOPIER	GOOD	8907.05
00005	10005	25MAY 81	PA026-33334921	70MM CAMERAS, STEREOSCOPE,LENSES		16194.00
00006	10006	21AUG 81	PA026-72279266	PHOTO/CARTO SUPPLIES,PENS	GOOD	3077.09
00007	10007	27MAR 81		TRANSFORMER		455.00
00008	10008	02SEP 81		ENLARGER STAND, DRYER,R.L-TABLE	GOOD	4407.00
00009	10001	JUN 81		5CALCULATORS, E-TYPEWTR,SPRS		3901.68
00010	10003	22JUN 81		2DOC-SHLVES,8MAP CASES		7312.80
00011	10011	01SEP 81		PHOTO EQUIP,PAPER, FILTERS	GOOD	1450.20
00012	10012	10OCT 81		M-READER,MIXER, CONT.PRINTER	GOOD	2683.87
00013	10012	12OCT 81		PHOTO EQ.,SUPPLIES	GOOD	1221.00
00014	10014	23OCT 81		2LEGAL FILES		695.75
00015	S					-0-
00016	S					-0-
00017	10017	29OCT 81		PHOTO EQ,IGNITION, D-PLANIMETER	GOOD	2512.97
00018	10018			12.5KB GENERATOR, BATTERY,PARTS	GOOD	9783.00
00019	10019	05DEC 81		COPY CAMERS,BASE, LENSES,SINK	GOOD	6582.21
00020	10020	08DEC 81		3STEEL SINKS & LEGS	GOOD	3118.00
00021	10021	06JAN 82		ENLARGER,RADIOMETER, DIAZO DEV.	GOOD	10662.71
00022	10022	15JAN 82	PA026-77845180	PHOTO EQ,L-TABLES, STATIONARY		1325.37
00023	10022	12APR 82		BLAZER SPARES,FIELD EQ., IMAGES	GOOD	9972.63
00024	10023	20APR 82		2TIRES,HAND-TOOLS, T-PRINTERS	GOOD	880.16
00025	10024	13MAY 82		3TIRES,PHOT & CATO SUPPLIES	GOOD	3932.19
00026	10026	10JUN 82		CARTO & PHOTO SUPPLIES		5623.70
00027	10027	15AUG 82		APPLE CP,2MONITORS, 2PRINTERS	GOOD	5393.00
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00029	10029	22AUG 82		REG-FRAME,TANKS, SAFELTS,PENPTS	GOOD	2714.71

00030	10030	13SEP 82		2STABILIZERS, 2PHONES, BATTERY		282.95
00031	10031	03OCT 82		SPAREPARTS, SOFTWARE	GOOD	2235.05
00032	10031	07OCT 82		PRINTING LAMPS & FRAME, PUNCH		5695.00
00033	10031	07OCT 82		PRINTING LAMPS & FRAME, PUNCH		5695.00
00034	10031	07OCT 82		PRINTING LAMPS 7 FRAME, PUNCH		5695.00
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00039	10036	20FEB 83		C-A-VIEWER, ATTMTS		29650.00
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00042	10038	05JUN 83		SUBURBAN SPARES		3050.24
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00045	10042	26JUN 83		HORIZON SPARES, LENSES, IMAGES		3471.87
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00047	10044	10AUG 83		FIELD EQ.CARTO SUPPLIES, BOOKS		9128.03
00048	10045	23OCT 83		PHOTO & OFFICE SUPPLIES		2229.66
00049	10046	07NOV 83		STEREOSCP, BATTERIES, MINICOURSE		12211.47
00050	10047	23NOV 83		B&W ENLARGER, Q-LAMPS, CARRIERS		2636.50
00051	S					-0-
00052	10049	05JAN 84	##618-50109614	SAT-GEOCEIVER, ANTENNA, SPARES - 26JAN 1984	GOOD	71380.00
00053	10050	29JAN 84		WAXER, ENLARGER LENSES, 10"PAPER		3357.86

APPENDIX 3:

