

6. Field activity

Field identification is one of the very significant tasks undertaken to ensure the accuracy of data obtained from unclear interpretation of aerial photos and images.

Field identification was carried out in the majority of Phase 2 area. It was also carried out several times for the cases of land use and geological/landform classification where the interpretation of satellite images are difficult.

6.1. Methodology

Field activity was carried out by hand GPS (single positioning accuracy of 15m) and the draft topographic map sheet on which the interpretation had been reflected, and the data was developed and updated on ArcView maps after the coordinates had been obtained. It has been confirmed that field data collection is an effective means to improve the accuracy of map information.

6.2. Equipment and Material

The following materials were used for the field activity.



1. Hand GPS
2. Draft topographic map sheet (ArcView Map)
3. Camera
4. Field survey Form

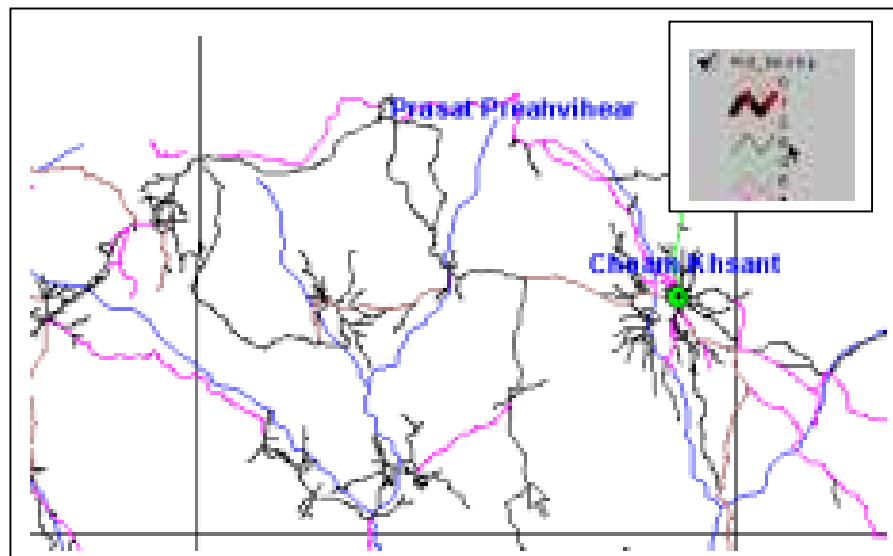


Figure 15: Dataset before the field activity

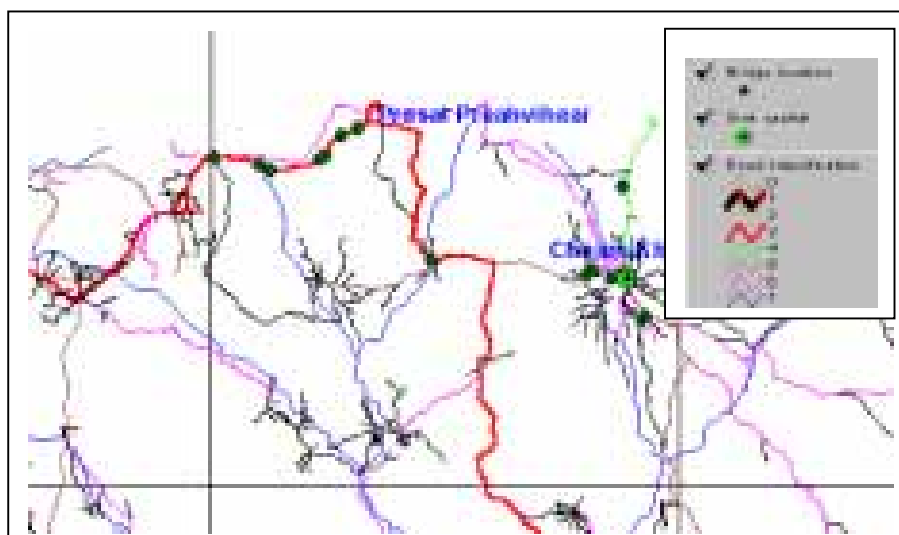


Figure 16: Corrected dataset after the field activity

7. Preparation Map at the scale of 1/500,000 for General use

Seamless GIS database coverage of the entire country was prepared at a scale of 1:500,000 for public use. The purpose is to distribute it to every school in the country. The work was carried out by the counterpart under the instruction of the

study team, by the map symbolization technique, which had been transferred by the team. One thousand copies of the maps (approximately four map sheets) were printed by local map printing house in Cambodia.

