

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF AGRICULTURE AND FOOD SECURITY (MAFS)

No.

THE STUDY
ON
THE NATIONAL IRRIGATION MASTER PLAN
IN
THE UNITED REPUBLIC OF TANZANIA

Operation Manual

for

Simple Database and Information System



December 2004

NIPPON KOEI CO., LTD.
NIPPON GIKEN INC.

RD

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1. Introduction



Operation of Irrigation GIS in the Data and Information Management Unit

THE STUDY
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**Operation Manual
for
Simple Database and Information System**

1 Introduction

(1) Authority

This operation manual has been prepared as a product of the Verification Study stipulated in the Scope of Work for the Study agreed between the Ministry of Agriculture and Food Security, the United Republic of Tanzania (MAFS) and the Japan International Cooperation Agency (JICA) on April 10, 2001.

(2) Background and Objective of Establishment of Database System

(a) Background

In the Master Plan and Action Plan Studies, lots of data, reports and topographic maps necessary for irrigation development have been collected. The results of the inventory survey are an important collection of data. It is expected that those data will continue to be accumulated and will be fully utilized for irrigation development. If systematically kept in one place and made easily retrievable, these data will be extremely valuable for planning irrigation development by DITS of MAFS and District Offices.

Currently, development of most irrigation schemes is in the hands of the District Offices in line with the decentralization policy. Even under this situation, DITS of MAFS should take control of ensuring that irrigation development in the country progresses on schedule. This means the need for timely exchange of collected data on irrigation development between DITS and District Offices. The data also need to be stored in the same place and to be available for ready access by DITS of MAFS at any time.

The database system has the functions mentioned above and is, therefore, extremely helpful for the management of irrigation development by not only DITS of MAFS but also District Offices.

(b) Objective

The objective of the database system to be established is to manage data and information necessary for irrigation development through the establishment of a computerized storage and retrieval system at DITS of MAFS.

(3) Objective and Composition of this Operation Manual

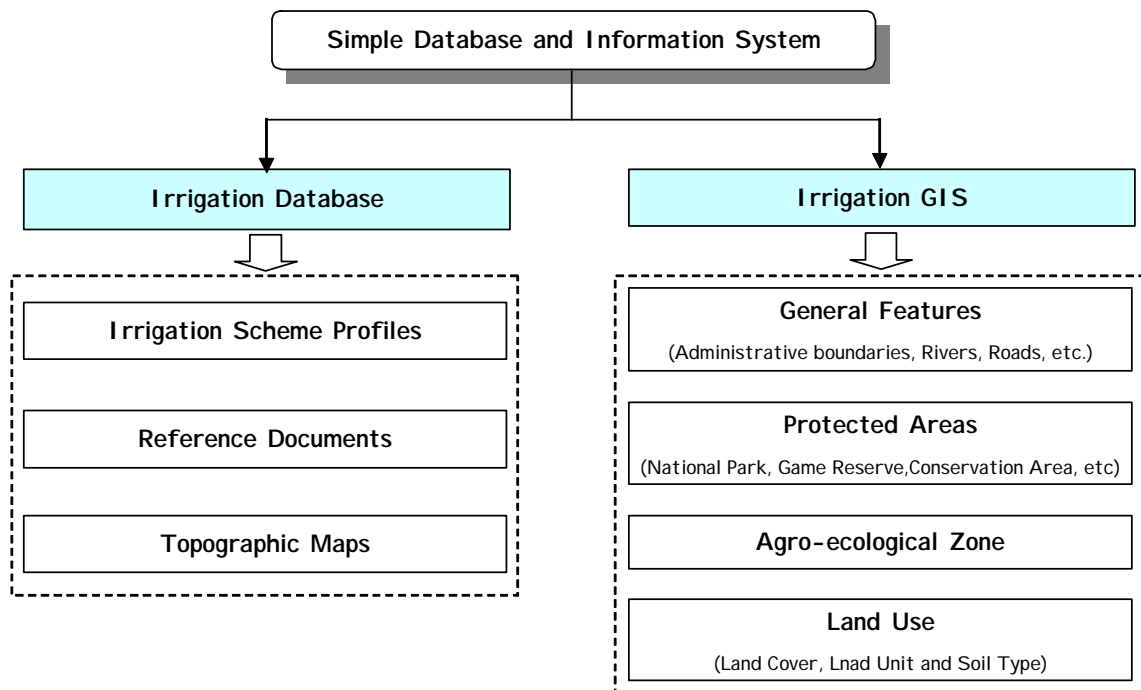
(a) Objective

The objective of this operation manual is to fully describe how to use the database and information system.

(b) Composition

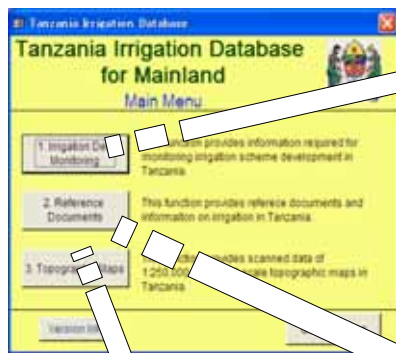
The Operation Manual consists of two parts: (a) Irrigation Database and (b) Irrigation GIS. The Irrigation Database is divided into three functions: Irrigation Scheme Profiles, Reference Documents and Topographic Maps. The Irrigation GIS is divided into four functions: General Features, Protected Areas, Agro-ecological Zones and Land Use (see Figure below). The operation of each function is explained in the following sections.

Composition of Simple Database and Information System



2. Irrigation Database

Main Menu



Result of Preliminary Planning
Scheme Digest as of 2006 Feb 11

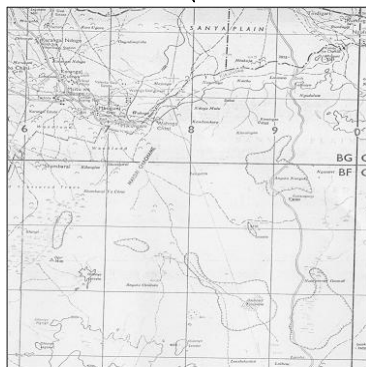
1. Name of the Scheme: Typ 1
2.1 Location: Latitude South: 00 deg. 16.33 min Longitude East: 29 deg. 18.01 min

3. Administration
Zone: Morogoro Zone Irrigation Office
Region: Coastal Region
District: Bagamoyo District
Ward: Ward 1, Ward 2
Village: Village 1, Village 2, Village 3

4. Present Condition
(1) Beneficial Irrigation: 00 (Beneficiaries: 00)
(2) Irrigation Association: 0
(3) Name: 0
(4) Established Year: 1900 (5) Registered Year: 1900 (6) Number of Members: 00
(7) Water Right: Granted Not granted yet
(8) Agriculture
(a) Total Cultivated Area: 00 (ha)
(b) Area under Planted: 00 (ha) (c) Area under Irrigation: 00 (ha)
(9) Water Source: River (10) Water Irrigation: Irrigation
(11) Average Inlet Depth: 3.3 (12) 1.5 (13) 2.0
(14) Channel Area (ha): 40.0 (15) 0.0 (16) 0.0
(17) Agricultural Benefit: 0,000,000 (TZS)

5. Development Plan
(1) Required Work: Rehabilitation Improvement New Development
(2) Water Resource: Perennial River Seasonal River Lake
 Groundwater Spring Main for water harvesting (systemal head)
(3) Irrigation Type: Gravity Pump Plan water harvesting

Irrigation Development Monitoring



Topographic Maps

Result of Documents and Information Searching

Ref Number	Library Title	Publisher	Year	Month	No. of Page	Type	Comments about
W - Pol- 001	Mwanga wa Mwanzi wa Waka 2000 (Mwanga wa Waka 2000)	Wananchi wa Tume ya Mwanga (Tume ya Waka)	2000	Jun	78	Copy	Whole Nation
W - Pol- 002	A Framework for a National Policy and the roles and social implications of Water Irrigation Development Programme in Tanzania	Mwanga wa Waka	1995	Oct	92	Copy	Whole Nation
W - Pol- 003	Regional Irrigation Development Strategy Draft Final Report Draft 1 Main report	Asil Australia Pty. Ltd. in association Shree Mountain Engineering Co.	1993	Mar	110	Copy	Wakanda
W - Pol- 004	Regional Irrigation Development Strategy Draft Final Report Draft Country Report Tanzania	Asil Australia Pty. Ltd. in association Shree Mountain Engineering Co.	1993	Mar	100	Copy	Whole Nation
W - Pol- 005	UNEP, Tanzania Development Co-operation Report 1999	Ru & Road Development	1999	Jun	173	Original	Whole Nation
W - Pol- 006	The National Poverty Eradication Strategy	Vice President's Office	1990	Jun	56	Original	Wakanda
W - Pol- 007	National Irrigation Development Plan, First Draft, Annex	ISD Team	1994	Jun	190	Copy	Wakanda
W - Pol- 008	First Progress Report on Tanzania Water Poverty	Poverty Reduction Strategy	2002	Jan	40	Copy	Wakanda
W - Pol- 009	A world Bank Country Study	The World Bank/Washington D.C	1994	Dec	200	Copy	Whole Nation
W - Pol- 010	Rubaya Irrigation and Drainage Plan for the S. J. Valley (April 2002/5, 2011/12)		2002	May	50	Copy	Wakanda

Reference Documents

Image of the Irrigation Database

2 Irrigation Database

(1) General

(a) Purpose of Database Development

There are numerous existing and proposed irrigation schemes in Tanzania. It is difficult for the government to manage the large amount of data and information on irrigation schemes. To facilitate smooth data and information management for irrigation development, the "Irrigation Database" was established.

(b) Basic Concept of Database Development

The database was prepared based on the following basic concept:

- i) To contribute to easier future maintenance, the database should be prepared using the most popular database software in Tanzania, which is "Microsoft Access".
- ii) To accommodate database operation by people with little knowledge about Microsoft Access, the database should be operated by 'user friendly' operation panels.

(c) Functions of the Database

The database has three major functions, which are:

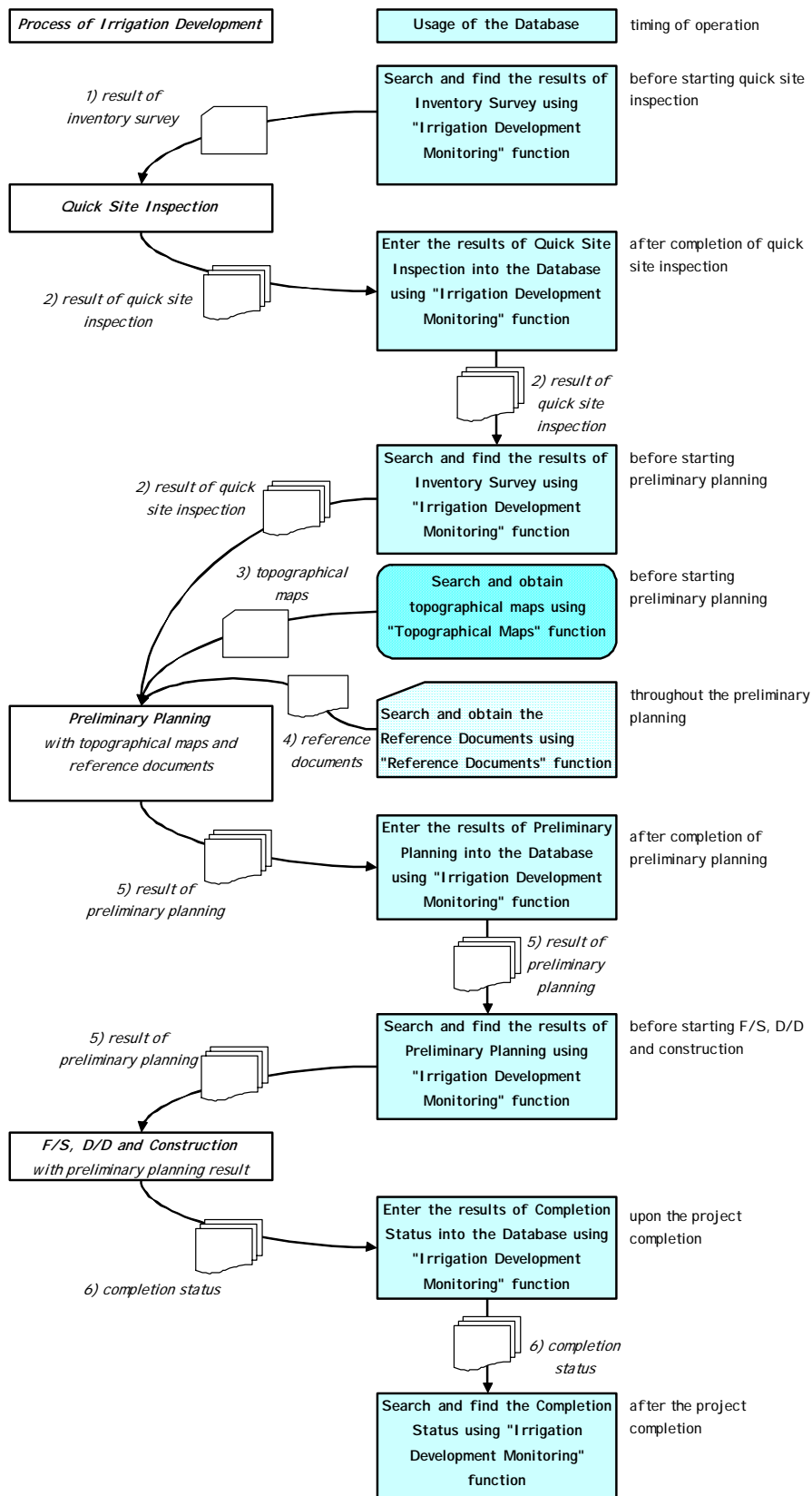
- i) "Irrigation development monitoring" function to search and browse irrigation scheme development status,
- ii) "Reference documents" function to search and find reference documents for irrigation development, and
- iii) "Topographic maps" function to search and obtain electronic topographic maps.

(d) Combination Usage with Irrigation GIS

In general, "Irrigation Database" provides numerical and text data on irrigation schemes. On the other hand, "Irrigation GIS" supplies geographical data. It is desirable for the user to obtain both types of data using "Database" and "GIS" in combination.

(e) Effective Usage of the Database

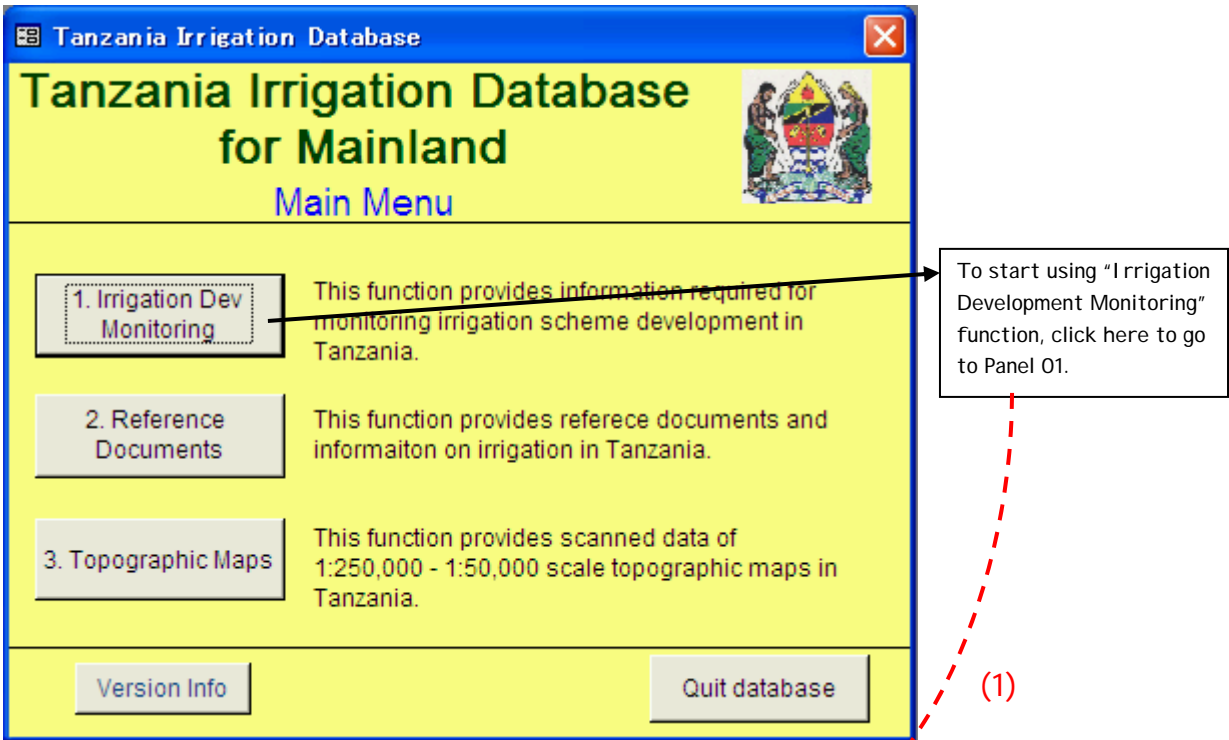
The database should be used at all stages of irrigation development, to confirm past study results, and to obtain related information for any reason. The effective usage of database in the respective stages of irrigation development is illustrated in next page.



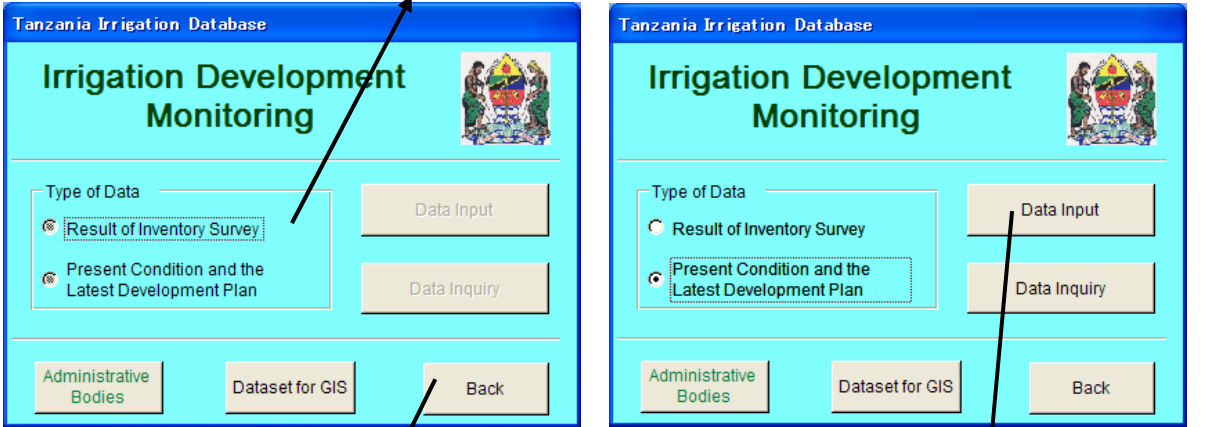
(2) Irrigation Development Monitoring

Data Input (p.2-3 to p.2-7)

Panel 00 Main Menu (will appear as soon as the database is executed)



Panel 01 First, choose one of the data types



Click here if you want to go back to Panel 00.

After choosing "Result of Inventory Survey", 'Data Inquiry' command button comes to be active. If you choose "Present Condition and Latest Development Plan", both of 'Data Input' and 'Data Inquiry' command buttons are activated.

To start data input, click here to go to Panel 01-01.