CHECK LIST OF ADVISORY COMMITTEE MEETINGS

CHECK-LIST OF THE ADVISORY COMMITTEE MEETINGS ATTENDENCE

First ?	Second 22nd Nov. '82	Third 13th Sept. '83	Fourth 6th Jan. '84	Number In Attendance
1. DSCWM.	1. DG. DSCWM (Joshi)	1. DG. DSCWM (Joshi)	1. DG. DSCWM (Joshi)	3
2. Irrigation	2. Geology (Yadav)	Irrigation	2. Irrigation Hydrology (Amatya) Meteorology	2
3. Hydrology & Meteorology	3. Topographical Survey (Sharma)	2. Hydrology (Adhikary) Meteorology	3. Geology (Bhattarai)	2
4. Geological Survey	4. Agriculture (Malla)	3. Topographic Survey (Oli)	4. Roads (Poudyal)	1
5. Dept. of Roads	5. Manager NRSC(Malla)	4. Livestock (Shah)	5. Survey Dept. (Shrestha)	3
6. Dept. of Survey	6. ERIM Advisor (Wagner)	5. Livestock (Rajbhandary)	6. Topographic Survey(Karki)	3
7. Dept. of Agriculture	7. USAID (Huxtable)	6. NRSC (Mool)		2
8. NRSC Manager Commission	8. Planning Commission (Gorkhali)	7. ERIM Advisor (Wagner)	7. NRSC(Malla)	3
File not available at NRSC. The departments listed above are as specified in the Project Paper.		8. USAID (Regmi)	8. NRSC(Mool)	
			9. ERIM Advisor (Wagner)	3
			10. USAID (Huxtable)	3
It is assumed that the NRSC Manager was present at the first meeting.			11. ITS/TU (Rimal)	1
			12. WB/GTZ (Myers)	1
			13. Forest (Tuladhar)	1

TOPICS OF DISCUSSION AT THE ADVISORY COMMITTEE MEETINGS

Second 22nd Nov. '82	Third 13th Sept. '83	Fourth 6th Jan. '84
1. Terms of Reference	1. Product Costing	1. Asian Conference
2. Training Syllabus	2. Cooperative Projects	2. Regional Workshop
3. Reference to Mapping Committee	3. Training Evaluation	3. Training
4. Product Costing	4. SPOT team visit	4. Product Costing
5. Autonomy of the center	5. Newsletter	5. HMG/WB/GTZ Project
6. Training		6. SPOT Satellite
7. Marsyangdi Report		7. GIS & Mini-Computer

APPENDIX 4:

REVIEW OF IMPLEMENTATION SCHEDULE

REVIEW OF IMPLEMENTATION SCHEDULE

S. No.	Activities	Scheduled Date	Actual Date	Time Lapse
		D M Y	D M Y	D M Y
1.	Project approved by USAID/Nepal	03 08 79		
2.	Project Approved by HMG/N	12-01-79	07 79	
3.	USAID/Nepal authorizes Project	23 01 79		
4.	Agreement negotiated and Signed	24 01 80	24 01 80	
5.	Conditions Precedent to Grant Agreement are Satisfied	29 02 80		
6.	Project advertised	29 02 80	00 07 80	00 04 00
7.	PIO/T Signed	29 02 80		
8.	RFTP issued	15 03 80		
9.	Technical Proposals received	30 04 80	22 07 80	08 02 00
10.	Proposal evaluation	30 05 80	00 08 80	00 03 00
11.	Selection of Photographic Technician for Training	30 05 80		
12.	Potential contractor notified	15 06 80	00 09 80	15 02 00
13.	Negotiation (contractor-HMG/N) commence	30 06 80	07 12 80	00 05 00
14.	Selection of trainee for managerial skill and cartography	30 06 80	00 05 81	00 11 00
15.	Contract between HMG/N and contractor signed	03 07 80	18 12 80	12 04 00

S. No.	Activities	Scheduled Date	Actual Date	Time Lapse
		D M Y	D M Y	D M Y
16.	Full time advisor arrives	30 08 80	08 02 81	22 05 00
17.	RSC advisory committee named	30 09 80	21 12 82	07 02 02
18.	Initial designs for lab.	15 10 80	00 04 81	00 06 00
19.	Order equipment for laboratory	15 10 80	00 02 81	00 04 00
20.	Photographic Technician to U.S.	15 10 80		
21.	Selection of trainee for Earth Science (M.S.)	15 10 80		
22.	Establish link with Bangkok, India, NASA	15 10 80	00 09 82	00 11 00
23.	Training for Managerial skills	01 01 81		
24.	Training Cartographic Assistant and Librarian commence	01 01 81		
25.	U.S. training of Earth Scientist	01 01 81		
26.	Advisor conduct 1st Training Program	15 01 81	00 06 81	00 05 00
27.	Design information/ dissemination Program	15 01 81		
28.	Project place for site specific problems	30 01 81		
29.	Receive first Laboratory equipment	15 03 81	00 06 81	15 02 00
30.	Complete plans for 1st Training Program	30 04 81	00 07 81	00 03 00
31.	Preparation of training material	15 06 81	00 07 81	15 01 00