8. Web site development

The study team set up the Internet website (www.mpwt-gis.gov.kh) during the project to make the information available to public. The website seeks to promote the GIS data advertisement and distribution of Phase 1 through the Internet. Unfortunately, the data downloading system is not currently functioning due to a technical problem: The facilities of a local internet service provider did not have the capacity to handle volume of data to be downloaded. Therefore, an order form was presented within the site.

During the project, over two hundred visitors to the website were counted so far.



Figure 17: Web site

9. Workshops

Three workshops were held during the Phase 2.

The main objective of Workshop 1 (September 2001) was to familiarize the effective applications of the survey results of Phase 1 within the organizations of Cambodia by using the data operational manuals of ArcView.

At Workshop 2 (March 2002), the expanded applications of the database created by the survey results were presented. Also, a demonstration linking the GIS database with “Bridge Data Inventories” was presented.

At Workshop 3 (March 2003), hundred twenty participants attended including representatives of other concerned agencies. First, the Study team reported about all the progress and final products of Phase 2. Then, technical approaches were explained and several kinds of GIS application were introduced in this workshop. The team also made recommendations for the future plan of GIS activity in Cambodia.

Major participating Organizations are as follows;

- 1) Road Department, MPWT
- 2) National Geographic Department, Ministry of National Lands
- 3) Ministry of Environment
- 4) Ministry of Regional Development
- 5) Ministry of Forestry
- 6) Ministry of Agriculture
- 7) Cambodian Land Mine Center
- 8) Cambodian Mekong River Committee
- 9) Institute of Technology in Cambodia
- 10) Mekong River Committee
- 11) Ministry of Metal Industry
- 12) Airport Construction Department, MPWT
- 13) Harbor Department, MPWT
- 14) Maeda Construction Company
- 15) JAHDS (NGO for landmine extraction)
- 16) JICA Cambodia Office

10. Consultative Meeting

The first consultative meeting with MPWT was held on May 16, 2001 in which the discussion remained mainly concentrated on technical aspects of the inception report such as study area, use of map symbols, the land use and landform legends and specifications of the GIS database. Further discussion was held on distribution of the GIS data, the request of MPWT for on-the-job-training, the needed staff for photo interpretation, and the request for access to existing aerial photographs.

The second consultative meeting was held in September 2001 with main discussion on the concern of the request to transfer the project to NGD, which was lastly decided to invite its participation. Necessity of field activity for improved accuracy, and the problem of website construction were also discussed.

The third consultative meeting was held on November 25, 2001 where it was agreed to have NGD as a cooperative agency. The status of the interpretation of land use, landforms, and topography, the proposals on distribution of output of Phase 1, the problem of the website, upgrading of equipments, and insufficient number of aerial photo sets were also discussed.

In the Forth Consultation Meeting with MPWT so held in February 2003, the Study team mainly about the status of interpretation work and Aerial Photography, technical transfer, field works and request of MPWT.

In the Fifth Consultation Meeting, with MPWT in March 2003, the Study discussed about time schedule for the recommendation of Draft Final Report (DF/R), status of Aerial Photography, Workshop III, Final check of data on Cambodian side and Request of donation of the equipment.

11. Transfer of Technology

The Cambodian national GIS database comprising Topographic Maps, land use maps, geological and geology (landform) maps was completed as of the end of Phase 2. Results of the technical transfer made in Phase 1 and 2 are appraised stated below in Table 5.

Operation manuals of each process were prepared to ensure continued training of the personnel and that of the GIS related staff.

Table 5 Appraisal of Technical Transfer

Item	Status before Project	Status after Project	Necessary Technology for in near Future
1) Ground Control Survey	No practice	Because the GCPs were obtained from the old 1/50,000 maps, the overall technologies of ground survey could not be transferred, however point positioning GPS technology has been transferred. Also, the datum and coordinates system transformation has been transferred.	Ground control survey technique should be learned from other department in MPWT. GPS and leveling instruments is available in Inland water Department.
2) Aerial Photo Interpretation	UNDP has conducted technical transfer.	After the termination of UNDP's support, some photo interpreters moved to another ministries, however they were re-assigned to this project. Together with skillful interpreters, some proper interpreters of MPWT were trained. All of them had received advanced training during the project.	
3) Aerial Triangulation	No practice	No practice	Aerial Triangulation method should be obtained to cooperate with Geography Department in near future.
4) Field Verification	No practice	Technical skills to prepare skeleton maps by Arc View and field verification have been transferred.	Only logistic support is required
5) Image Analysis	No practice	As the results of introduction of image analysis technique and OJT, geometric correction and preparation of ortho-photo images could be conducted. Though MPWT has presently no 3D-analytical plotter, 2D-mapping by using ortho-photo images is now possible.	