Panel 01-01

The screenshot shows the 'Irrigation Development Monitoring' interface for '1. General Information'. The form includes the following sections and fields:

- (1) Name of the Scheme:** A text input field containing 'Msambanyamani' and a 'Choose Scheme for Data Revision' button.
- Development Stage:** A group of radio buttons with options: Village Plan (checked), DADP, F/S, D/D, Construction, and Completion.
- (2) Location:** Fields for 'Latitude South' (07 deg, 23.137 min) and 'Longitude East' (39 deg, 18.215 min).
- (3) Administration:** A series of dropdown menus for 'Zone' (Morogoro Zonal Irrigation Office), 'Region' (Coast), and 'District' (Mkuranga), followed by text input fields for 'Ward' and 'Village (s)'.
- (4) No. of Household:** A text input field containing '0'.

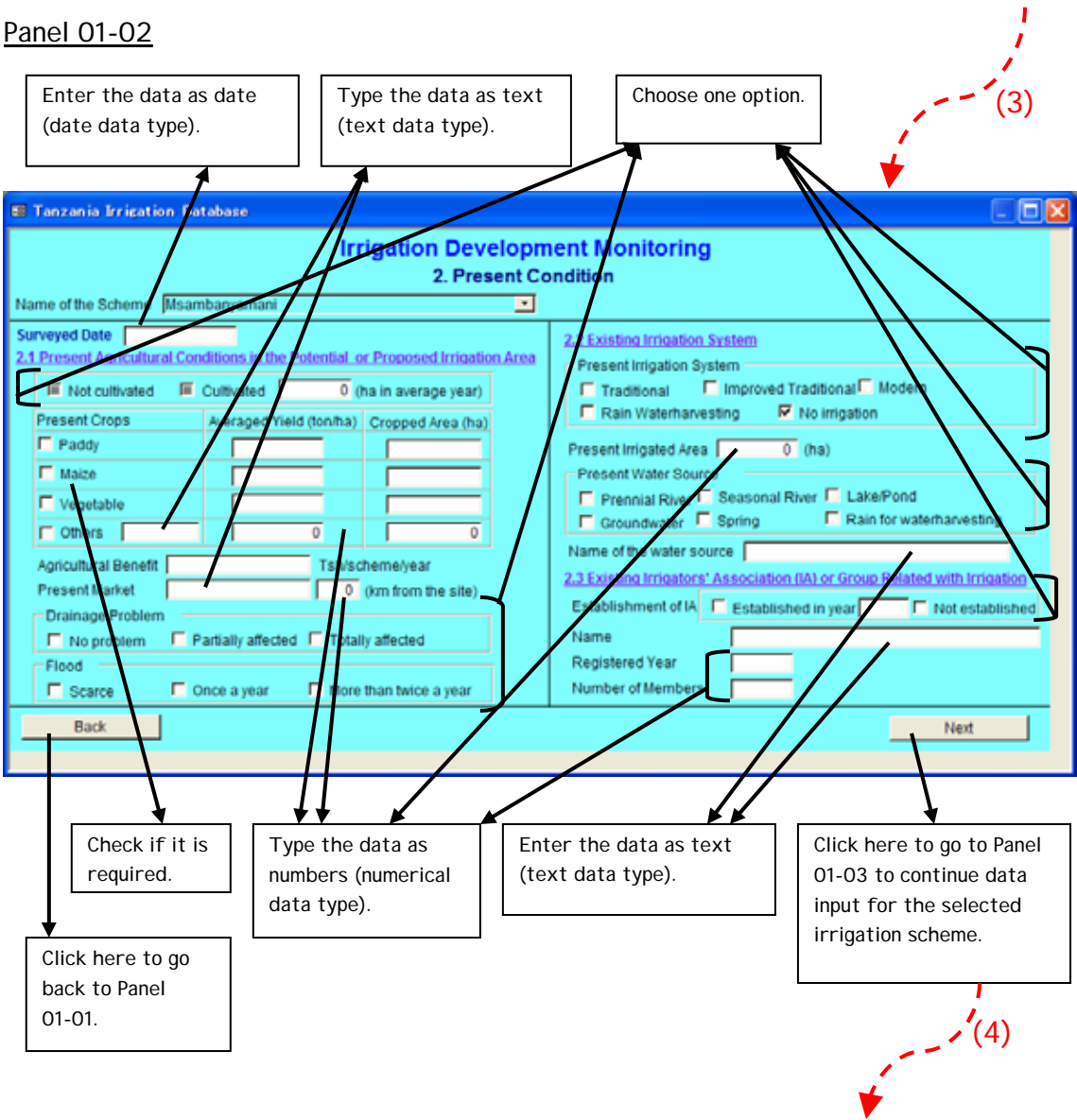
Navigation and control elements at the bottom include a 'Back' button, a 'Continue Input for Selected Scheme' button, and a record navigation bar showing 'Record: 1 of 8' with arrows for navigation.

Callout boxes provide the following instructions:

- 'Choose one of the options.' (points to the Development Stage radio buttons)
- 'Type the data as text (text data type).' (points to the Name of the Scheme field)
- 'Enter the data as numbers (numerical data type).' (points to the Latitude and Longitude fields)
- 'Click here and choose one of the options from the drop down list.' (points to the Zone dropdown)
- 'Type the data as text (text data type).' (points to the Ward and Village (s) fields)
- 'Click here to go to next record.' (points to the right arrow in the record bar)
- 'Click here to jump to the last record.' (points to the right arrow with a double bar in the record bar)
- 'Click here to enter the data for a new record (scheme) of preliminary planning result. Please make sure that the new record has not already been entered.' (points to the 'Continue Input for Selected Scheme' button)
- 'Click here to go back to Panel 01.' (points to the 'Back' button)
- 'Click here to go back to previous record.' (points to the left arrow in the record bar)
- 'Click here and press "Delete" key to delete the record. (Be careful to operate this function since the data is not retrieval once it is deleted)!' (points to the 'Delete' icon in the record bar)
- 'Click here to go to Panel 01-02 to continue data input for the selected irrigation scheme.' (points to the 'Continue Input for Selected Scheme' button)

Red dashed arrows labeled (2) and (3) indicate the flow from the form to the next panels.

Panel 01-02



Panel 01-03

Enter the data as date (date data type, "dd/mm/yyyy").

Choose one.

Enter the data as number (numerical data type).

Type the data as text (text data type).

(4)

Click here to go back to Panel 01-02.

Check if it is required.

Enter the data as numbers (numerical data type).

Check if it is required.

Enter the data as numbers (numerical data type).

Choose one.

(End of the operation)

Special Consideration on Data Input

1. Necessity to Confirm Present Irrigated Area

The present condition screen shows the status of irrigation development. If the present irrigated area is smaller than the development area, the reason should be confirmed. The probable reasons are:

- The scheme is being developed by stage (phase) wise.
- Development is incomplete due to some reason.
- The scheme was once fully developed but some areas abandoned for some reason.

2. Careful Input for Scheme Area.

The scheme might have been split to several schemes in the process of scheme formulation. Data on those schemes should be input carefully to ensure consistency on total potential area.

Example-1

A scheme is split into B and C scheme and the names changed.

(in this case data on A scheme should be deleted and B and C scheme should be newly registered)

Quick inspection stage	A scheme	village plan	300 ha
Preliminary planning stage	B scheme	DADP	50 ha (applied for DADP)
	C scheme	village plan	250 ha (not applied)

(C scheme area still has potential to be developed)

Example-2

Area of A scheme was decreased but remaining area still has potential.

(in this case area of A scheme should be revised and newly register B scheme)

Quick inspection stage	A scheme	village plan	300 ha
Preliminary planning stage	A scheme	DADP	50 ha (applied for DADP)
	B scheme	village plan	250 ha (not applied)

(B scheme area still has potential to be developed)

Example-3

Area of A scheme was decreased and remaining area is not going to be developed.

(in this case area of A scheme should be simply revised)

Quick inspection stage	A scheme	village plan	300 ha
Preliminary planning stage	A scheme	DADP	50 ha (applied for DADP)

(remaining area is not going to be developed)

Data Editing (p.2-8 to p.2-12)

Panel 00 Main Menu (will appear as soon as the database is executed)

1. Irrigation Dev Monitoring This function provides information required for monitoring irrigation scheme development in Tanzania.

2. Reference Documents This function provides referece documents and informaiton on irrigation in Tanzania.

3. Topographic Maps This function provides scanned data of 1:250,000 - 1:50,000 scale topographic maps in Tanzania.

Version Info Quit database

To start using "Irrigation Development Monitoring" function, click here to go to Panel 01.

First, choose one of the data types

Panel 01

Irrigation Development Monitoring

Type of Data

Result of Inventory Survey Data Input

Present Condition and the Latest Development Plan Data Inquiry

Administrative Bodies Dataset for GIS Back

Click here if you want to go back to Panel 00.

After choosing inventory survey stage, Data Inquiry command button becomes active. In case of choosing "Present Condition and the Latest Development Plan", both Data Input and Data Inquiry command buttons are activated.

To start data editing, click here to go to Panel 01-01.

(2)

Panel 01-01

(2)

Click here if you want to go back to Panel 01.

Before editing the data, click here to choose target irrigation scheme.

Panel 01-05

(3)

Click the "down arrow" and choose one of the options from the Zone.

Click here to go to the panel 01-06.

Click here if you want to go back to Panel 01-01.

(4)

Panel 01-01

The screenshot shows the 'Irrigation Development Monitoring' interface for '1. General Information'. The form includes the following sections and fields:

- (1) Name of the Scheme:** A text input field containing 'Msambanyamani' and a 'Choose Scheme for Data Revision' button.
- Development Stage:** A yellow box containing radio buttons for 'Village Plan' (checked), 'DADP', 'F/S', 'D/D', 'Construction', and 'Completion'.
- (2) Location:** Fields for 'Latitude South' (07 deg, 23.137 min) and 'Longitude East' (39 deg, 18.215 min).
- (3) Administration:** A series of dropdown menus for 'Zone' (Morogoro Zonal Irrigation Office), 'Region' (Coast), and 'District' (Mkuranga), followed by text input fields for 'Ward' and 'Village (s)'.
- (4) No. of Household:** A text input field containing '0'.

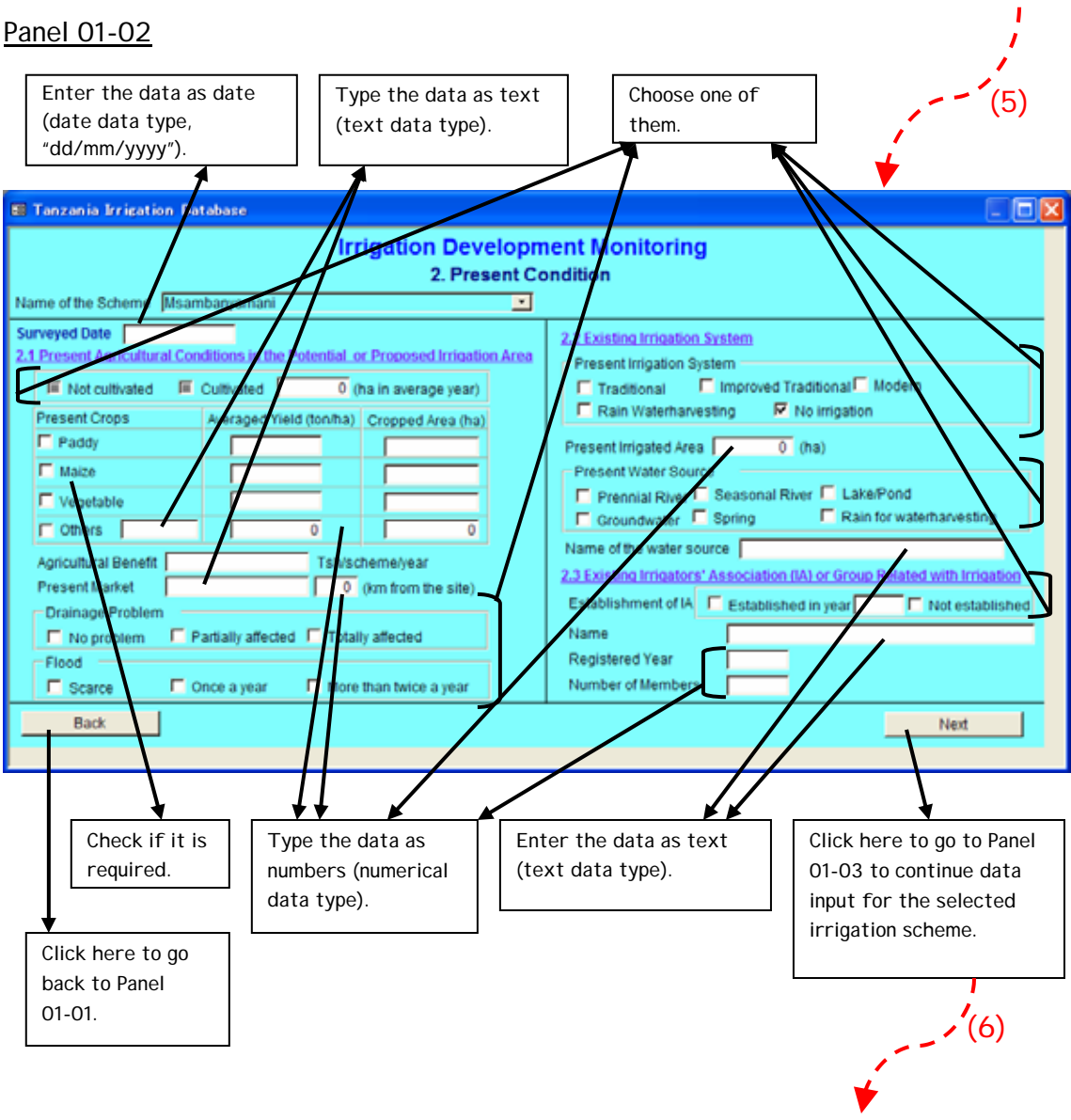
Navigation and control elements include a 'Back' button, a 'Continue Input for Selected Scheme' button, and a record navigation bar showing 'Record: 1 of 8'. A 'Delete' button is also present.

Callout boxes provide the following instructions:

- 'Choose one of the candidates.' (points to the 'Choose Scheme for Data Revision' button)
- 'Type the data as text (text data type).' (points to the 'Name of the Scheme' field)
- 'Enter the data by number (numerical data type).' (points to the 'No. of Household' field)
- 'Click here and choose one of the options.' (points to the 'Zone' dropdown)
- 'Type the data as text (text data type).' (points to the 'Ward' and 'Village (s)' fields)
- 'Click here to go to next record.' (points to the right arrow in the record bar)
- 'Click here to jump to the last record.' (points to the right arrow with a double bar in the record bar)
- 'Click here to enter the data for new record (scheme) of preliminary planning result. Please make sure that the new record has not already been entered.' (points to the 'Continue Input for Selected Scheme' button)
- 'Click here to go back to Panel 01.' (points to the 'Back' button)
- 'Click here to go back to previous record.' (points to the left arrow in the record bar)
- 'Click here and press "Delete" key to delete the record. (Be careful to operate this function since the date is not retrieval once it is deleted)!' (points to the 'Delete' button)
- 'Click here to go to Panel 01-02 to continue data input for the selected irrigation scheme.' (points to the 'Continue Input for Selected Scheme' button)

Red dashed arrows labeled (4) and (5) indicate the flow from this panel to subsequent panels.

Panel 01-02



Panel 01-03

The screenshot shows a web-based form titled "Irrigation Development Monitoring" for "3. The Latest Development Plan". The form is divided into several sections:

- 3.1 Irrigation:** Includes fields for "Name of the Scheme" (Msambansiani), "Planned Date", "Planned by", "Irrigable Area" (400 ha), "Water Resources" (Perennial River, Seasonal River, Lake, Groundwater, Spring, Rain for Water Harvesting), "Name of the Water Source", "Water Right" (Granted, Not Granted Yet, Intended, Not Aware), "Required Works" (Rehabilitation, New Development, Expansion, Improvement, Drainage improvement), "Irrigation Type" (Gravity, Pump, Rain Waterharvesting), "Water Quality" (No problem, Anticipated to Damage Crop Cultivation), and "Required Facilities" (Dam, Headworks, Pump, Main Canal, Secondary Canal, Tertiary Canal, Main Drain, Secondary Drain, Tertiary Drain, No. of Related Structures).
- 3.2 Irrigators' Association:** Includes "Establishment Plan" (Existing, Formed by year, Not sure) and "Mode of Contribution to Development" (In Cash, In Kind, None).
- 3.3 Agriculture:** Includes "Proposed Crops" (Paddy, Maize, Vegetable, Others), "Averaged Yield (ton/ha)", and "Cropped Area (ha)".
- 3.4 Anticipated Negative Impacts:** Includes checkboxes for "Water Conflict within the Scheme", "Water Conflict with Other Scheme", "Land Conflict", "Affection of Protected Area", and "Soil Erosion", plus a "Description" field.
- 3.5 Project Implementation:** Includes "Proposed Implementation Period" and "Project Cost" (Construction, Soft Component, Administration, Operation and Maintenance, Replacement, Engineering Services) in Tsh.

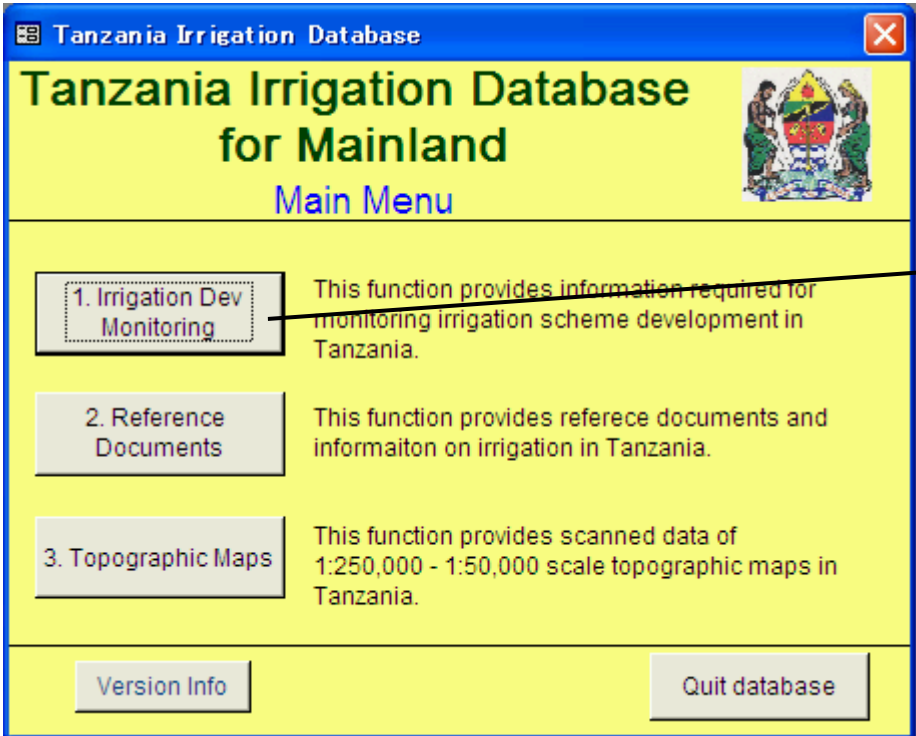
Instructional callouts with arrows point to various fields and buttons:

- "Enter the data by date (date data type)." points to the "Planned Date" field.
- "Choose one." points to the "Development Stage" dropdown menu.
- "Enter the data as numbers (numerical data type)." points to the "Irrigable Area" field.
- "Type the data as text (text data type)." points to the "Name of the Water Source" field.
- "Check if it is required." points to the "Water Right" and "Required Works" sections.
- "Enter the data as numbers (numerical data type)." points to the "Main Canal" length field.
- "Check if it is required." points to the "Water Quality" section.
- "Enter the data as numbers (numerical data type)." points to the "Averaged Yield" field.
- "Choose one." points to the "Mode of Contribution to Development" dropdown menu.
- "Click here to go back to Panel 01-02." points to the "Back" button.
- "End of the operation" points to the "End" button.