S. No.	Activities	Scheduled Date	Actual Date	Time Lapse
		D M Y	D M Y	D M Y
32.	Plans for cooperation with Bangkok, Hyderbad, NASA and other	30 06 81		
33.	Complete 1st Nepal Workshop	15 07 81	00 09 81	00 02 00
34.	Selection of 2 Earth Science trainees	15 07 81	00 03 83	
35.	Selection of Photo. Assistant trainee	15 07 81		
36.	Feedback on training to advisory committee	15 08 81		
37.	Advisory Committee recommendation on training needs	30 08 81		
38.	Arrangements with consultants for training assistance	30 09 81	00 09 81	
39.	U.S. training for 2(1) Earth Scientist	30 09 81	00 02 84	00 03 02
40.	Forest Project audit	30 10 81		
41.	Training of Photo-graphic Assistant	30 10 81		
42.	Second Year evaluation	01 12 81		
43.	Consultants assist on application and training	15 01 82	00 06 82	15 04 00
44.	Second Nepal Workshop	15 03 81	00 04 83	00 01 01
45.	Feedback to Advisoy Committee	30 04 82	00 05 83	00 01 01
46.	Recommendation on Application, Projects and Training	30 05 82		

S. No.	Activities	Scheduled Date	Actual Date	Time Lapse
		D M Y	D M Y	D M Y
47.	New application and up-date commence	01 06 82	00 05 83	00 11 00
48.	Initiate arrangements with consultants	01 06 82		
49.	Transfer of Centre to new building	01 07 82	00 04 84	00 09 01
50.	Update specific site project analysis	30 07 82		
51.	Consultants assist on applications and training	01 09 82	00 05 83	00 08 00
52.	Second Project Audit	30 10 82		
53.	3rd round of training and application work	15 12 82	00 04 84	00 04 01
54.	3rd year accomplishment and mid-term evaluation	30 12 82	23 03 84	07 03 01
55.	Feedback to Advisory Committee	30 01 83		
56.	Advisory Committee recommendations	30 02 83		
57.	New applications and up-date	01 03 83	00 07 84	00 04 01
58.	Training initiation with consultants	01 03 83	00 01 85	00 08 01
59.	Consultants assist on application & training	15 05 83	00 04 85	00 11 01
60.	Update specific site project problems	30 07 83	00 05 85	00 05 01
61.	4th round of training and application activities	15 08 83	00 02 85	00 06 01

S. No.	Activities	Scheduled Date	Actual Date	Time Lapse
		D M Y	D M Y	D M Y
62.	Complete 4th year and evaluation	30 09 83		
63.	Third project audit	30 10 83		
64.	Feedback to Advisory Committee	30 11 83		
65.	Advisory Committee recommendations	30 12 83		
66.	New applications and update	01 01 84		
67.	Training arrangements with consultants	01 01 84		
68.	Consultants assist in last round of application & training	15 05 84		
69.	Update specific site project problems	30 07 84		
70.	Last round on application and training	15 08 84		
71.	4th Project Audit	30 09 84		
72.	Final accomplishment and evaluation	30 10 84		

NOTE: Activities listed are according to Project Paper pp. 25-28.

ON THE COVER

A false-color composite Landsat image of central Nepal, collected in March, 1977, vividly portrays the great physical diversity that exists within this relatively small country.

In the north (top) is the Mountain Region, part of the Himalayan Range, marked by a series of north-south ridges flanking deep, narrow valleys. Where the slopes are too steep for cultivation there is dense forest, up to about 13,000 feet.

The most prominent feature of the Midlands is the Kathmandu Valley (on back cover). This semi-circular basin, covering 218 square miles, contains the kingdom's three largest towns, including the capital. The valley floor is 4,000 to 5,000 feet above sea level. The surrounding hills protect it on the north from the icy winter winds and on the south from the most extreme effects of the summer monsoons. With ample rainfall and an almost year-round growing season, the soil is intensely cultivated.

The Tarai Region consists mainly of a narrow belt of flat, alluvial land between the southerly Mahabaharat Lekh and Siwalik mountain ranges and the Indian border. The Tarai is crossed by numerous streams; during the annual monsoon they carry away tons of silt, sand, gravel, and huge boulders from the mountains.

The hues of the image convey a feeling for the vegetation that covers the terrain. The darker reds in mountainous areas and on the edge of the Tarai represent forest. The oranges in the Midlands are mixed forest and agriculture. The bright red in the Kathmandu Valley shows the winter wheat crop. The light tones in the Tarai are bare soil and stubble, while white in the mountains represents snow.

Two major river systems can be seen north of Kathmandu. On the left is the Trisuli, flowing in a westerly direction; on the right is the Sun Kopi, which flows to the southeast.