6) Plotting	No practice	Digital data capture on geographic information is now possible by the ortho-photo using ArcView. Trained interpretation skills will contribute to such data capture.	No instrument is available in Cambodia but it must be introduced for the Data capturing by 3 dimensional photogrametric method in near future.
7) Map Compilation/ Symbolization	No practice	Technical transfer of map symbolization has been conducted using Adobe Illustrator software on OJT. The counterpart has prepared a general map at the scale 1/500,000, and this will be contributed to schools throughout the country.	
8) GIS Data generation	Digitizing technologies by using PC ArcInfo had been available.	Not only digitizing but also input techniques (by introducing ArcInfo 7.2 and ArcView 3.1) have been trained for: -digitizing without digitizing table -scanning -Raster/Vector conversion -topology structuring -data quality control	
9) GIS Data Analysis and Application	No practice	GIS data analysis and simulation technologies have been practiced and obtained. Applications of bridge inventories and distribution map of discharged soldiers were presented in Workshop	In MPWT, the use of GIS application has just started and its technical level is still at a basic. For the GIS solution of National Master plan, more efforts to learn and practice the advanced technology are necessary.
10) Facilities of Operation Room	Only space was available.	The following equipments were introduced: Hardware -Personal Computer 12 sets -Degitizer 2 set (A0) -Data server 1 set -Colore printer 1 set(A3) -Lazer printer 1 set (A3) -Scanner A4 1 set	JICA's study equipment introduced during Phase 1 greatly improved the geographical information compilation technique of MPWT, contributing to the technology transfer through OJT. However, the equipment is already four years old. Hardware needs to be updated urgently, since its working speed is slow and lacks in capacity. Software also required

		-Copy machine 1 set -Stereo scope 6 set -Generator 1 set -Furniture 1 set -Map Rocker 1 set Software -ArcInfo 7.1 1 license -ArcView3.1 5 licenses -Erdas Imagine 8.3 1 license -PC ArcInfo 5 licenses -Illustrator 8.0 2 license -Photoshop 5.0 1 license	upgrading as no maintenance has been done since Phase 1. Note that PC ArcInfo is no longer manufactured due to change in development concept of the vendor (ESRI). An urgent conversion into ArcGIS is needed. Hardware -Personal computer Pentium III to latest Software -Arc/Info 7.1 to ArcGIS 8.1 -ArcView 3.1 to ArcGIS 8.1 -Erdas Imagine 8.3 to Erdas Imagine 8.5 -PC Arc/Info to ArcGIS 8.1 -Illustrator 8.0 to Illustrator 9.0 -Photoshop 5.0 to Photoshop 6.5
11) Human Resources	Not available	Management 1 person -GIS specialist 2 person -GIS technician 3 person -Interpreter 3 person -Map editor 3 person (Illustrator) -Image analyst 1 person -System engineer 1 person	Trained staff should be secured permanently through the institutional enhancement in MPWT

11.1. Annex of Report

Operation manuals were prepared for each item for MPWT staff as a ANNEX in this report. ANNEX is included Map symbol and its application rule, GIS data definition and Field report. ANNEX are as follows:

- (1) Annex I.....MAP SYMBOL
- (2) Annex II.....DATABASE SCHEMA DEFINITION
- (3) Annex III.....ArcView OPERATION MANUAL
- (4) Annex IV.....ERDAS MNUAL
- (5) Annex V.....RASTER VECTOR CONVERSION
- (6) Annex VI.....MAP SYMBOLIZATION
- (7) Annex VII.....LAND USE INTERPRETATION KEY
- (8) Annex VIII.....FIELD IDENTIFICATION REPORT

11.2. GIS Application

During the study period from 1996 to 2003, several tentative applications were tried to developed as an advanced use of GIS based on the compiled data.

11.2.1. Selection of Agricultural Land (Phase1)

Applications were tested to select the land suitable for agricultural development in the unexploited land in the province of Battambang. Potential for land development was studied using the overlay method on topographic data, land use data, geological data and minefield data.