(End of the operation)

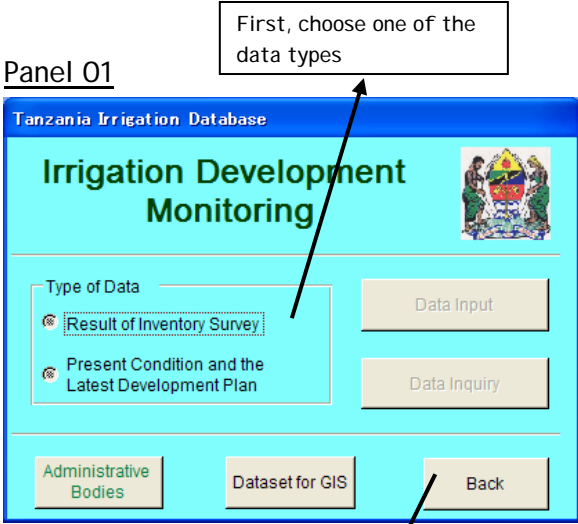
Data Inquiry (p.2-13 to p.2-19)

Panel 00 Main Menu (will appear as soon as the database is executed)



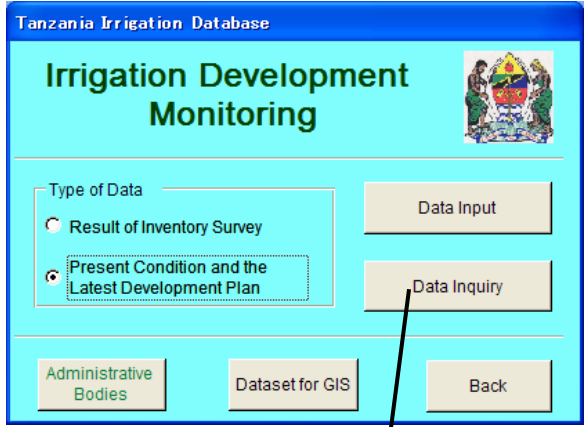
To start using "Irrigation Development Monitoring" function, click here to go to Panel 01.

(1)



First, choose one of the data types

Panel 01



Click here if you want to go back to Panel 00.

After choosing inventory survey stage, Data Inquiry command button becomes active. In case of choosing "Present Condition and the Latest Development Plan", both Data Input and Data Inquiry command buttons are activated.

To start data inquiry, click here to go to Panel 01-07.

(2)

Panel 01-07

First, choose one of the output formats from the list.

Click here to obtain further panels (Panel 01-08 to 01-11) for output condition setting.

Click here to go back to Panel 01.

(2)

Panel 01-08

(3a) If you choose Form 1-1-1

Click target administrative body using the lists.

(3d) If you choose Form 1-2-2

Click here to go back to Panel 01-07.

Click here to obtain the output with Form 1-1-1.

Panel 01-09

(3b) If you choose Form 1-1-2

(3c) If you choose Form 1-2-1

Click target administrative body using the lists.

Click here to go back to Panel 01-07.

Choose "All" to output all the irrigation schemes under the selected administrative body.

Click here to obtain the output with Form 1-1-2.

(In the example shown above, data for all the irrigation schemes under Coast Region will be outputted).

Panel 01-10

Tanzania Irrigation Database

Present Condition and the Latest Dev Plan

Choose Irrigation Scheme

Zonal Irrigation Office [dropdown]
Region [dropdown]
District [dropdown]
Irrigation Scheme [dropdown]

Back Inquiry

(3c) If you choose Form 1-2-1

Click target administrative body using the lists.

Click here to go back to Panel 01-07.

Click here to obtain the output with Form 1-2-1.

(3d) If you choose Form 1-2-2

Panel 01-11

Tanzania Irrigation Database

Present Condition and the Latest Dev Plan

Setting Inquiry Condition

Zonal Irrigation Office All [dropdown]
Region All [dropdown]
District All [dropdown]
Irrigation Scheme All [dropdown]

Back Inquiry

Click target administrative body using the lists.

Click here to go back to Panel 01-07.

Choose "All" to output all the irrigation schemes under the selected administrative body.

Click here to obtain the output with Form 1-2-2.

(In the example shown above, data for all the irrigation schemes under Morogoro Zonal Irrigation Office will be outputted.)

(End of the operation)

Form 1-1-1

Scheme Digest
Inventory Survey

Form 1-1-2

Listed Outlines
Inventory Survey

Form 1-2-1

Scheme Digest
Development Monitoring

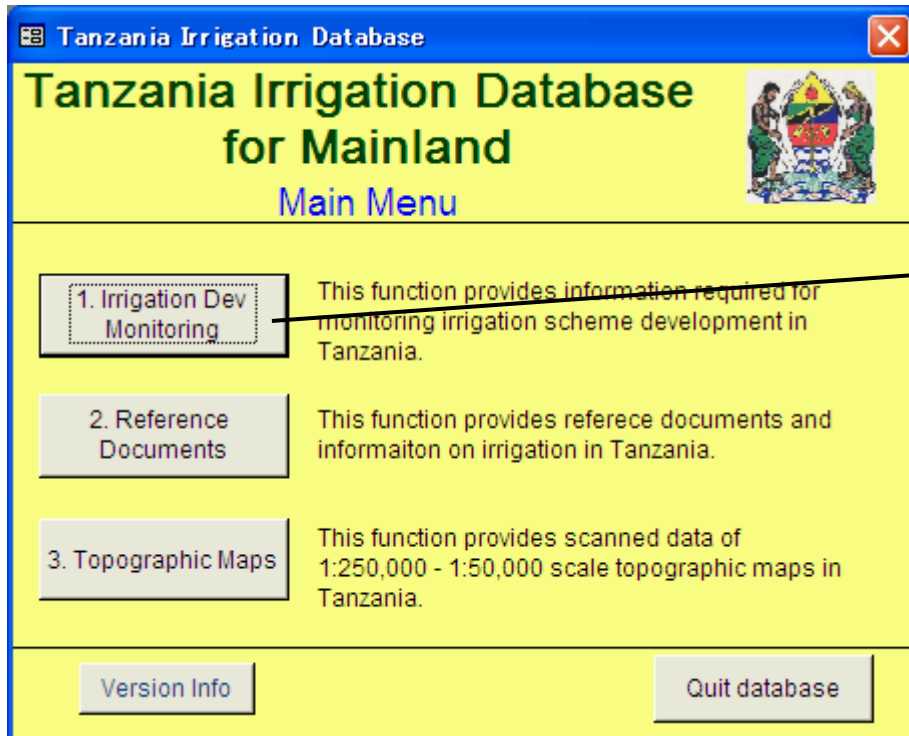
Form 1-2-2

Listed Outlines
Development Monitoring

(Original data was arranged in some part for display.)

Editing List of Administrative Bodies (p.2-20 to p.2-26)

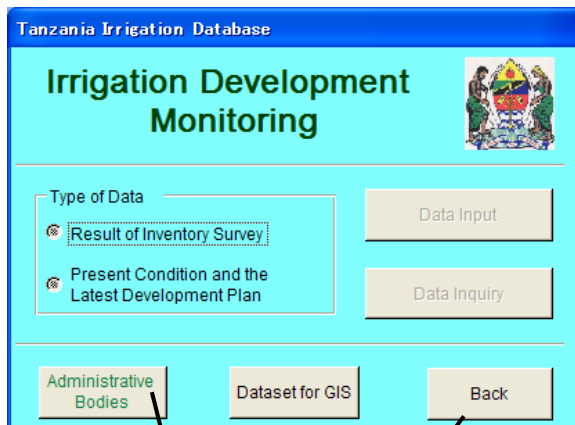
Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Irrigation Development Monitoring" function, click here to go to Panel 01.

(1)

Panel 01

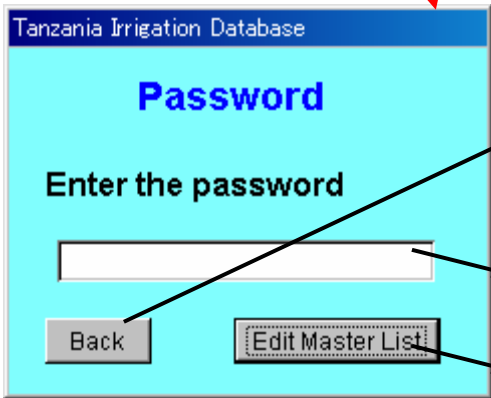


To edit the list of administrative bodies, click here to go to Panel 01-11

Click here if you want to go back to Panel 00.

(2)

Panel 01-11

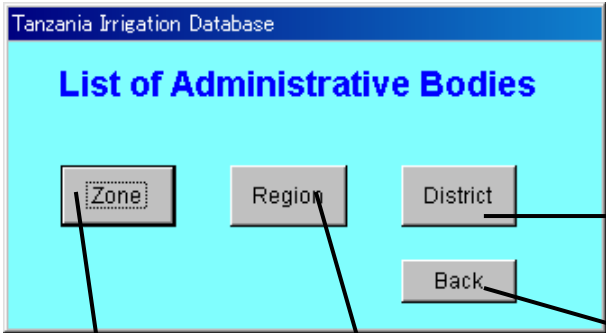


Click here to go back to Panel 01.

Enter the password to allow editing of master data.

After entering the password, click here to go to Panel 01-12.

Panel 01-12



To add/delete a zone or edit the list of regional irrigation offices, click here to go to Panel 01-13.

To add/delete a region or edit the list of regions, click here

To add/delete a district or edit the list of districts, click here

Click here to go back to Panel 01.

Refer the irrigation GIS to confirm the schemes under the new administration!

The operation is the same as the one for "Zone".
(4a-1, 4a-2)

(4a-1)

(4a-2)

To add a zone

To delete a zone

Next Page

Page 2-23

To add a new zone

Panel 01-13

(4a-1)

Click here to go back to Panel 01-12.

Click here to go to next record.

Click here to go to previous record.

Click here to jump to the first record.

Click here to jump to the last record.

Click here to add a new zonal irrigation office.

After checking that the new office has not been registered, enter the name.

Enter the name of the zonal irrigation office.

A new zone was registered

Click here to edit regions under the zones.

(4a-1)

Panel 01-14

Select a zone which was covering before.

Select the present zone for each region

Click here to go to next record.

Click here to jump to the last record.

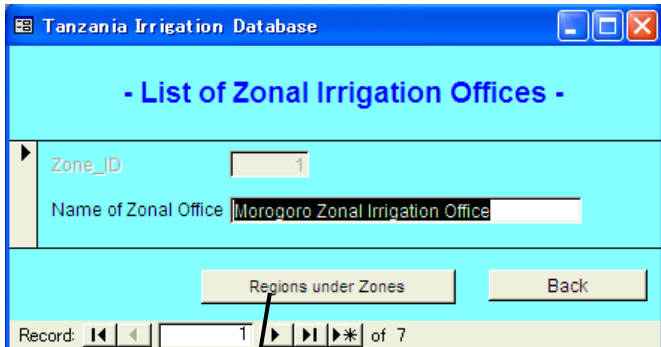
There are four regions under the zone. Three of them are shown in the panel.

Click here to go back to Panel 01-13.

(End of the operation)

To delete a zone

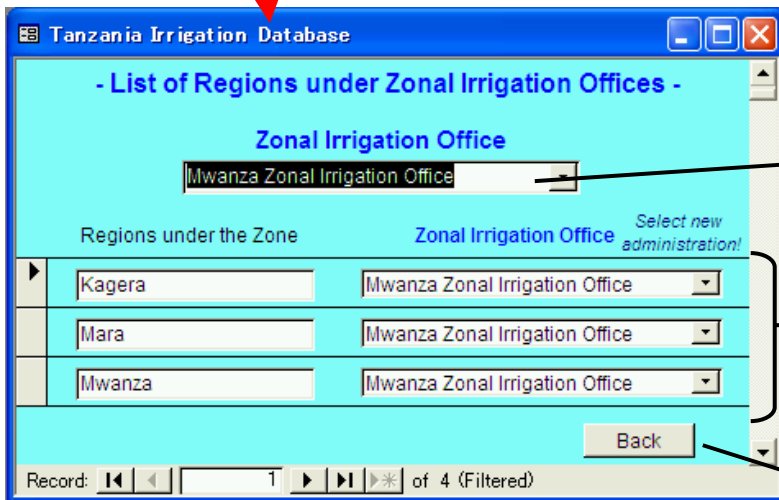
Panel 01-13



Click here to edit the regions under the zone.

Panel 01-14

(4a-2)

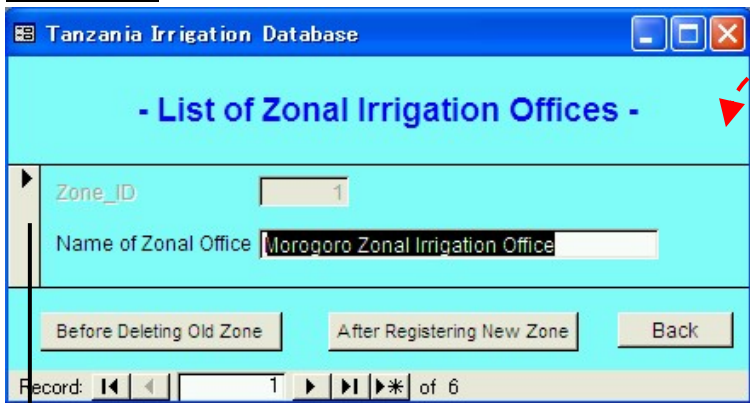


Select the zone to be deleted.

Select the present zone for each region.

Click here to go back to Panel 01-13.

Panel 01-13



Click here and press "Delete" key to delete the record.

(4a-2)

A zone was deleted.

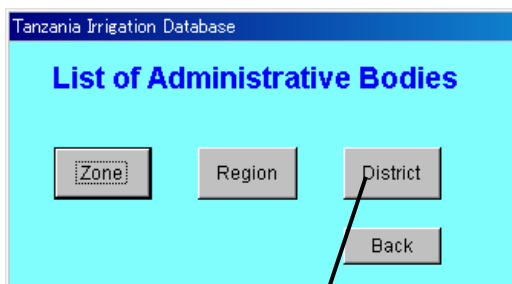
(End of the operation)

(4a-3: Special case)

Some new districts and a new region are generated, and also a new zone is formed.

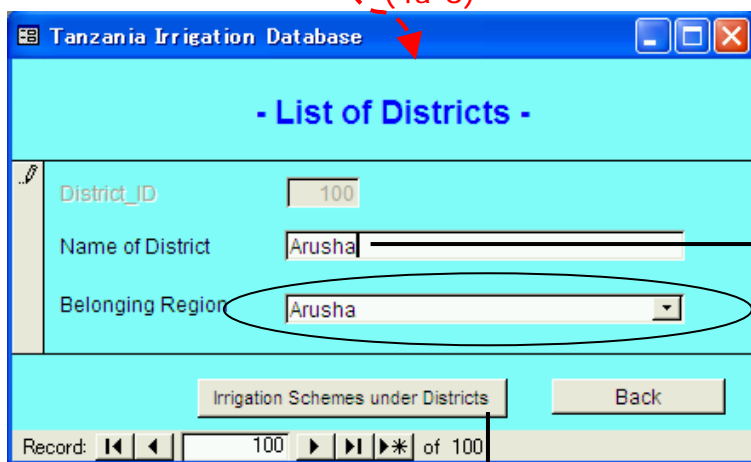
1) Start with the smallest one, that is, district

Panel 01-12



Click here to add new districts

Panel 01-15



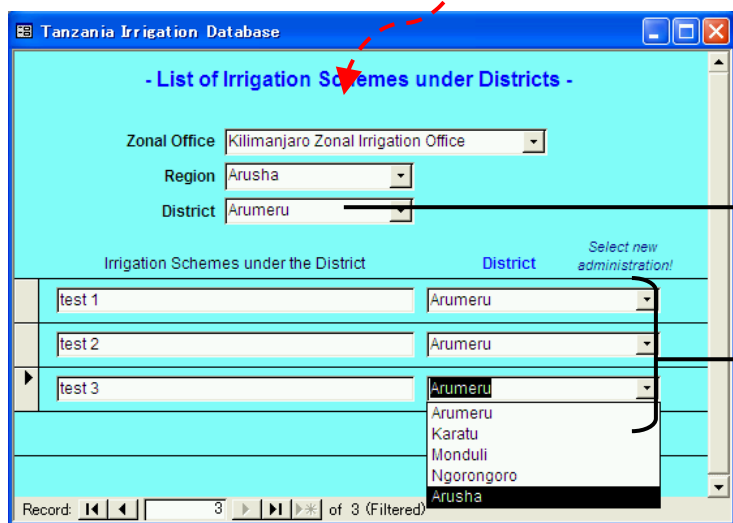
Enter the name of a new district.

The new district must be put under a previous region temporarily, so that irrigation schemes under the new district can be retrieved from the former district.

Click here to edit the districts under the new region.

Click [Back] to go back to Panel 01-12.

Panel 01-16



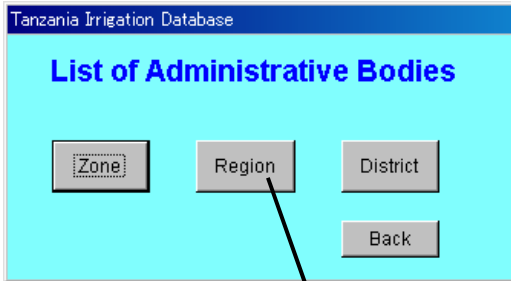
Select the district which was covering the area of the new district before.

Select the present district for each scheme.

Click [Back] to go back to Panel 01-15.

2) Register a new region

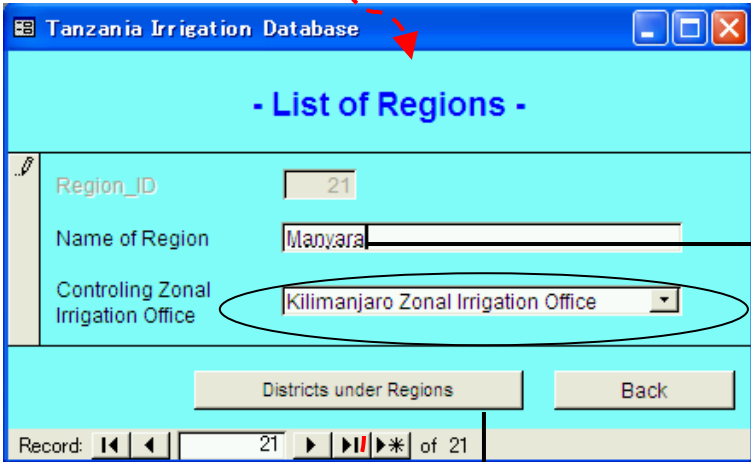
Panel 01-12



Click here to add a new region

(4a-3)

Panel 01-17



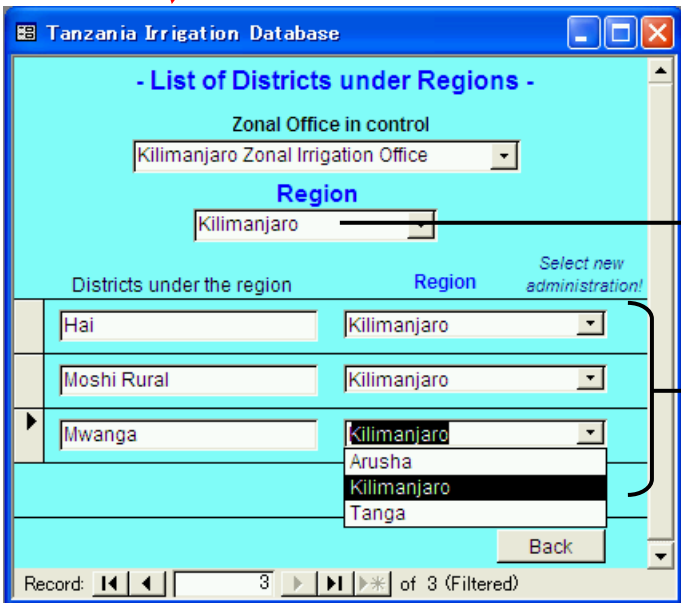
Enter the name of the new region.

The new region must be put under the old zone temporarily so that districts under the new region can be retrieved from the former region.

Click [Back] to go back to Panel 01-12.

Panel 01-18

Click here to edit the districts under the new region.



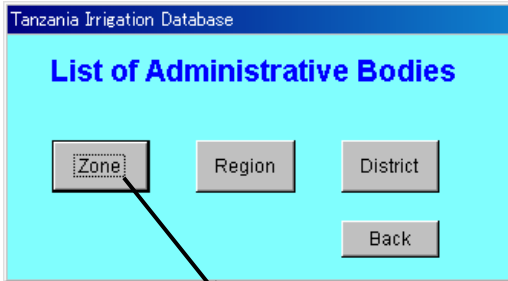
Select the region that was covering the area of the new region before.

Select the present region for each district.

Click [Back] to go back to Panel 01-17.

3) Register a new zone

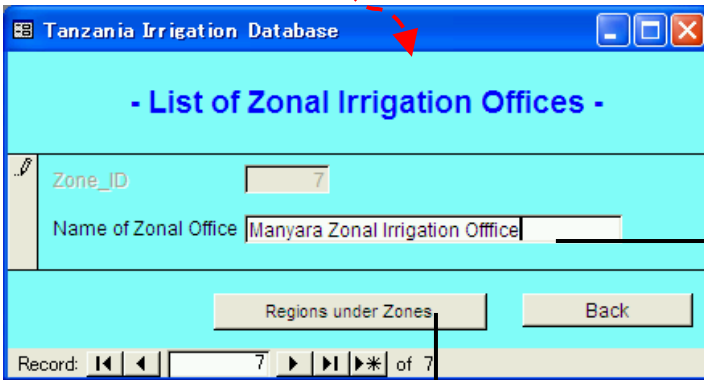
Panel 01-12



Click here to add a new zone

Panel 01-13

(4a-3)



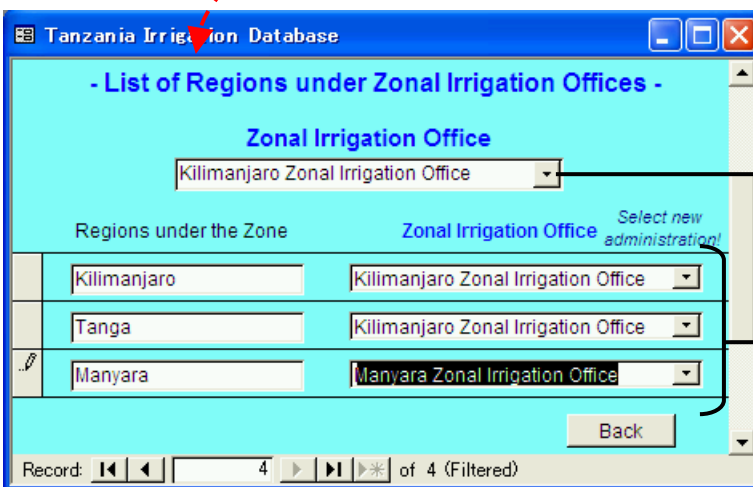
Enter the name of the new zone.

Click [Back] to go back to Panel 01-12.

Click here to edit the regions under the new zone.

Panel 01-14

(4a-3)



Select the zone which was covering the area of the new zone before.

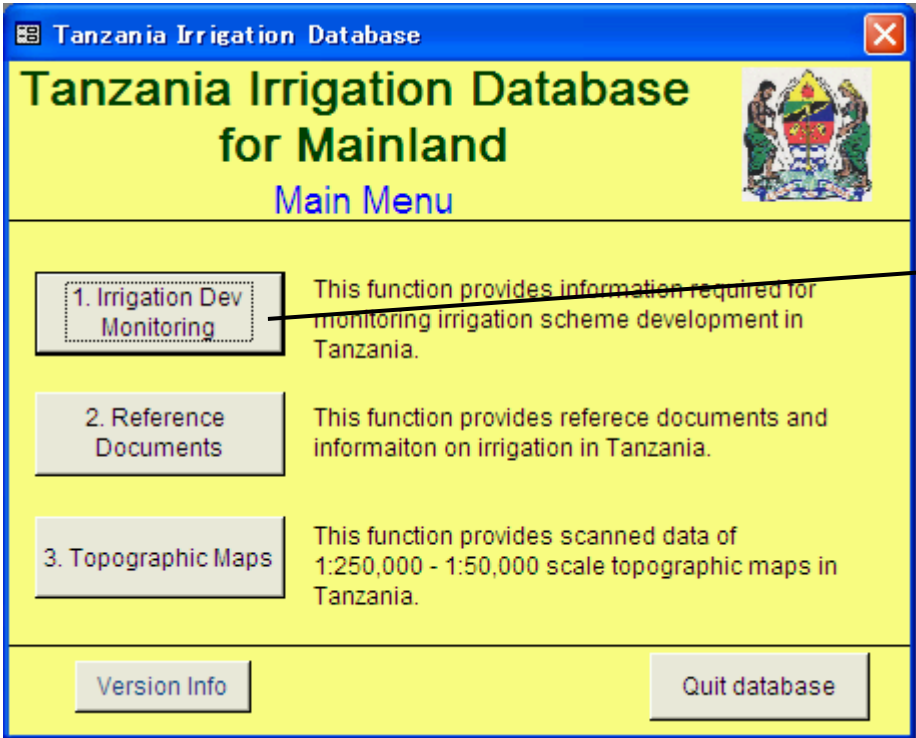
Select the present zone for each district.

Click [Back] to go back to Panel 01-13.

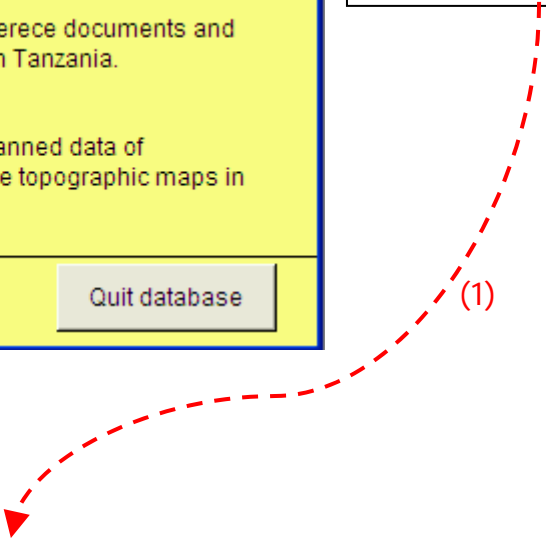
(End of the operation)

Preparation of Dataset for Irrigation GIS (p.2-27 to p.2-29)

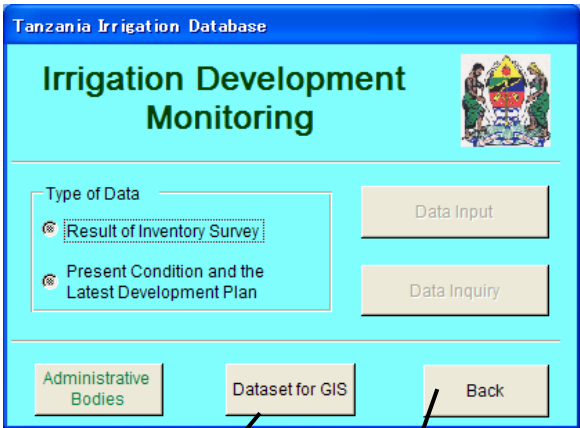
Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Irrigation Development Monitoring" function, click here to go to Panel 01.



Panel 01



To send dataset to "Irrigation GIS", click here.

Click here if you want to go back to Panel 00.



Panel 02

Choose administrative bodies for the dataset.

Click here if you want to go back to Panel 01.

Click here to prepare dataset for "Irrigation GIS".

List of irrigation schemes appears.

Screen (a)

Zonal Office	Region	District	Scheme	Latitude_deg	Latitude_min	Longitude_deg	Longitude_min	Current Irri
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Choga Basin	07	08.919	39	06.180	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Kisele Basin	07	11.885	39	07.213	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Mbezi Basin-1	07	11.624	39	10.339	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Mbezi Basin-2	07	09.765	39	13.894	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Msambariyamar	07	23.137	39	16.215	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Ngwale Basin	07	25.972	39	04.328	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Nyamaronde Ba	07	28.305	39	08.642	No Irrigation
Morogoro Zonal Irrigation Office	Coast	Mkuranga	Yavayava downs	07	07.948	39	22.005	No Irrigation

With the list of irrigation schemes active, click the Excel icon to export the list of data to Microsoft Excel.

Screen (b)



	A	B	C	D	E	F	G	
1	Zonal Office	Region	District	Scheme	Latitude_deg	Latitude_min	Longitude_deg	Long
2	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Choga Basin	07	08.919		39
3	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Kisele Basin	07	11.886		39
4	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Mbezi Basin-1	07	11.824		39
5	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Mbezi Basin-2	07	09.765		39
6	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Msambanyamani	07	23.137		39
7	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Ngwale Basin	07	25.972		39
8	Morogoro Zonal Irrigation Office	Coast	Mkuranga	Nyamaronde Basin	07	28.306		39
9	Morogoro Zonal Irrigation Office	Coast	Mkuranga	downstream	07	07.948		39
10								
11								
12								
13								
14								

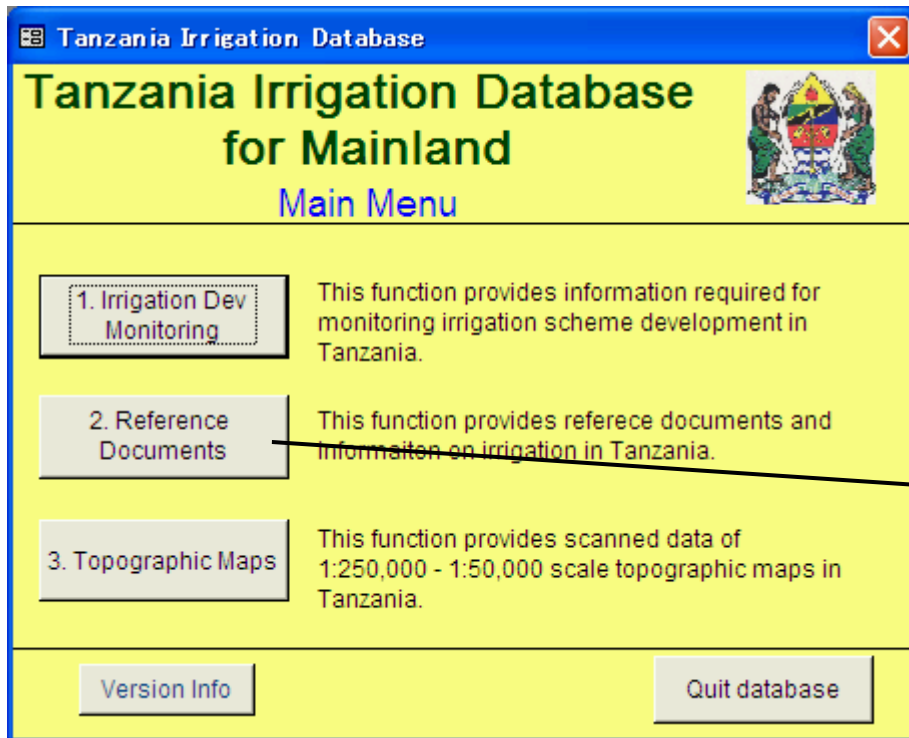
Save the Microsoft Excel file to the desired destination folder of your computer.

(End of the operation)

(3) Reference Documents

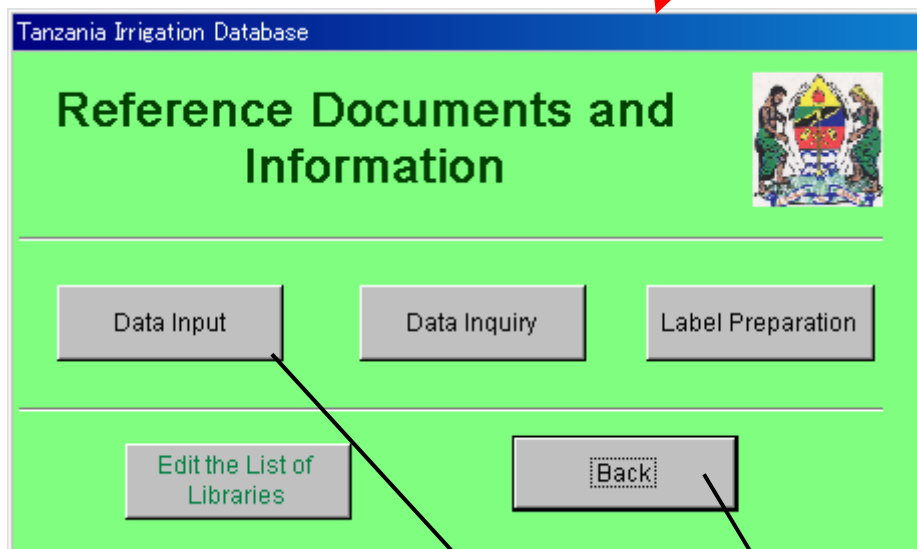
Data Input and Data Editing (p.2-30 to p.2-31)

Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Reference Documents" function, click here to go to Panel 01.

Panel 02



To start data input, click here to go to Panel 02-01.

Click here to go back to Panel 00.

Panel 02-01

Tanzania Irrigation Database

Reference Documents and Info. Data Input

Library *Choose storage!*

Classification *Choose classification!*

Back

Select location (library) where the document is to be stored.

Select classification of the document to be registered.

Click here to go back to Panel 02.

After choosing library and classification, following information will appear.

Tanzania Irrigation Database

Reference Documents and Info. Data Input

Library *Choose library!*

Classification *Choose classification!*

Number

Title

Published by

Published year

Published month

Page No.

Original Copy

Contents about Whole Nation Mainland only Zanzibar only

Record: of 12

Back

The database allocates document code number automatically.

Click here and press "Delete" key to delete the record.

Enter name of the document.

Enter name of the publisher.

Enter the published year as 4 digits.

Choose published month.

Enter the page number.

Choose whether the document is original or copy.

Choose the area that the document describes.

Click here to go back to previous record.

Click here to go to next record.

Click here to go to the last record.

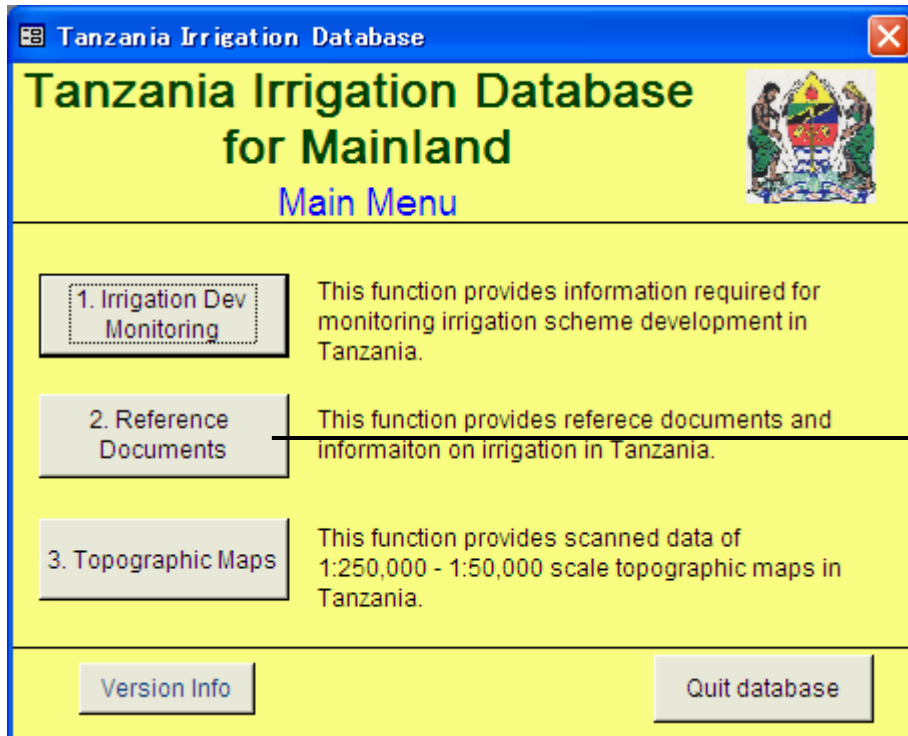
Click here to register new documents.

(End of the operation)

Data Inquiry

(p.2-32 to p.2-34)

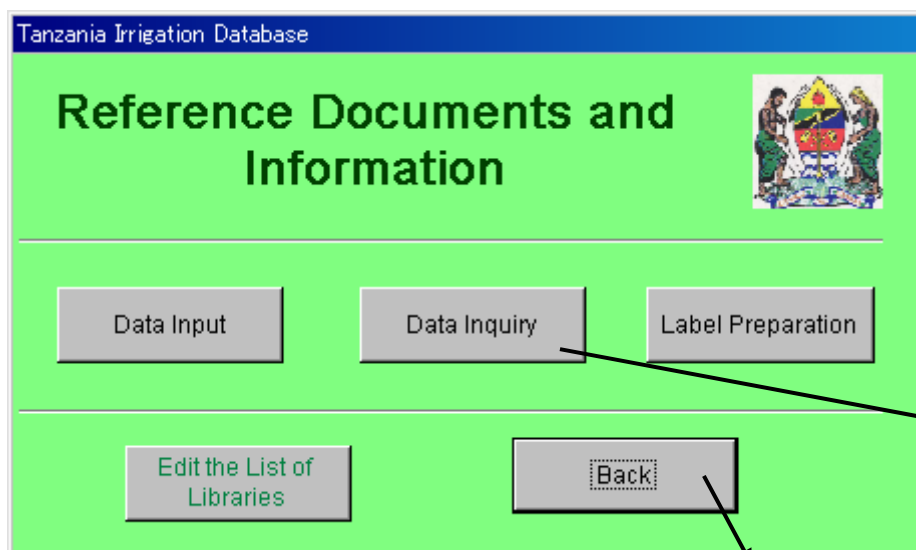
Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Reference Documents" function, click here to go to Panel 01.

(1)

Panel 02



To start data inquiry, click here to go to Panel 02-02.

Click here to go back to Panel 00.