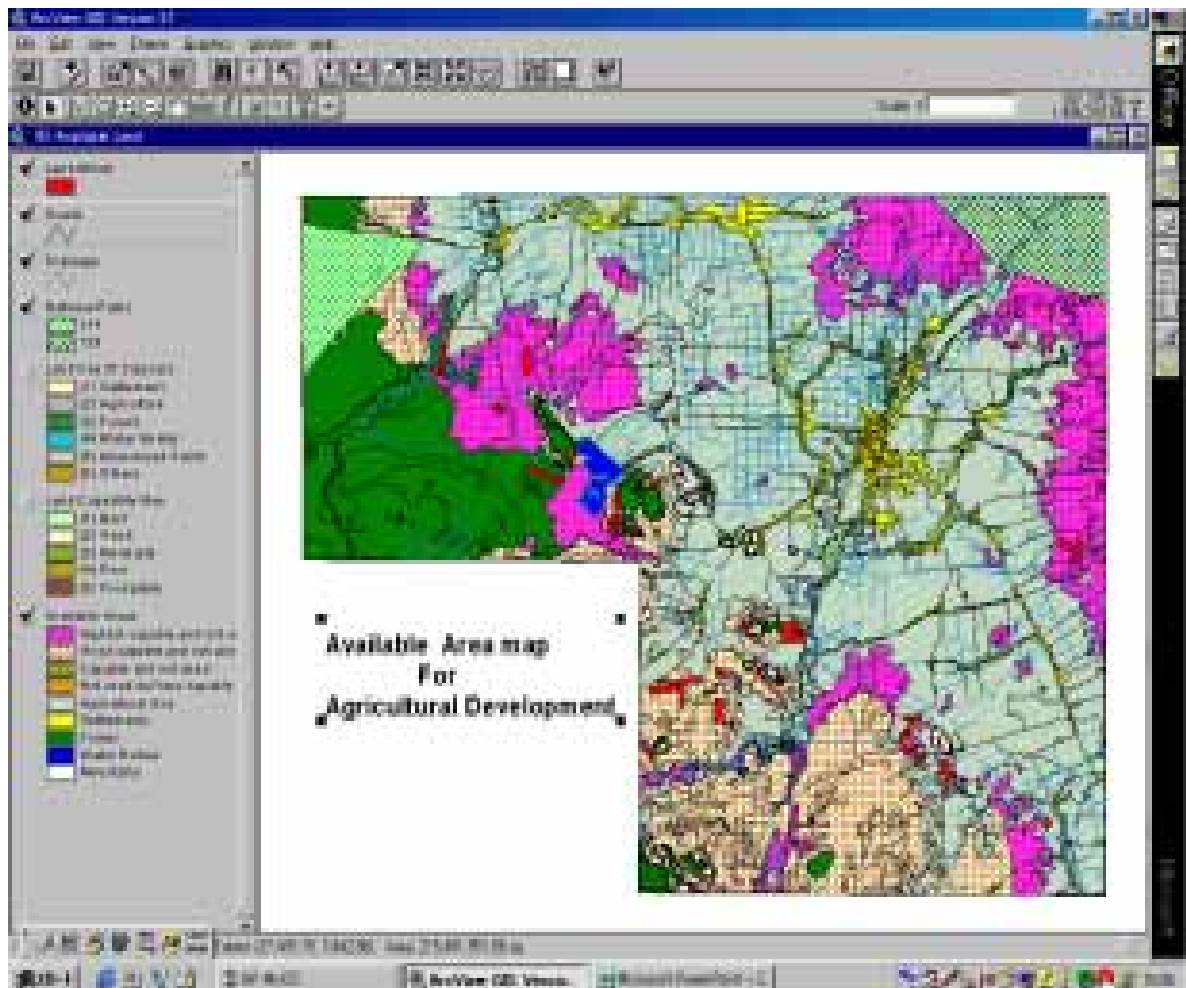


Figure18 Application for selection of land for agricultural development

11.2.2. Selection of New National Route 5 (Phase1)

National Route 5 is severely damaged by the flood every year, requiring constant reparation. Through the analysis of river system and geological data, this application aims at selecting new route, free from damages of flood.

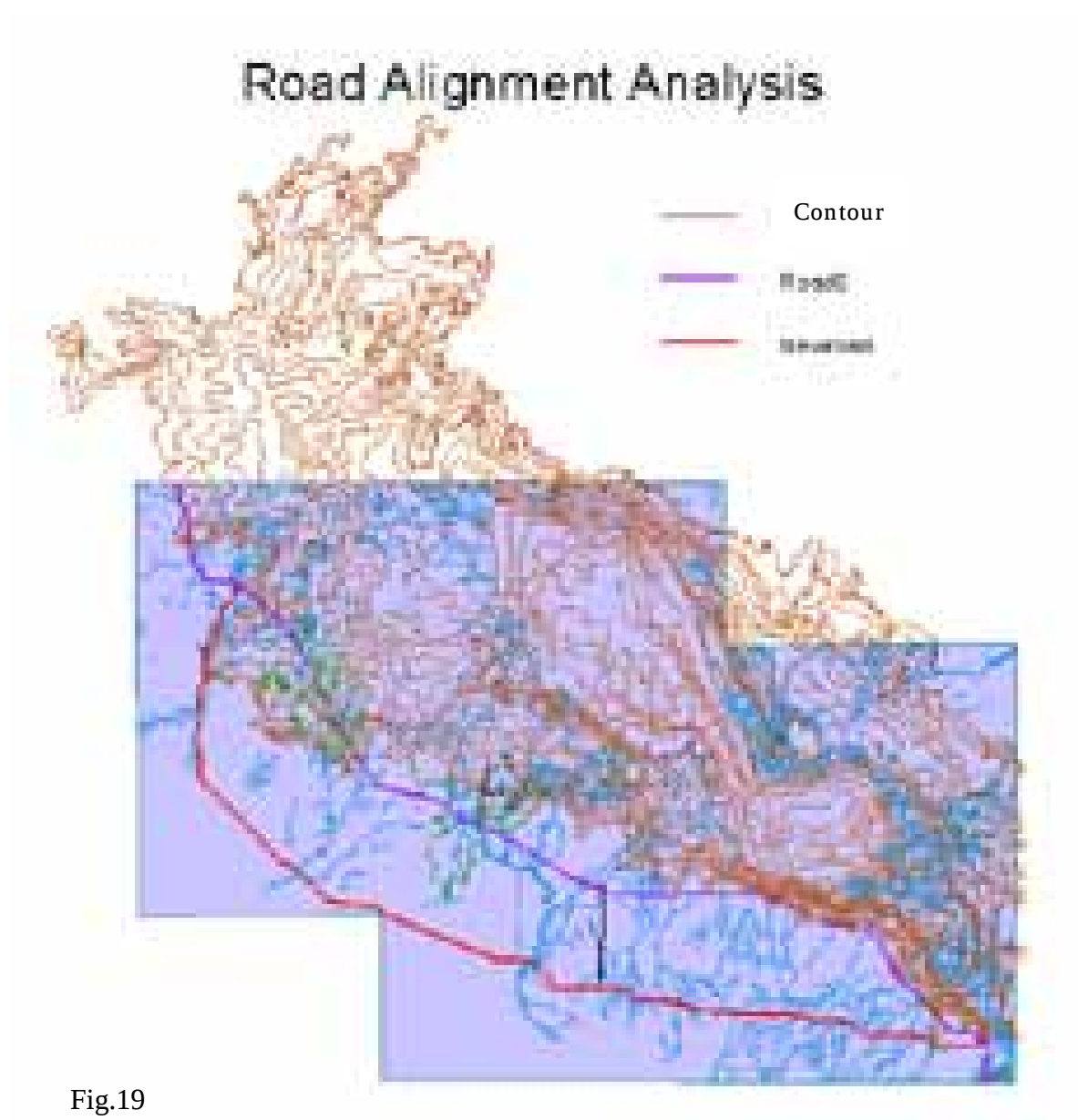


Fig.19

Fig.19 Application for route selection

11.2.3. Bridge Inventory (Phase2)

In order to prepare the bridge inventory currently sought for by MPWT, an application linked with map information was tested. This demonstration was presented at Workshop 2.