(2)

Panel 02-02

The screenshot shows a web interface for the Tanzania Irrigation Database. The main heading is "Reference Documents and Info. Data Inquiry". The form includes several input fields and a radio button group:

- Library:** A dropdown menu with "Mainland" selected.
- Classification:** A dropdown menu with "Policy" selected.
- Title includes the key word:** A text input field containing "Tanzania".
- Publisher includes the key word:** An empty text input field.
- Contents about:** A group of four radio buttons: "Whole Nation", "Mainland only", "Zanzibar only", and "Any place". The "Any place" option is selected.
- Buttons:** "Back" and "Inquiry".

Explanatory callouts are provided for each field:

- Library:** Choose library, if you want to display only the list of documents stored in the selected library. If not, you will get the list for all the libraries.
- Classification:** Choose classification, if you want to display only the list of documents for one classification. If not, you will get the list for all classifications.
- Title includes the key word:** Enter key word by text data, if you want to display only the list of documents that includes the key word in the title. If not, you will get the list of all document titles.
- Publisher includes the key word:** Enter key word by text data, if you want to display only the list of documents that includes the key word in the publisher. If not, you will get the list for all publishers.
- Contents about:** Choose contents to display the documents list with selected contents (one of them must be selected).
- Back:** Click here to go back to Panel 02.
- Inquiry:** Click here to get the results (Output Form 2-1) after setting the inquiry conditions.

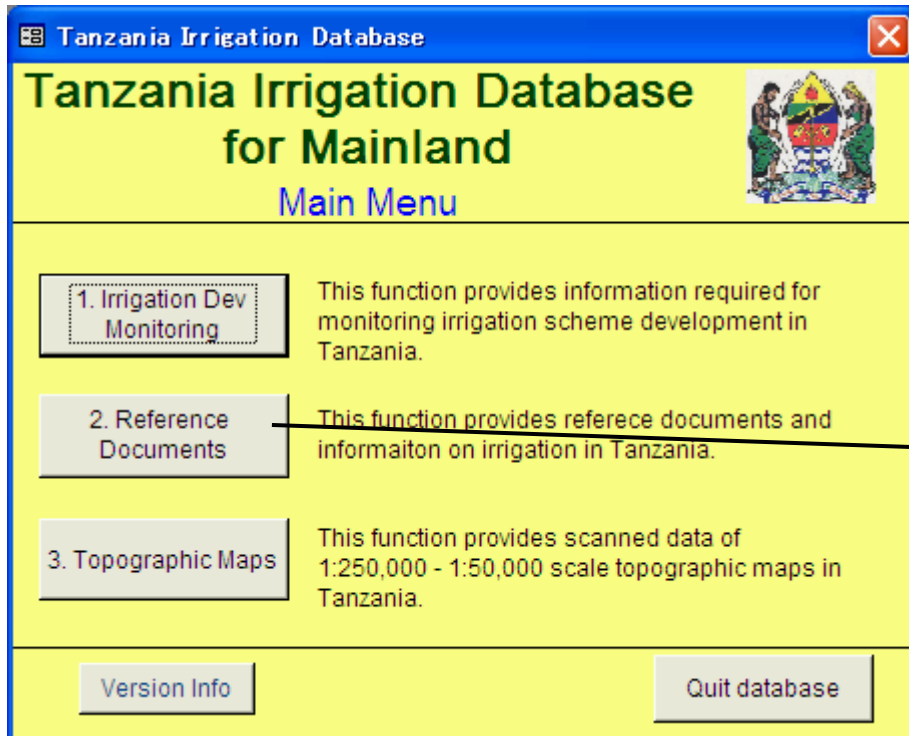
Additional annotations include a red dashed arrow labeled "(2)" pointing to the top right, and another red dashed arrow labeled "Obtain Output Form 2-1" pointing to the "Inquiry" button.

(End of the operation)

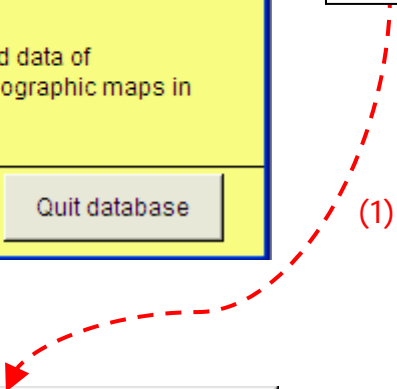
Form 2-1

Label Preparation (p.2-35 to p.2-39)

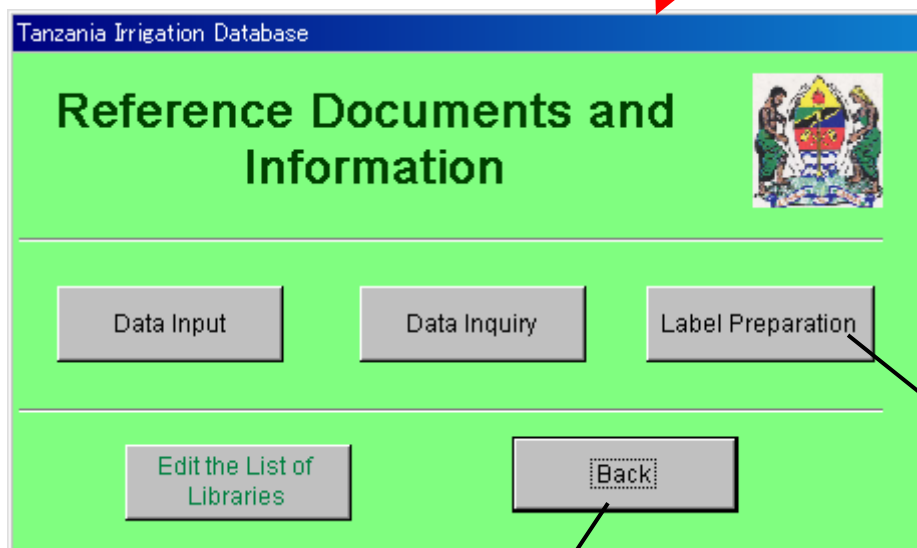
Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Reference Documents" function, click here to go to Panel 01.



Panel 02



To start preparing labels, click here to go to Panel 02-03.

Click here to go back to Panel 00.



Panel 02-03

Tanzania Irrigation Database

Preparation of Document Lable

Choose library:

Prepare

Back

(2)

Click here to obtain documents label (Output Form 2-2).

Click here to go back to Panel 02.

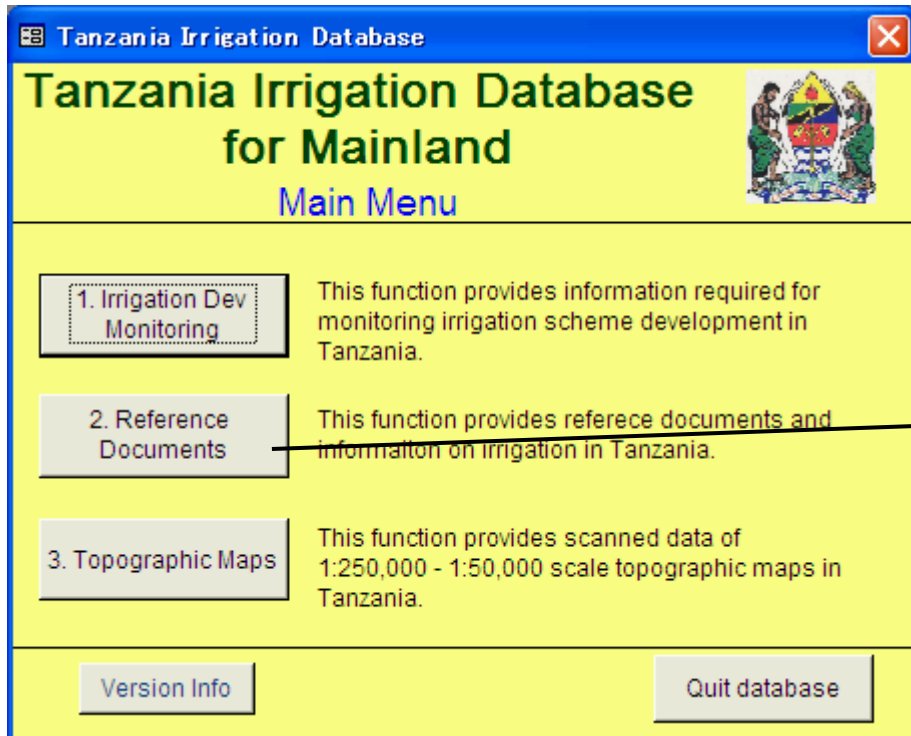
Obtain Output Form 2-2

(End of the operation)

Form 2-2

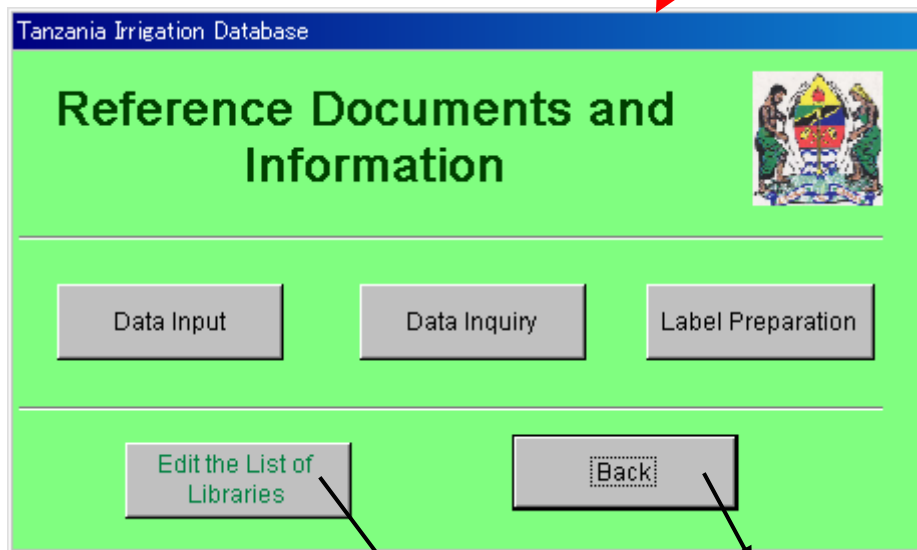
Editing List of Libraries (p.2-38 to p.2-39)

Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Reference Documents" function, click here to go to Panel 01.

Panel 02



To start editing library list, click here to go to Panel 02-04.

Click here to go back to Panel 00.

Panel 02-04

The screenshot shows a web application window titled "Tanzania Irrigation Database" with a green header and a form titled "- List of Library -". The form contains three input fields: "Library_ID" with the value "1", "Name of Library" with the value "Mainland", and "Library Code" with the value "M". A "Back" button is located at the bottom right of the form. Below the form is a record navigation bar with the text "Record: 1 of 2" and several navigation icons. A red dashed arrow labeled "(2)" points to the top right corner of the window. Several callout boxes with arrows provide instructions for each element:

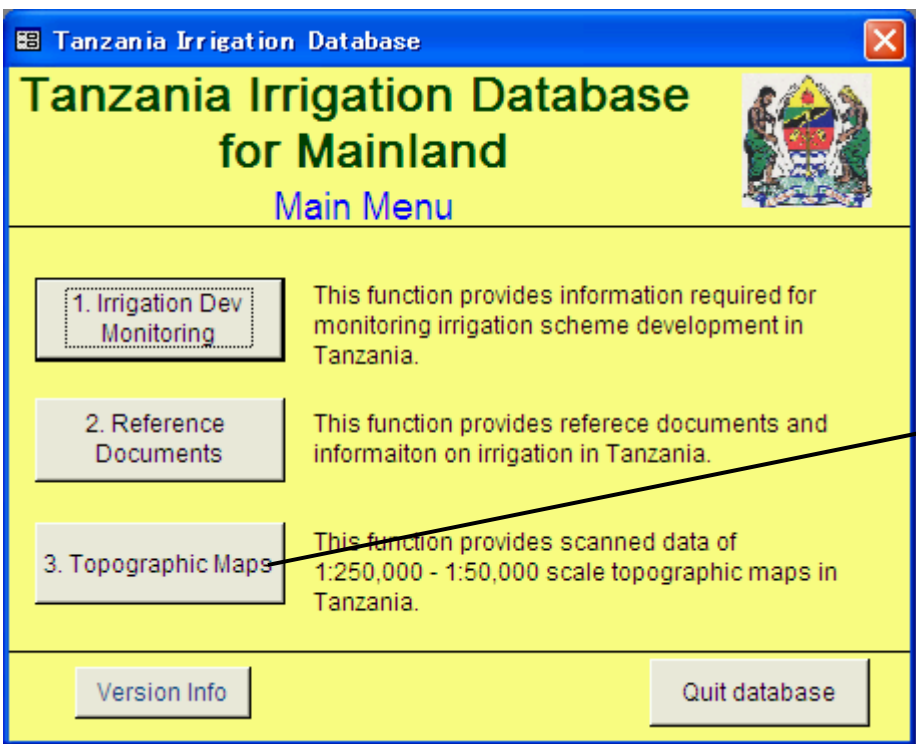
- Enter or edit the name of library. (points to the "Name of Library" field)
- Allocate a code for the library. The code should be unique. (points to the "Library Code" field)
- Click here to go back to Panel 02. (points to the "Back" button)
- Click here to go to next record. (points to the right arrow icon)
- Click here to go to the last record. (points to the right arrow with a double asterisk icon)
- Click here to register new name of library. Please make sure that the new name of library has not been already registered. (points to the right arrow with a double asterisk icon)
- Click here and press "Delete" key to delete the record. (points to the left arrow with a double asterisk icon)
- Click here to go back to previous record. (points to the left arrow icon)

(End of the operation)

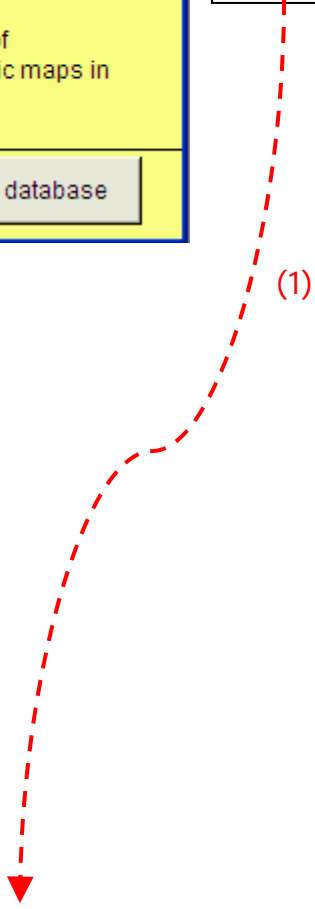
(4) Topographic Maps

Data Inquiry (p.2-40 to p.2-42)

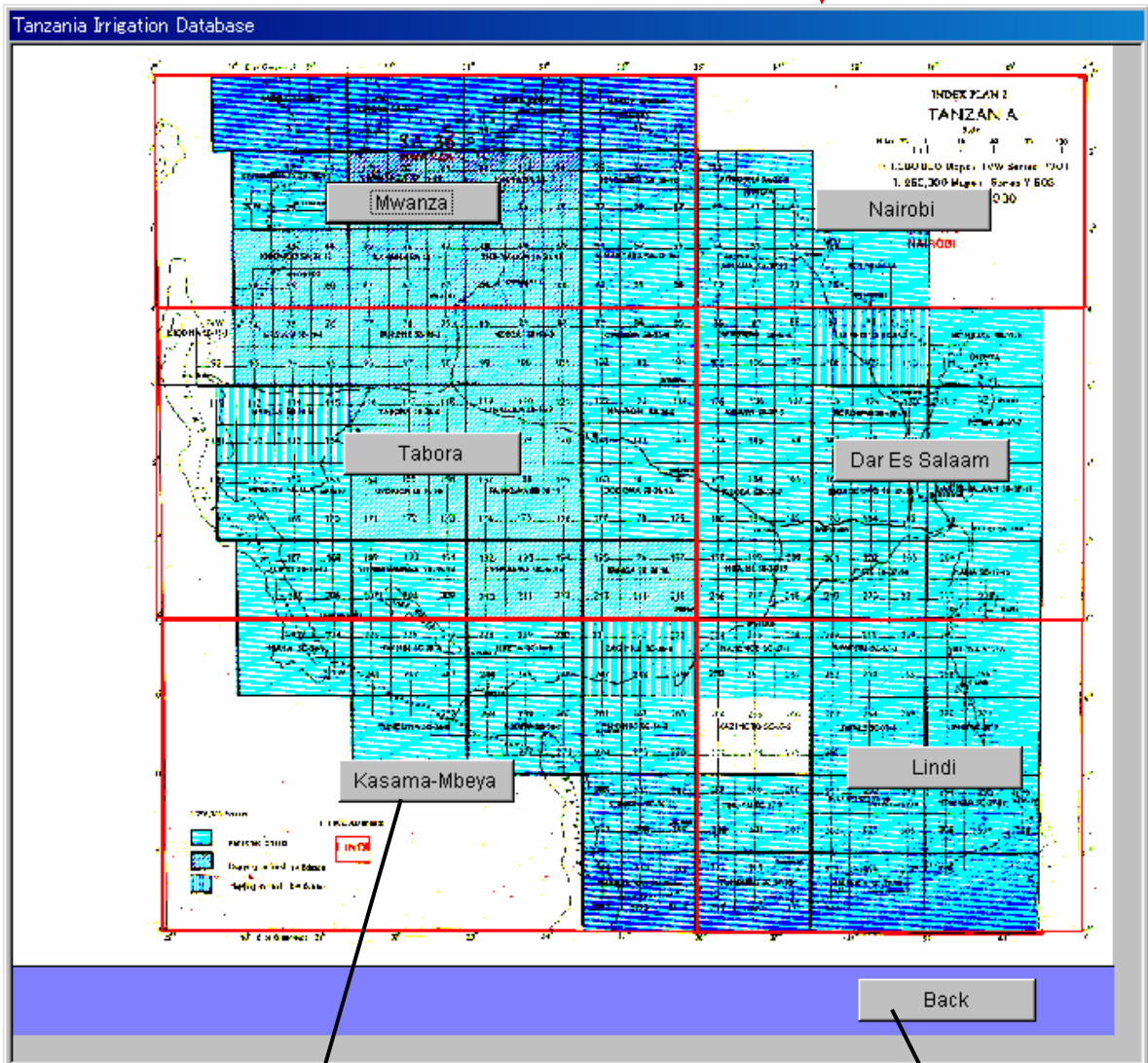
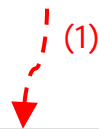
Panel 00 Main Menu (will appear as soon as the database is executed)



To start using "Topographic Maps" function, click here to go to Panel 03.