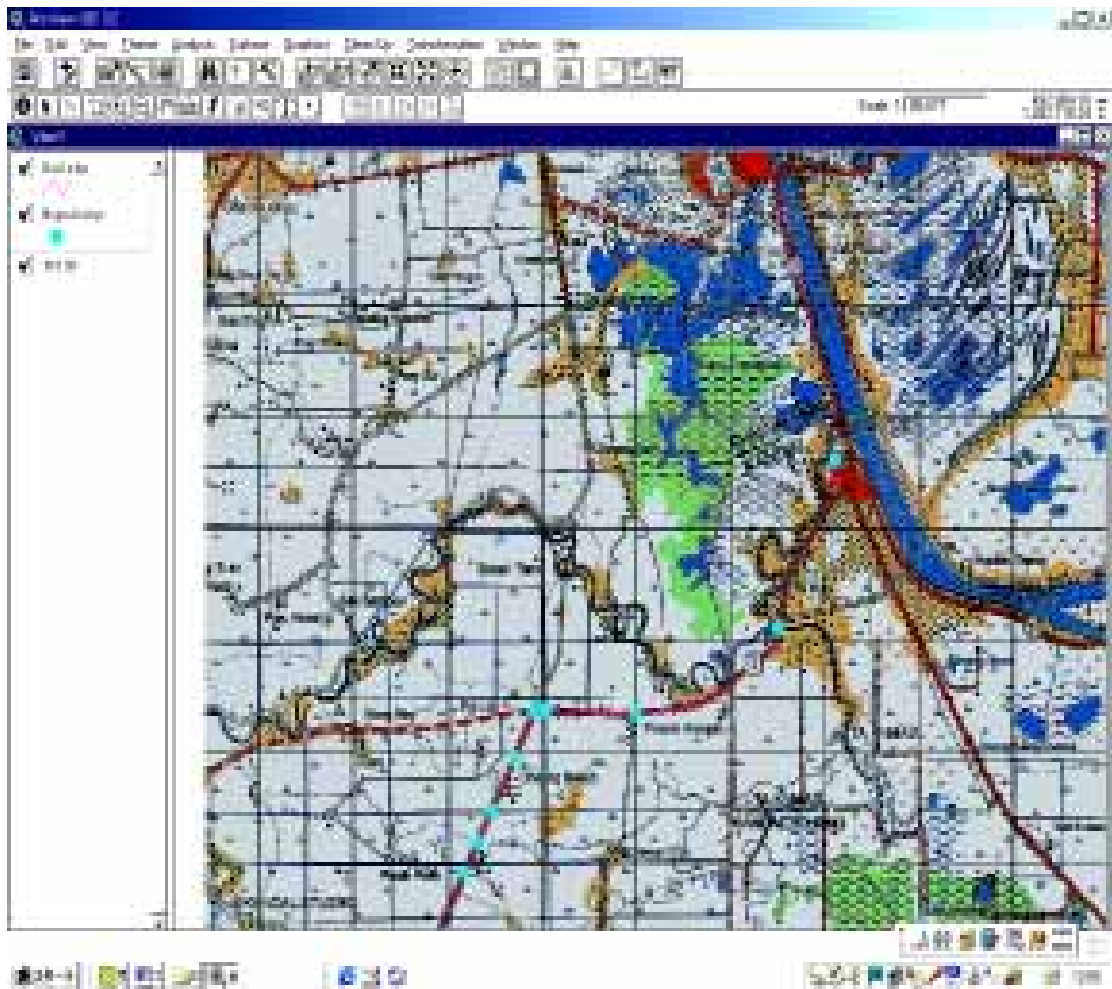


Fig.20 Bridge inventory

11.2.4. Distribution Map of discharged soldiers

This application was created upon request of the Indochina section of JICA as necessary information for social rehabilitation of discharged Por Pot soldiers. It shows the distribution of discharged soldiers in the state of Kampong Cham on a communal level.

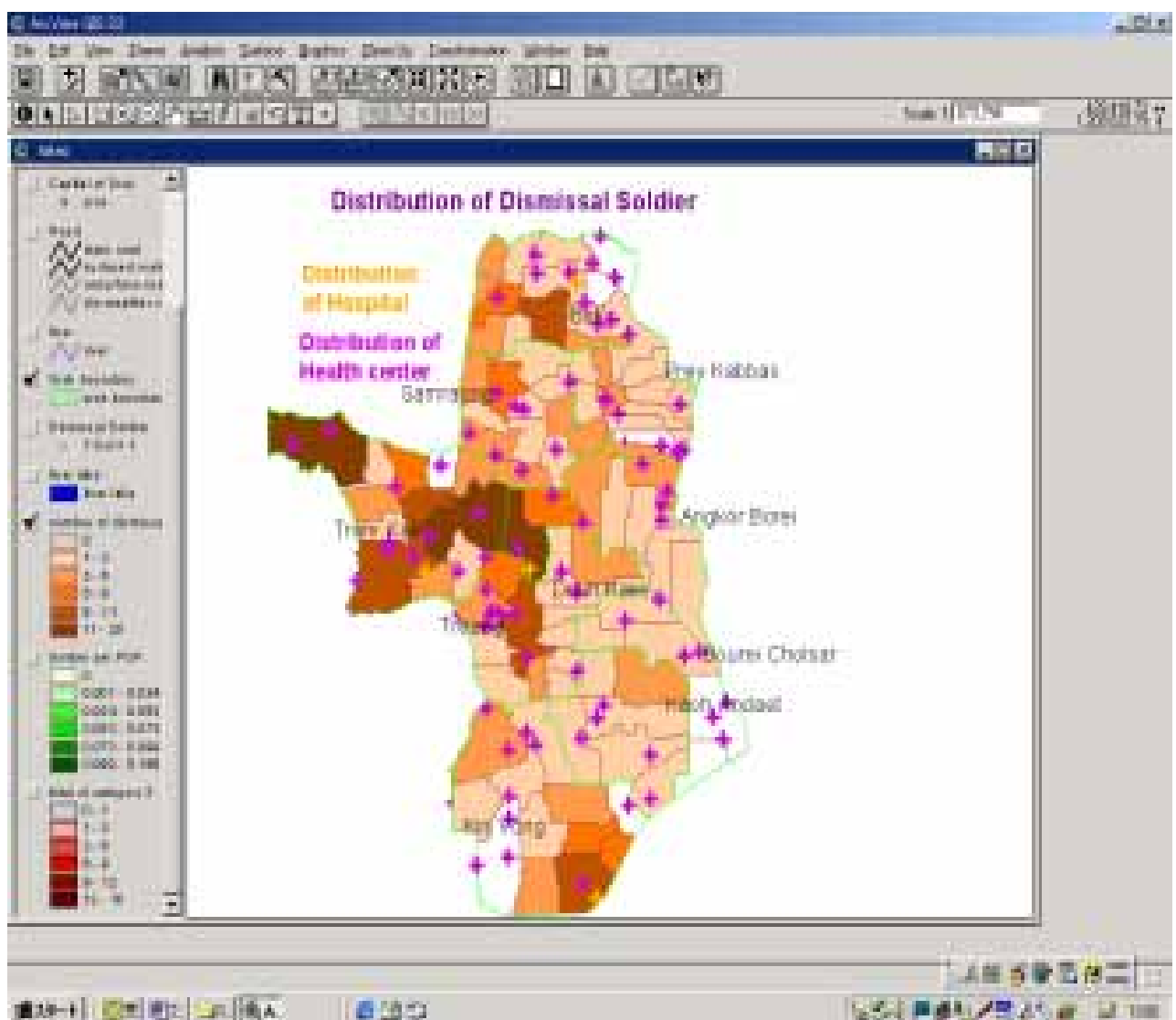


Fig.21 Distribution of discharged soldiers

11.2.5. Land Use Change (1992/93-1996)

This application tried to show the change in land use in Chamkar Leu district, Kampong Cham Province during the period of 1992/93-1996. This was presented in workshop 3 of Phase 2.

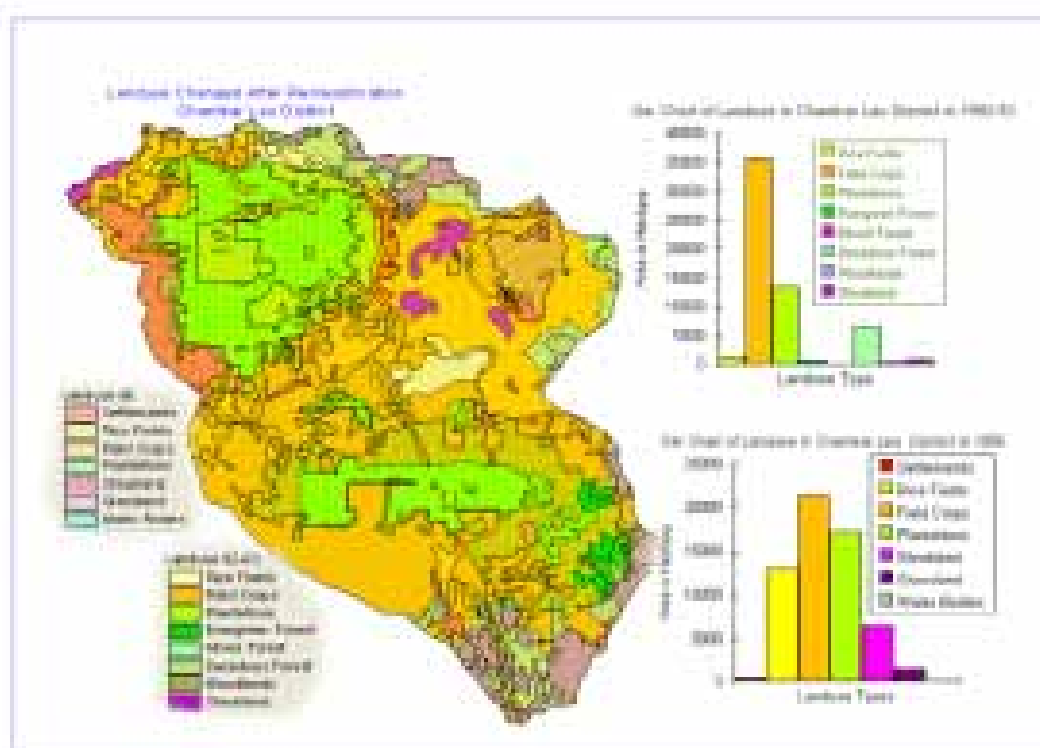


Figure 22: Land Use Change Map (1992/93-1996)

11.2.6. Communes with Hungry People Affecting the Protected Areas.

This application was developed to show food insufficient communes where people might be affecting the protected area in Cambodia. Photos indicate the Problem due to hungry people. This application was presented in workshop 3 of Phase 2.