Panel 03

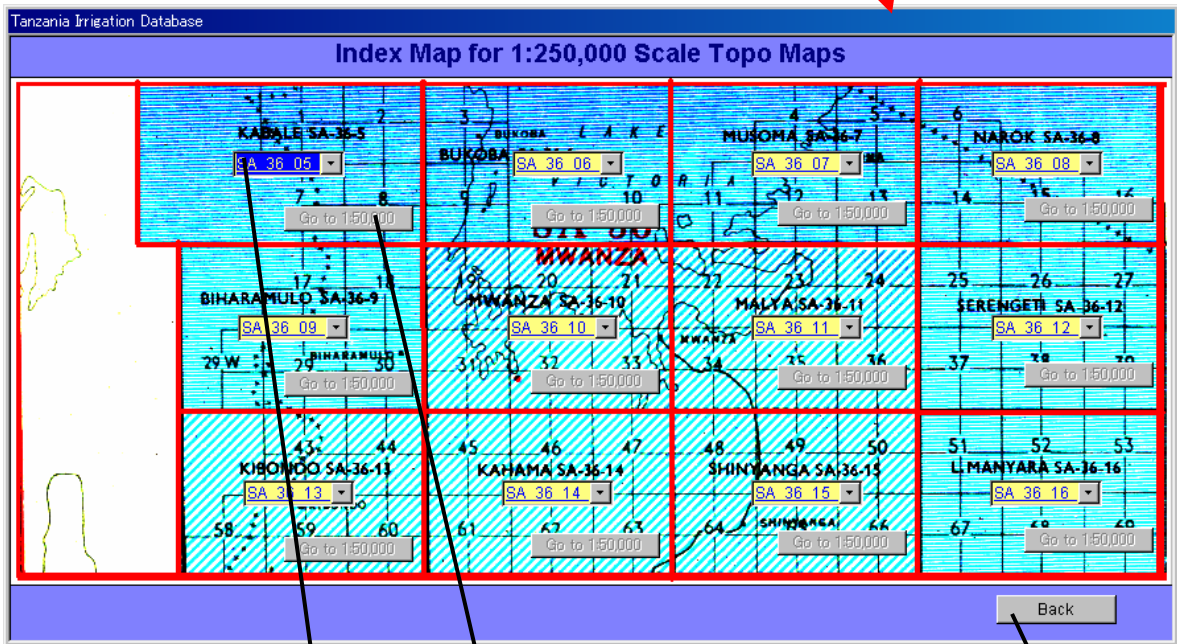


Click a command button to obtain Panel 03-02 (more detail index maps for respective area).

Click here to go back to Panel 00.



Panel 03-01 Index Map for 1:250,000 Scale Maps



Click here to obtain electronic topographical map of the respective area.

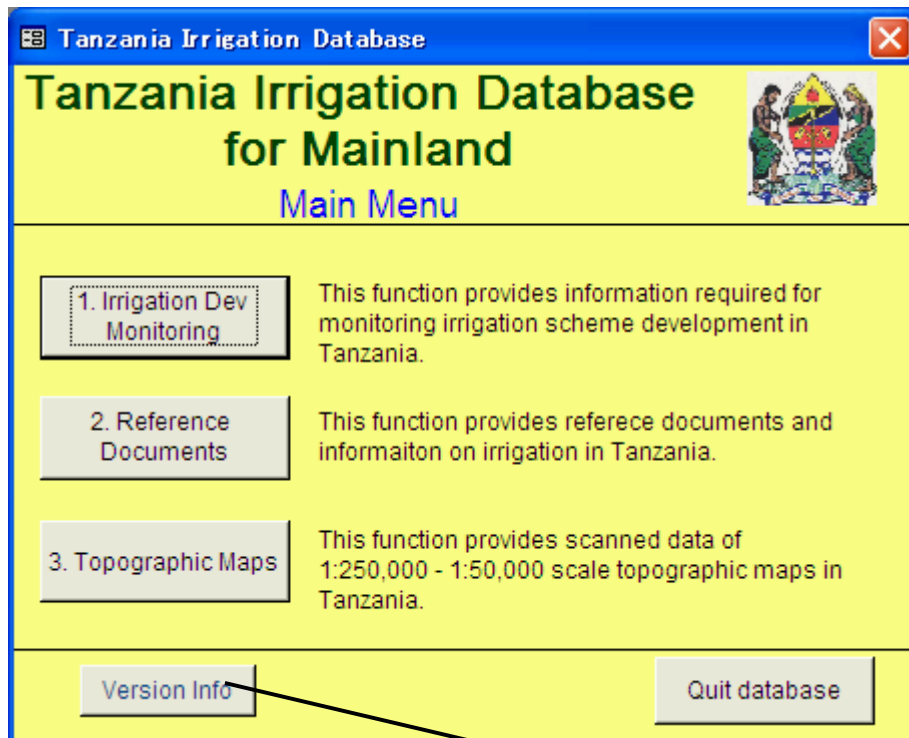
Click here to obtain index map for 1:50,000 scale topographic maps (the function is under construction).

Click here to go back to Panel 03-01.

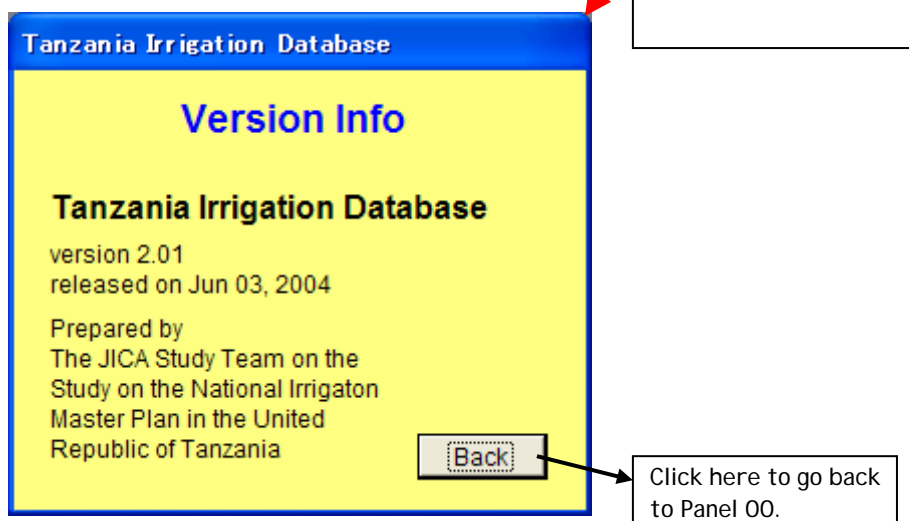
(5) Version Information

Version Information (p. 2-43)

Main Menu (the main menu will appear as soon as the database is executed)



Panel 04 Version Information



Click here to obtain version information of the database.

Click here to go back to Panel 00.

(End of the operation)

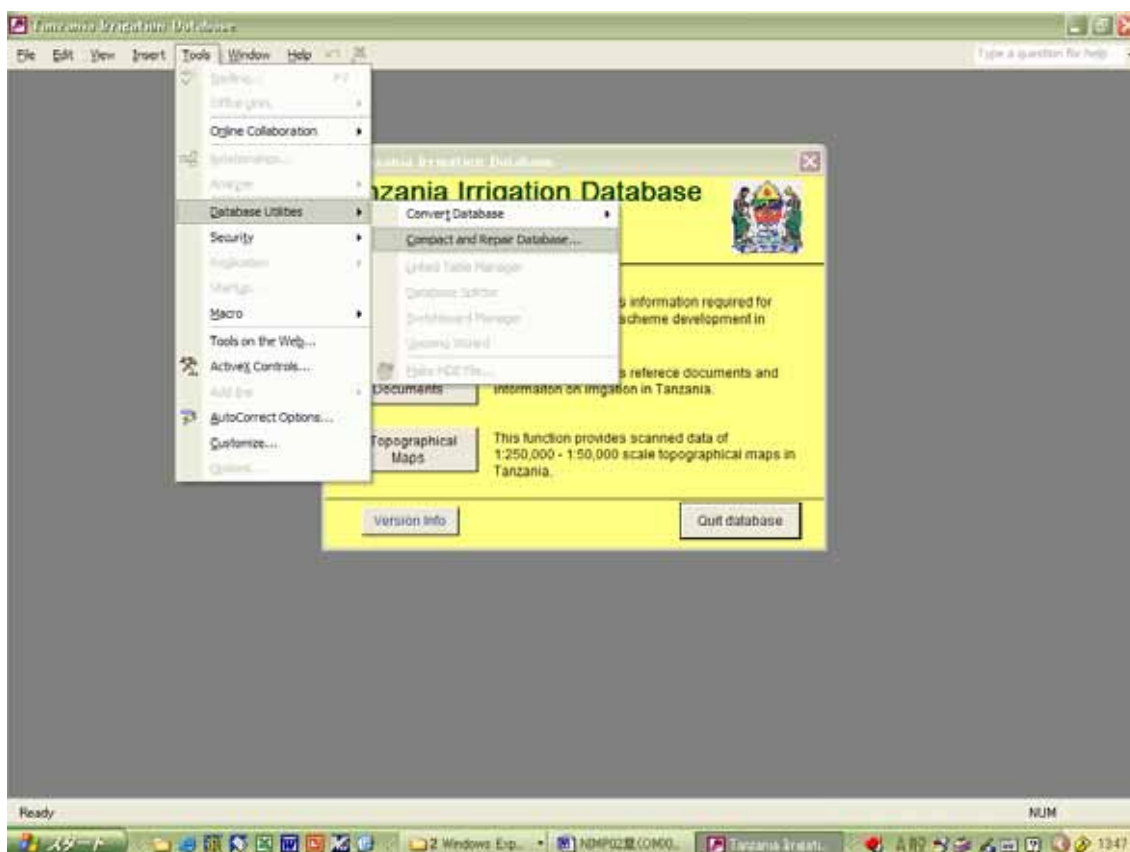
(6) Maintenance of the Database

(a) Daily Maintenance

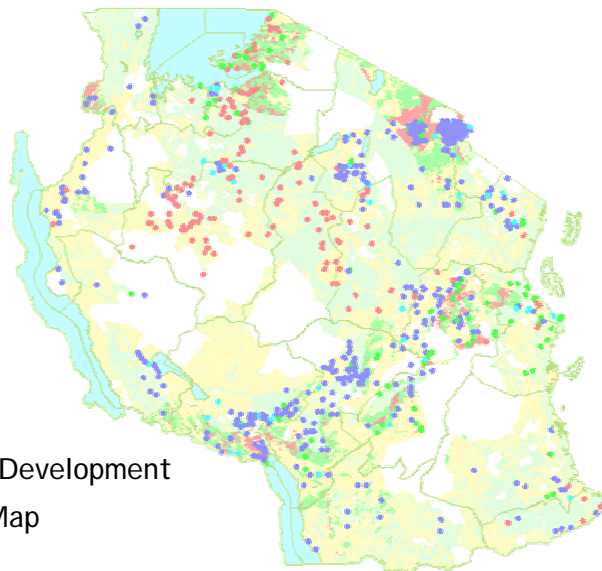
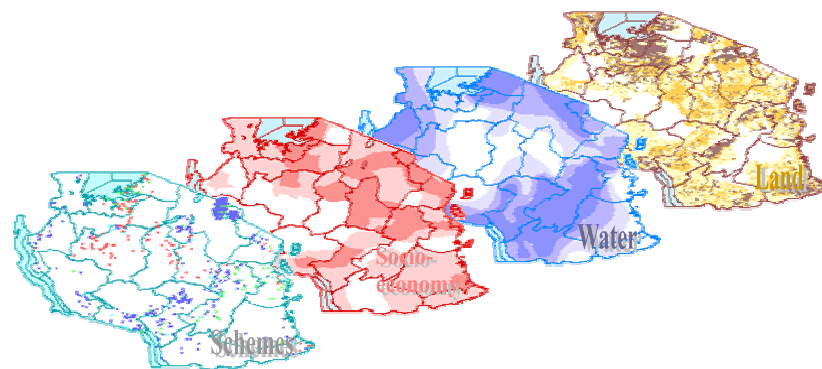
The database should be backed up and stored on external media (such as external hard disk) everyday to avoid loss of the database program and accumulated data. After choosing “quit the database” button in Main Menu (Panel 00), the user should copy the database file and past it into the external media. Even if the computer is totally destroyed, the database can be restored to another computer.

(b) Weekly Maintenance

As time goes on, the database file size becomes larger and larger. To minimize the size of the database, the user should compact it once a week, after taking backup (after completion of daily maintenance). The user can compact the database by choosing “Tools” in the menu bar and choosing “Database Utilities” and “Compact and Repair Database”, as shown below.



3. Irrigation GIS



Irrigation Development
Potential Map

Image of the Irrigation GIS

3 Irrigation GIS

(1) General

In order to organize the data and information collected during the Master Plan study, an Irrigation GIS was prepared mainly based on the materials employed for the analysis of water resource potential, land resource potential, and socio-economic potential. This GIS system can be utilized to assist with evaluating the irrigation potential of the proposed scheme. This GIS consists of various information on socio-economic conditions, including administrative boundaries and road distribution along with protected areas, land cover, land units and soil type. Most of the data is at the national level and the accuracy of some data is not satisfactory for regional and district level at the present stage. The Irrigation GIS system should therefore be developed as the availability and accuracy of the data increase.

There are some other GIS data available in the Department of Research and Development, Soil Conservation and Land Use Planning Section. Some of those data are also useful for evaluating the irrigation potential of proposed schemes. Outlines on those data were also presented in this manual.

(2) Structure of GIS

Arc View (Version 3.2), the most prevalent GIS software, was selected for the operation of the system. All the information collected during the study is stored in the structure shown below. Details are shown on the following page.

Main directory	Sub directory		Files
C:\Irrigation_gis	¥national		agro-ecological zone, protected area, land cover, land unit, soil type, rainfall, river, lakes, road network, railway network, water potential, land potential, socio potential, irrigation potential, irrigation scheme
	¥zonal	6 zones	
	¥regional	20 regions	
	¥district	100 districts	
	¥legend		

Table Structure of Irrigation_GIS

Main Directory	Sub-directories	File Name	Type	Contents
C:\irrigation_gis	\national	\tz_border	.shp	National border
		\tz_regions	.shp	Regional border
		\tz_regheadq	.shp	Regional Headquarter
		\tz_dist	.shp	District border
		\tz_road	.shp	Road network
		\tz_railway	.shp	Railway network
		\tz_lakes	.shp	Lakes
		\tz_rivers	.shp	River
		\tz_rain	.shp	Rainfall
		\tz_agroecologicalzone	.shp	Agro-ecological zone
		\tz_protectedarea	.shp	Protected area
		\tz_nationalparks	.shp	National park
		\tz_forestreserves	.shp	Forest reserve
		\tz_gamereserves	.shp	Game reserve
		\tz_conservationareas	.shp	Conservation area
		\tz_landcover	.shp	Land cover
		\tz_landunits	.shp	Land unit
		\tz_soiltype	.shp	Soil type
		\tz_waterpotential	.shp	Water potential for irrigation
		\tz_landpotential	.shp	Land potential for irrigation
	\tz_sociopotential	.shp	Socio potential for irrigation	
	\tz_irrigationpotential	.shp	Irrigation potential	
	\tz_irrigationscheme	.shp	Irrigation Scheme	
	\zonal\zone	\zone_border	.shp	Zonal border
		\zone_regheadq	.shp	Zonal Headquarter
		\zone_region	.shp	Region border
		\zone_road	.shp	Road network
		\zone_railway	.shp	Railway network
		\zone_lakes	.shp	Lakes
		\zone_rivers	.shp	River
		\zone_rain	.shp	Rainfall
		\zone_agroecologicalzone	.shp	Agro-ecological zone
		\zone_protectedarea	.shp	Protected area
		\zone_nationalparks	.shp	National park
\zone_forestreserves		.shp	Forest reserve	
\zone_gamereserves		.shp	Game reserve	
\zone_conservationareas		.shp	Conservation area	
\zone_landcover	.shp	Land cover		
\zone_landunits	.shp	Land unit		
\zone_soiltype	.shp	Soil type		
\zone_waterpotential	.shp	Water potential for irrigation		
\zone_landpotential	.shp	Land potential for irrigation		
\zone_sociopotential	.shp	Socio potential for irrigation		
\zone_irrigationpotential	.shp	Irrigation potential		
\zone_irrigationscheme	.shp	Irrigation Scheme		

(continued)

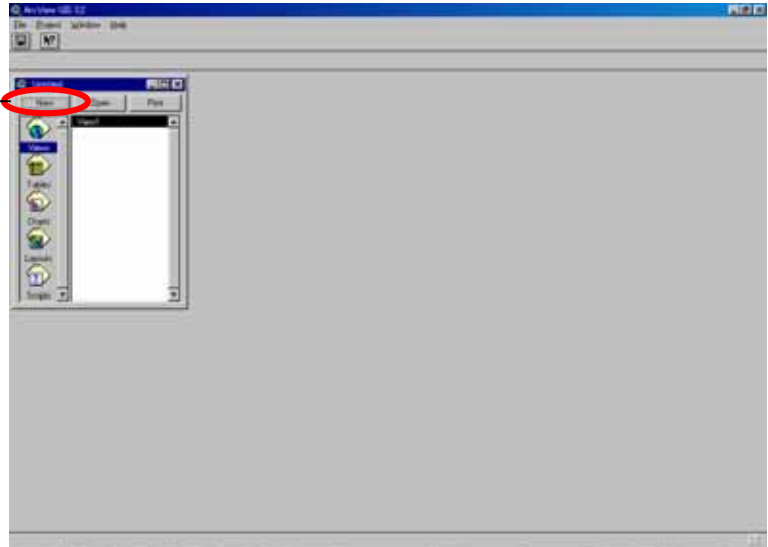
Main Directory	Sub-directories	File Name	Type	Contents
C:\irrigation_gis	<u>\regional\region</u>	\region_border \region_regheadq \region_dist \region_road \region_railway \region_lakes \region_rivers \region_rain \region_agroecologicalzone \region_protectedarea \region_nationalparks \region_forestreserves \region_gamereserves \region_conservationareas \region_landcover \region_landunits \region_soiltype \region_waterpotential \region_landpotential \region_sociopotential \region_irrigationpotential \region_irrigationscheme	.shp .shp	Regional outer border Regional Headquarter District border Road network Railway network Lakes River Rainfall Agro-ecological zone Protected area National park Forest reserve Game reserve Conservation area Land cover Land unit Soil type Water potential for irrigation Land potential for irrigation Socio potential for irrigation Irrigation potential Irrigation Scheme
	<u>\district\region\district</u>	\district_border \district_road \district_rivers \district_rain \district_agroecologicalzone \district_protectedarea \district_landcover \district_landunits \district_soiltype	.shp .shp .shp .shp .shp .shp .shp .shp .shp	District outer border Road network River Rainfall Agro-ecological zone Protected area Land cover Land unit Soil type
	<u>\legend</u>	\rain.avl \agroecologicalzone.avl \landcover.avl \soiltype.avl \waterpotential.avl \landpotential.avl \sociopotential.avl \irrigationpotential.avl	.avl .avl .avl .avl .avl .avl .avl .avl	Legend for rainfall Legend for agroecologicalzone Legend for land cover Legend for soil type Legend for water potential Legend for land potential Legend for socio potential Legend for irrigation potential

- (3) Operation of GIS
- (a) Basic operation of GIS (Arc View)
- (i) Add Theme to the View Screen

Add Theme

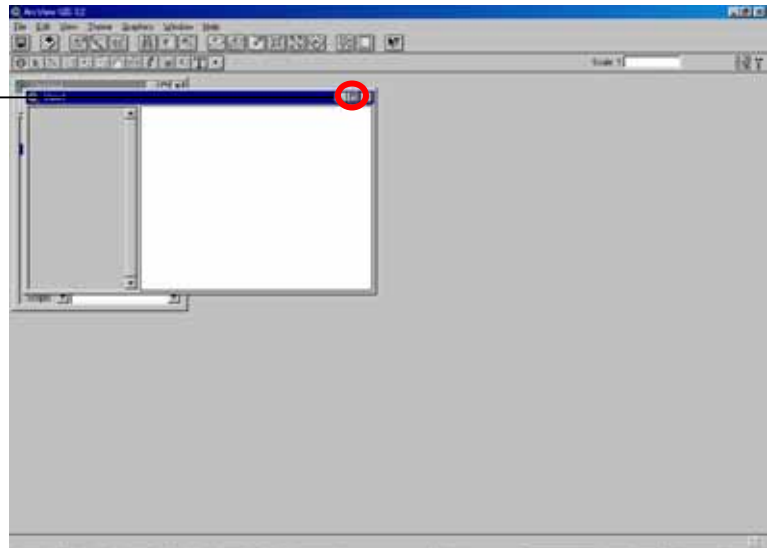
When the "theme" is added, Arc View accesses the database and shows the "theme" on the view screen.