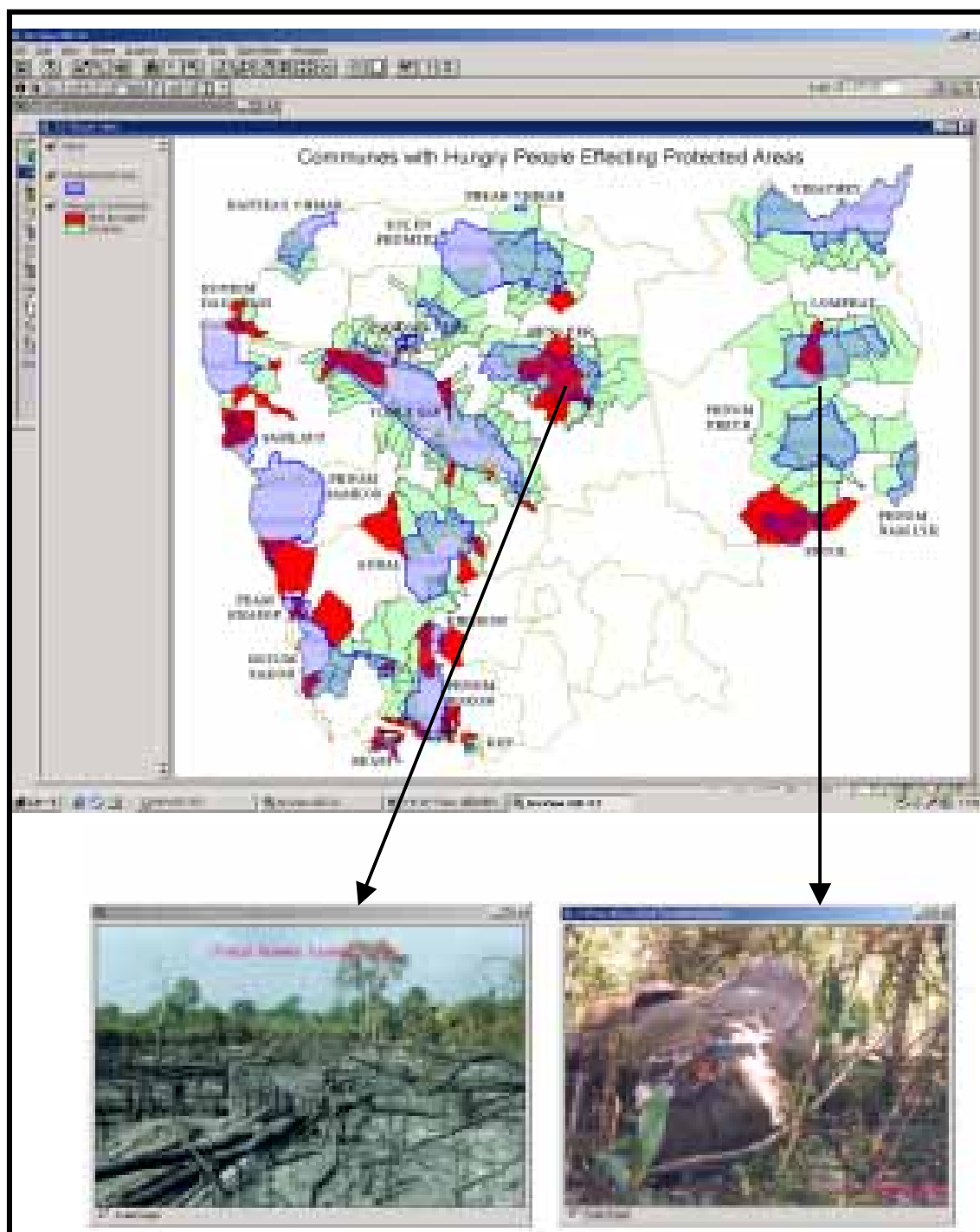


Figure 23: Communes with Hungry People Affecting the Protected Areas