(1) Click "New" to open View Screen



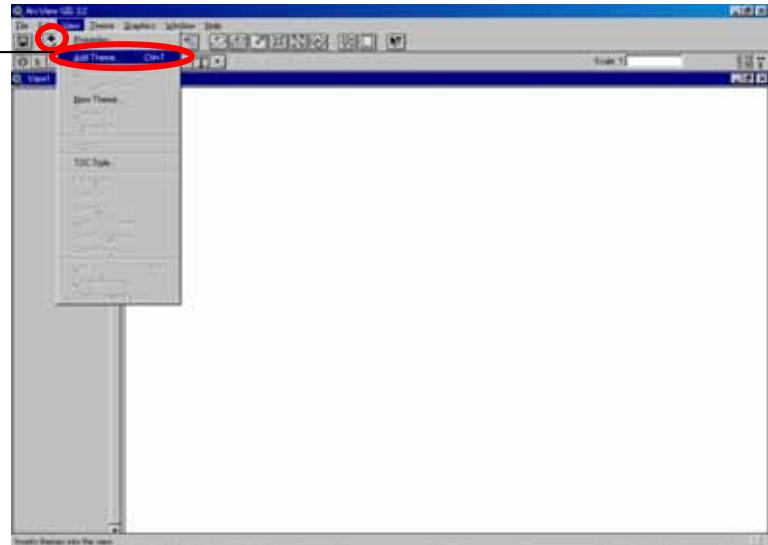
(2) View1 will be opened

(3) Click "Full Screen" button to enlarge View1

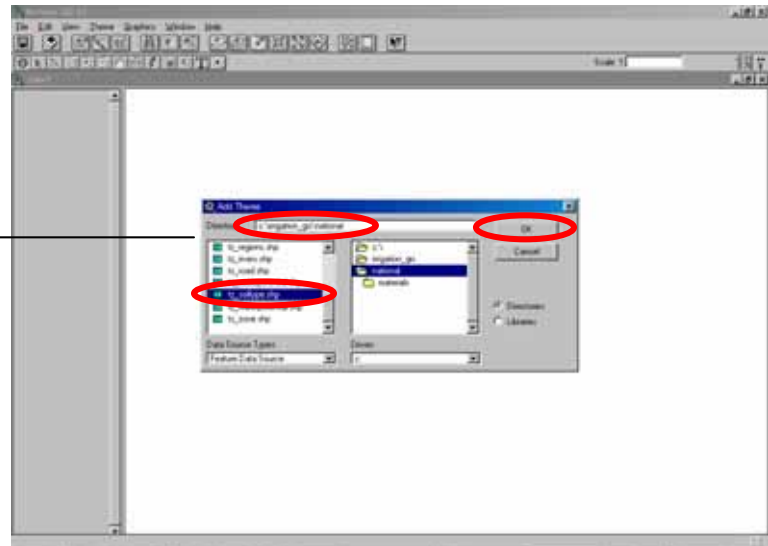


(4) View1 will be enlarged

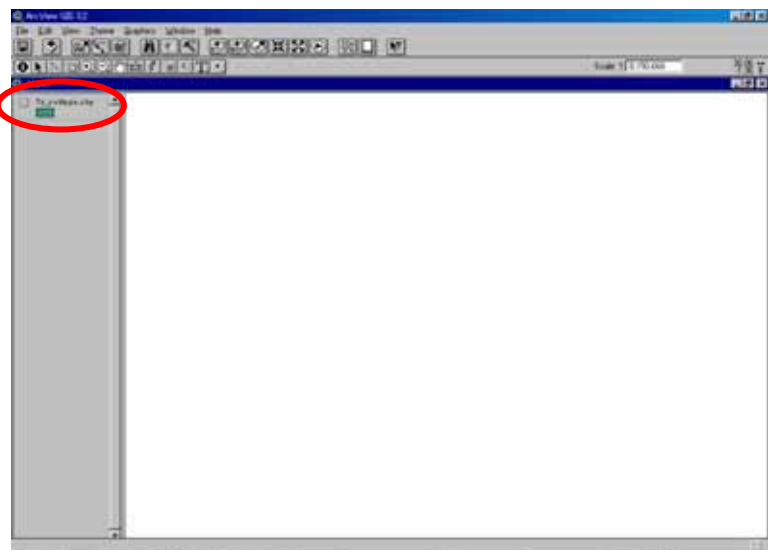
(5) Click "+" button
or select "Add
Theme"
from
View Menu



(6) Select target
"Theme" from
the directory
where the shape
files are stored

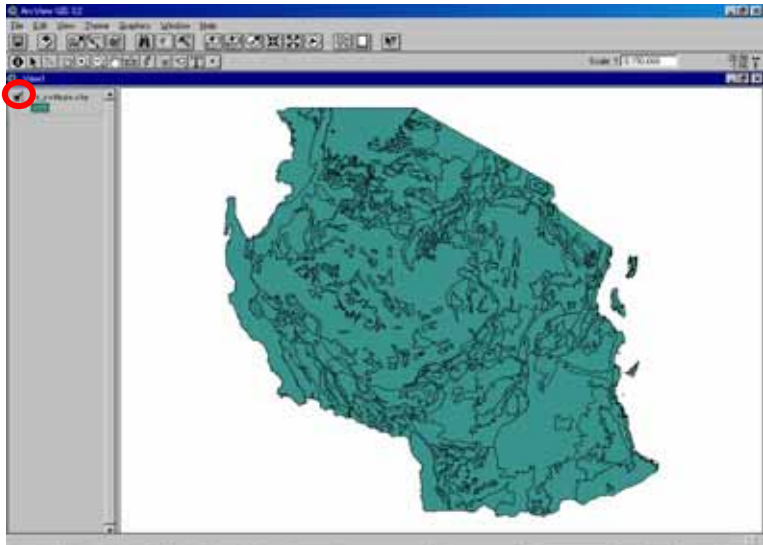


(8) When the target
"Theme" is
selected, click
"OK"



(9) Confirm the
target "Theme"
is located at the
legend position
of the View
Screen

(10) Click the check box of "Theme" to show the "Theme" on the View Screen



Utilization of readily available legend

For some themes, such as land cover and soil type, the ready-made legend can be utilized as shown below.

(1) Double click "Theme" added (Tz_soiltype for example)

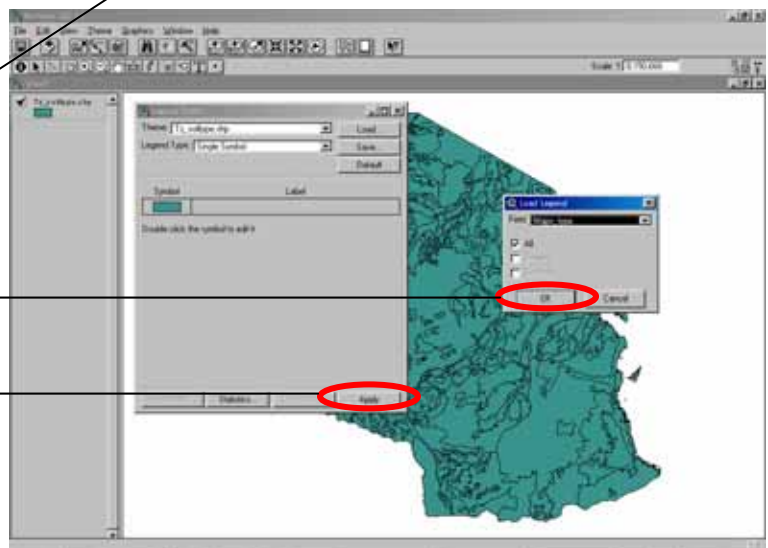
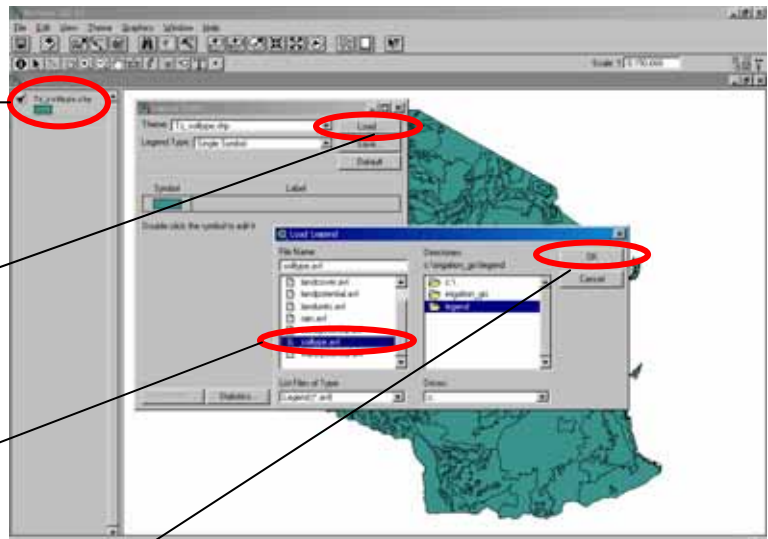
(2) Click "Load" in Legend Editor window

(3) Select "soiltype.avl" in Load Legend window

(4) Click "OK"

(5) Click "OK" in Load Legend window

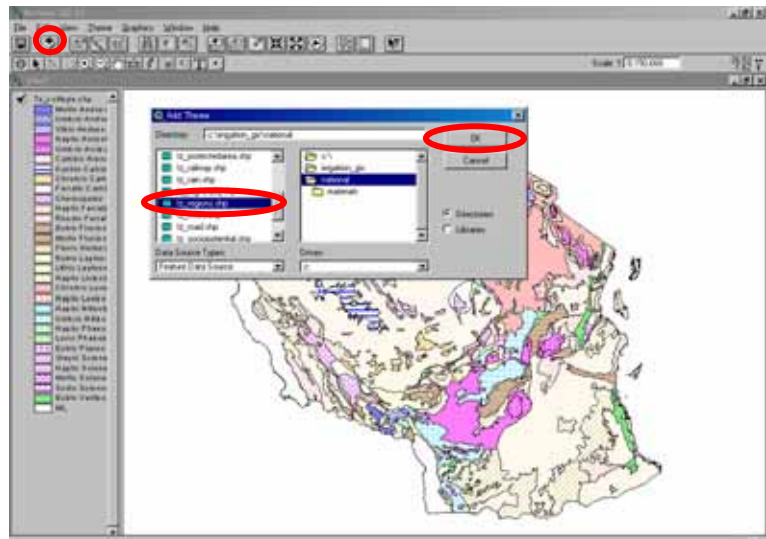
(6) Click "Apply" in Legend Editor window



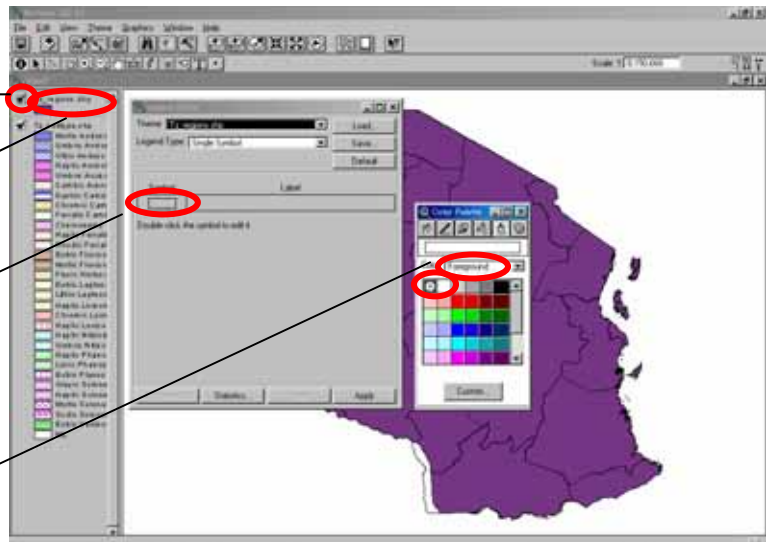
Add Another "Theme"

In addition to Tz_soiltype.shp, Tz_regions.shp can be added to the same view screen in order to show the border of regions on the map of soil type.

(1) *Tz_regions.shp* will be added in the same manner mentioned above



(2) Click the check box of "Theme" to show the "Theme" on the View Screen



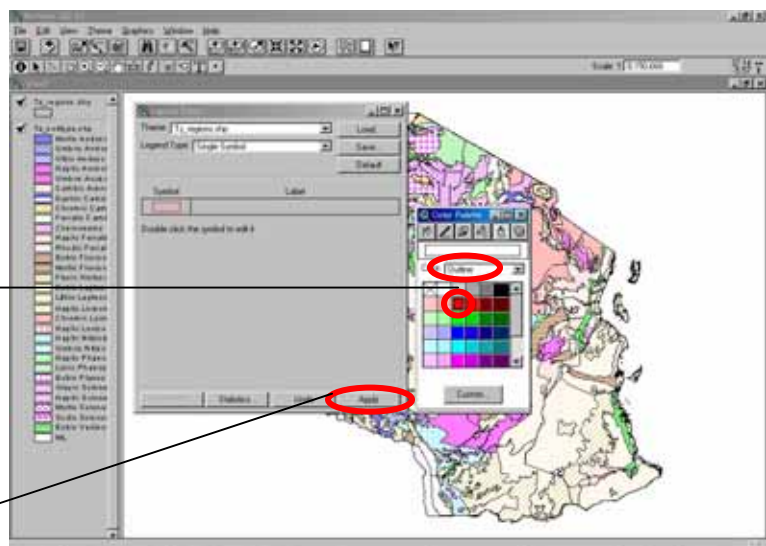
(3) Double click "Theme" to get legend editor

(4) Double click "Symbol" to edit legend

(5) Select "Foreground" and click white and X to show only border

(6) Select "Outline" and click red to show the border in red color

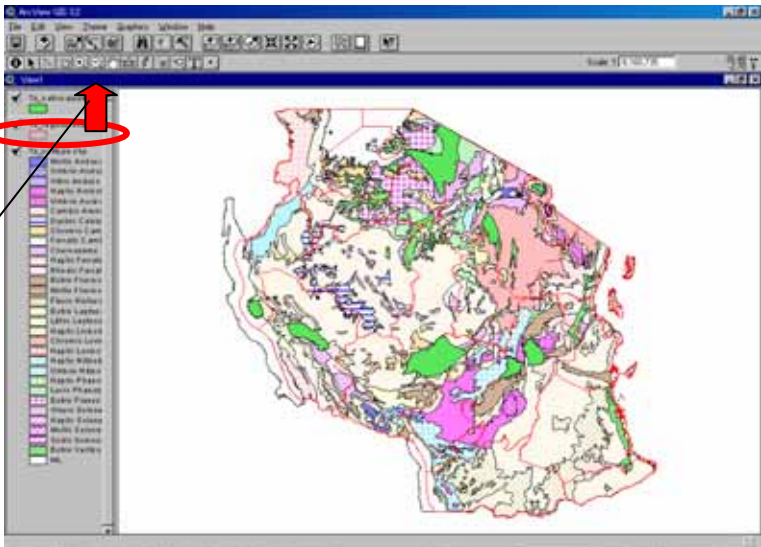
(7) Click "Apply" to show the result on screen



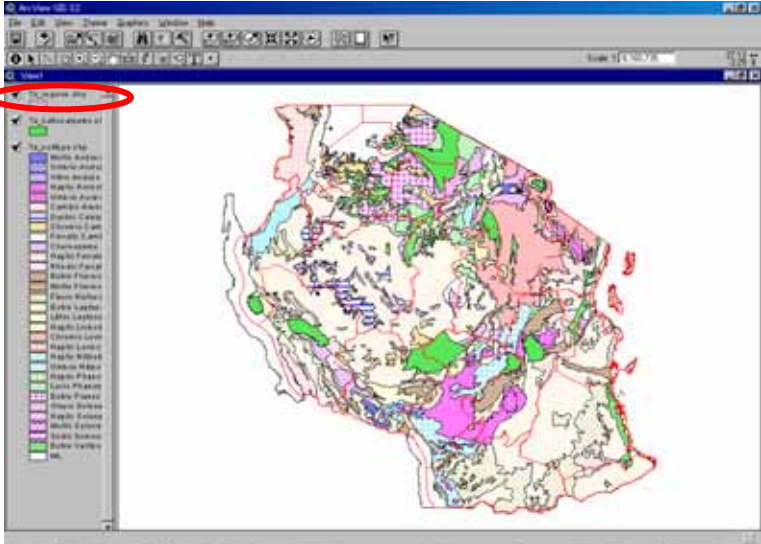
Arrangement of Themes

Add another theme of Tz_nationalparks.shp and arrange themes.

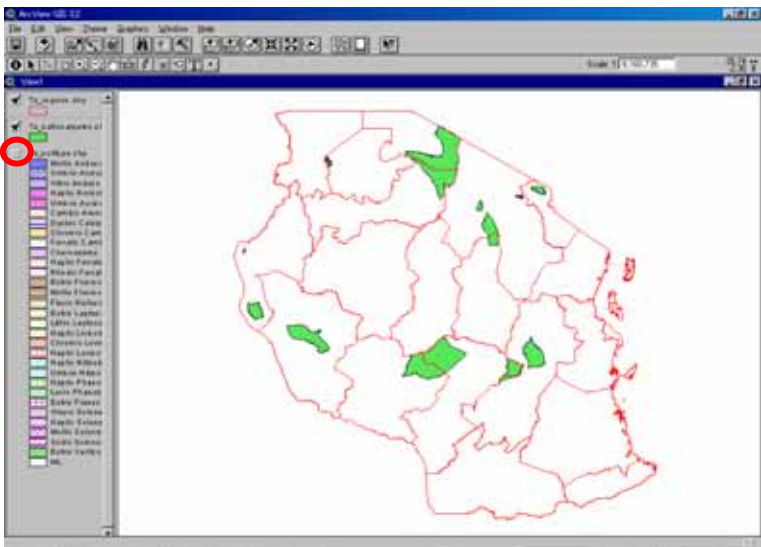
(1) National parks will be shown on the boundary of the region



(2) In order to show the boundaries of the region, activate Tz_regions.shp and drag to the top of the list



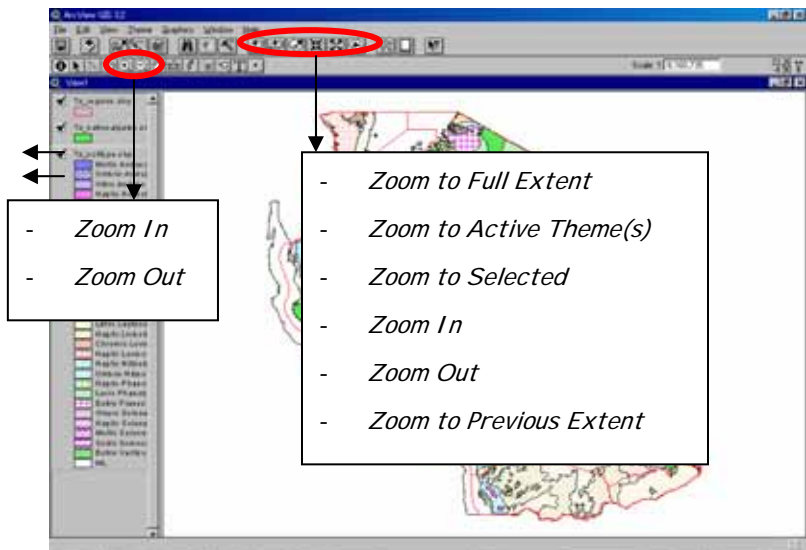
(3) Boundary of the region is shown on National Parks and National Parks are shown on Soil Types



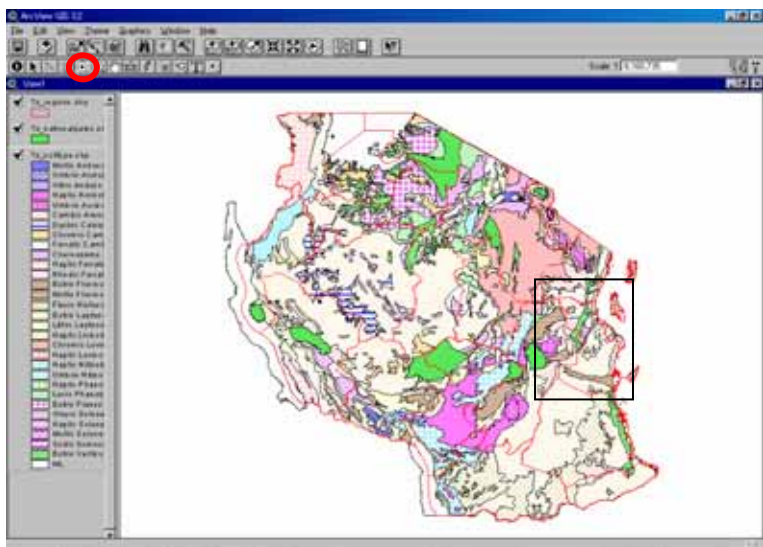
(4) Display can be turned off for unnecessary theme(s) by removing the check mark from check box

Other view controls such as zoom in and zoom out

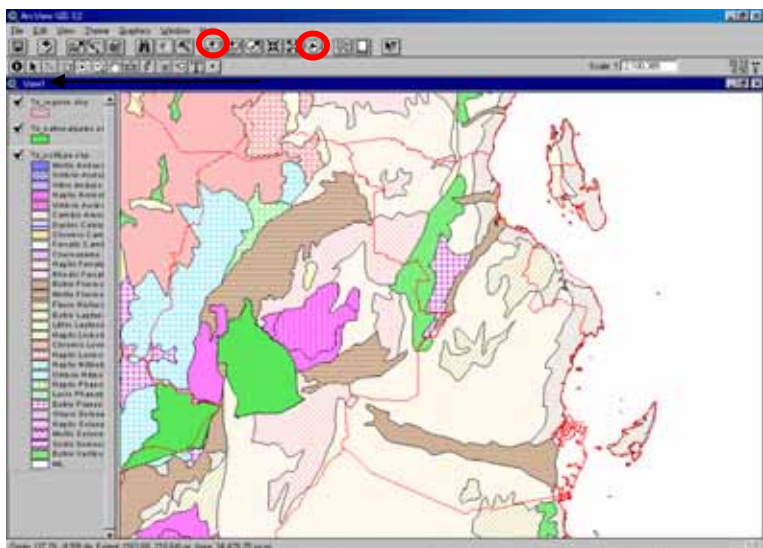
The following buttons can be used to zoom in, zoom out and for other functions.



(1) Click "Zoom In" button and select the area to be enlarged, for example, Coast Region



(2) The selected area will be enlarged, for example, to show the details of Coast Region



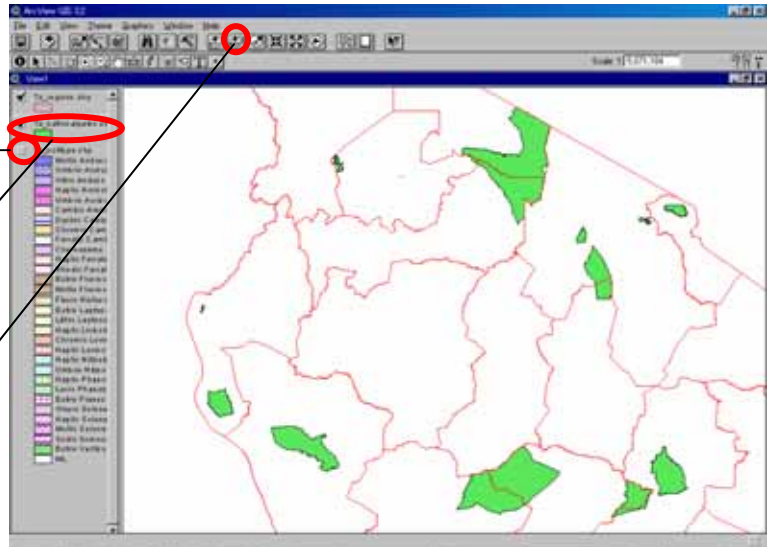
(3) Return to the previous extent by clicking "Zoom to Full Extent" or "Zoom to Previous Extent"

To show the distribution of national parks in different regions, the following arrangement can be carried out.

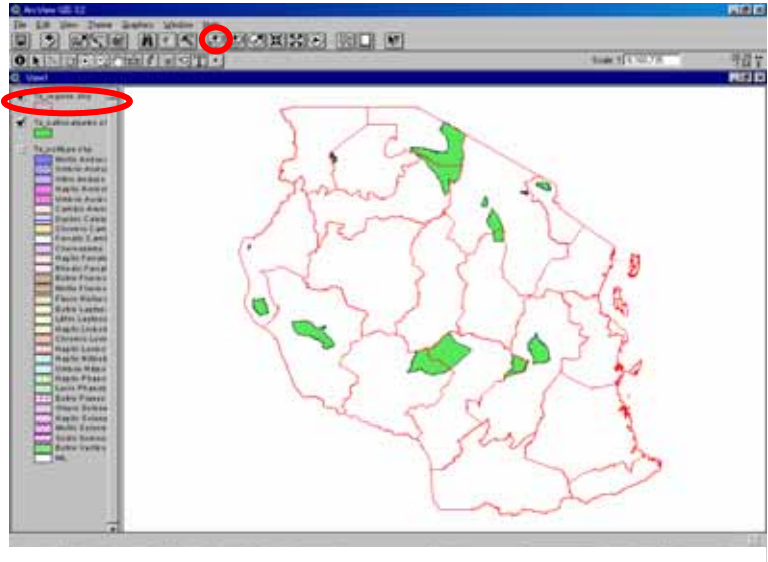
(1) Remove check mark from soil type

(2) Activate National Parks Theme

(3) Click "Zoom to Active Theme"



(4) Return to the previous extent by activating the regions theme and clicking "Zoom to Full Extent"



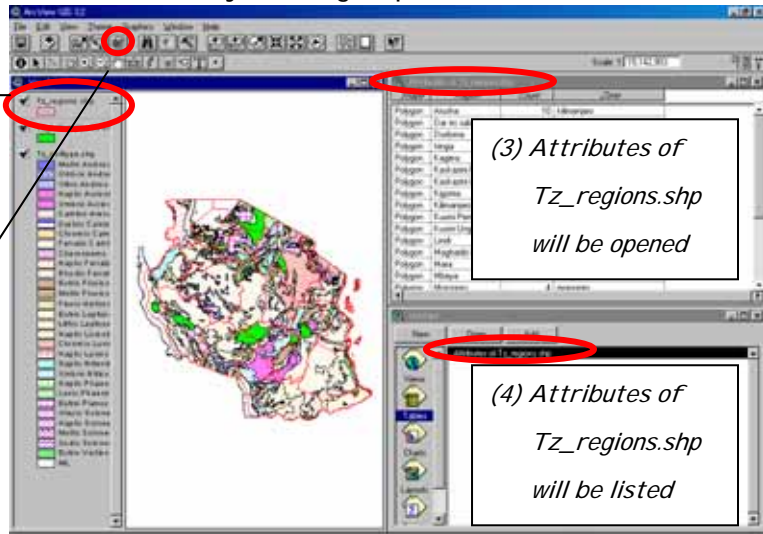
(ii) Theme Tables

Open Theme Table

Theme table can be shown on screen by clicking "Open Theme Table" button.

(1) Activate the theme for example *Tz_regions.shp*

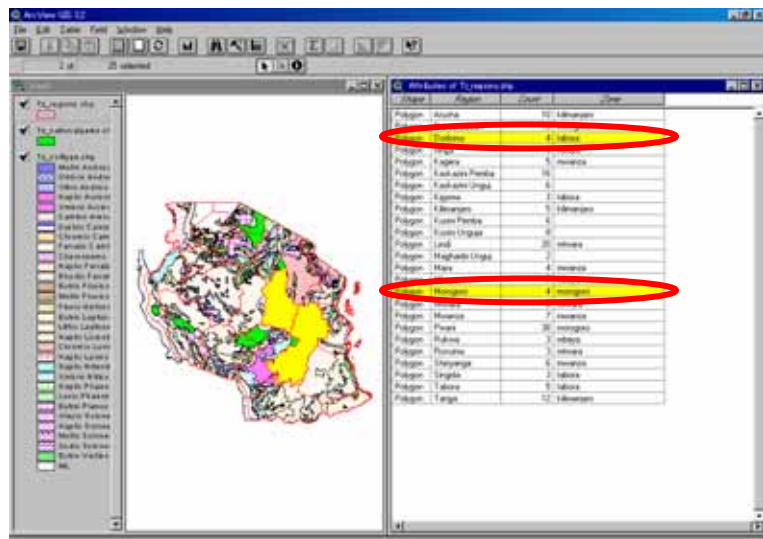
(2) Click "Open Theme Table" button



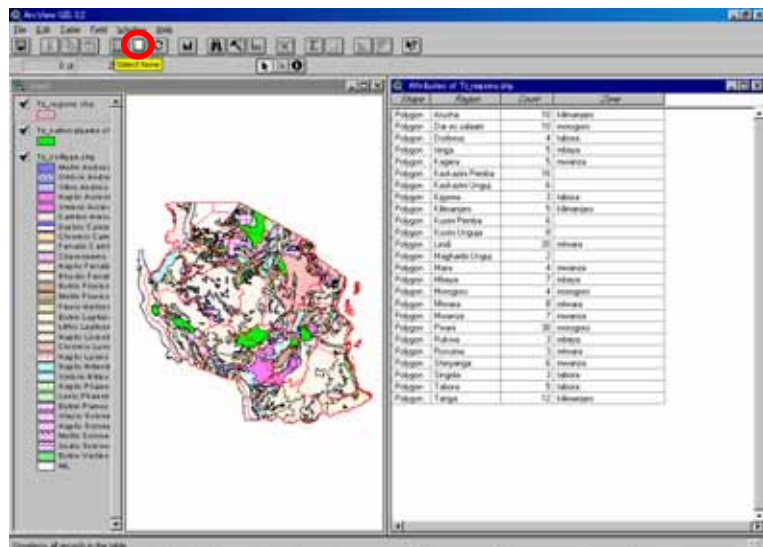
(5) Click any polygon in the table

(6) The selected polygon will be highlighted in the map

(7) More than one polygon can be selected with Shift Key

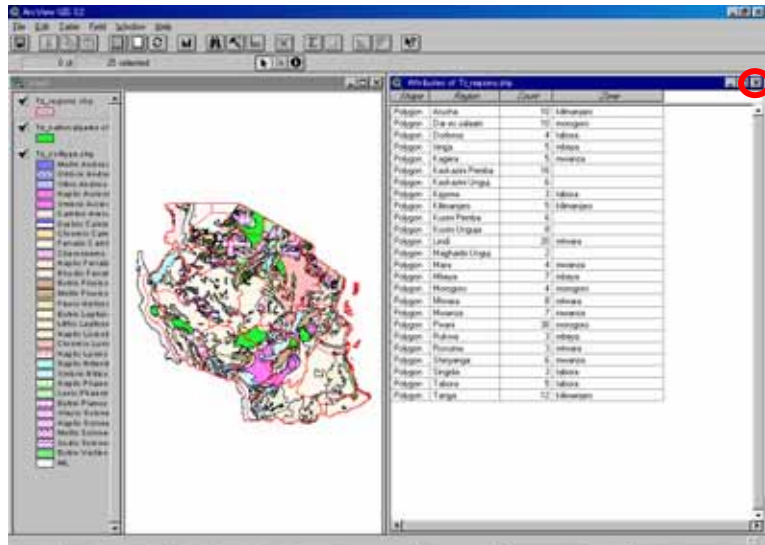


(8) Selected polygons can be cancelled by clicking "Select None" button



Close Theme Table

Theme table can be closed by clicking the close button of the table window.



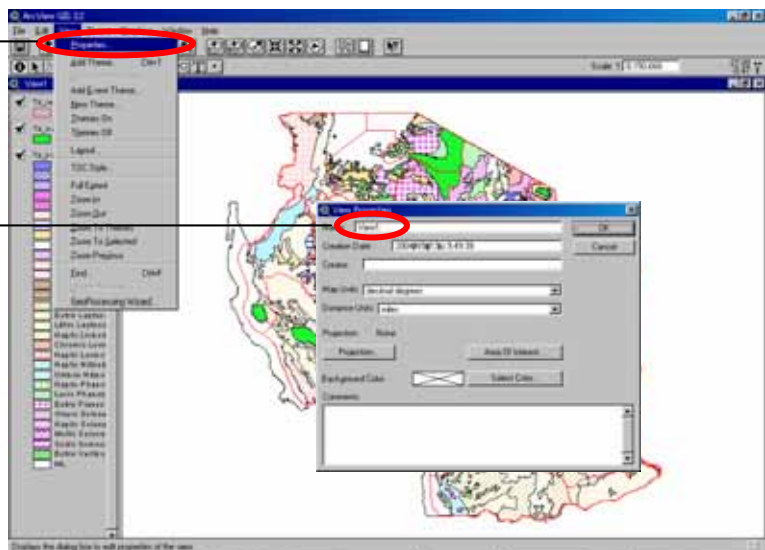
(iii) Project

Change View Name

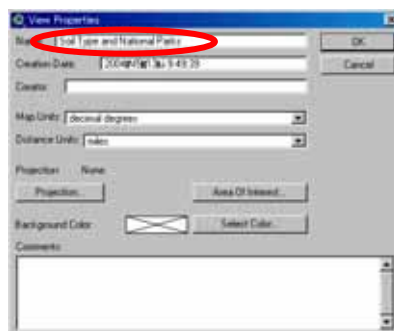
View name can be changed from the temporary name of "View1".

(1) Select
"Properties"
from View Menu

(2) Type appropriate
name instead of
View1



(3) "Soil Type and
National Parks"
for example



Save Project

Created set of data can be stored as Project Files.

(1) Select "Save Project As" from File Menu

(2) Select suitable directories

(3) Type appropriate name instead of Proj1

(4) "lesson1" for example

The first screenshot shows the ArcView 3.2a interface with the 'Save Project As' dialog box open. The 'File Name' field contains 'proj1.apr' and the 'Directories' list shows 'c:\irrigation_gis' selected. The second screenshot shows the 'File Name' field changed to 'lesson1.apr' and 'irrigation_gis' selected in the 'Directories' list.

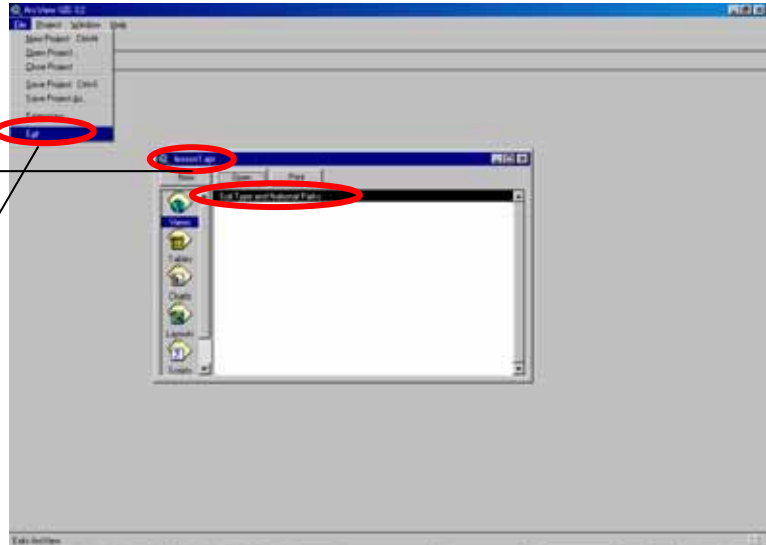
Close Project

(1) Close View by clicking close button of view screen

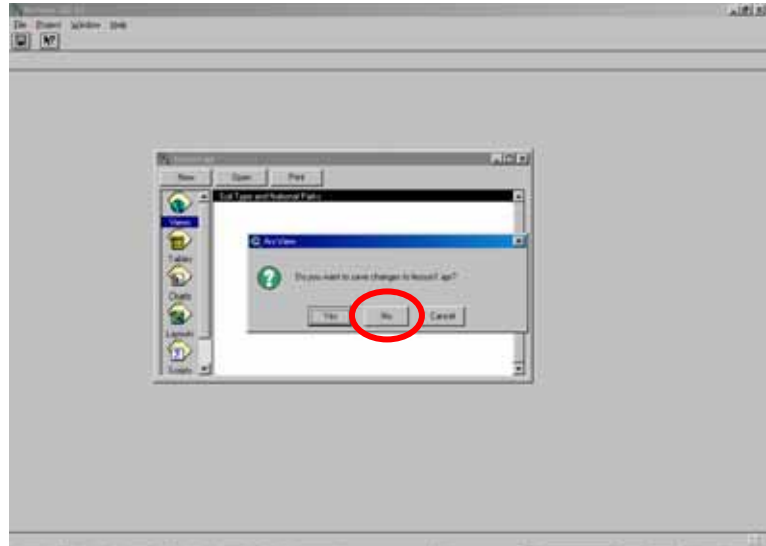
The screenshot shows the ArcView 3.2a interface with the main map view. The close button (X) in the top right corner of the map window is circled in red.

(2) Confirm "View Name" and "Project Name"

(3) Select "Exit" from File Menu



(4) Select "No" if there is no change



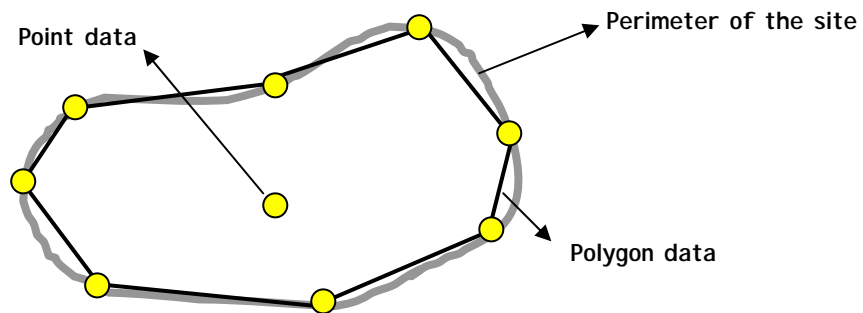
Open Project

Once the project file is saved, this project file can be opened by simply double clicking the icon of this file.

(b) Plotting the Location of a Proposed Irrigation Site on the GIS

(i) Collect coordinate data of proposed irrigation site by GPS

Since the unit of available map data is decimal degree, the location of the proposed irrigation site should be collected in the form of degree and minute (ddd°mm.mmm'). If coordinates for several points on the perimeter of the site are obtained, polygon data can be created instead of point data for the proposed site.



(ii) Prepare DBF file of proposed irrigation site

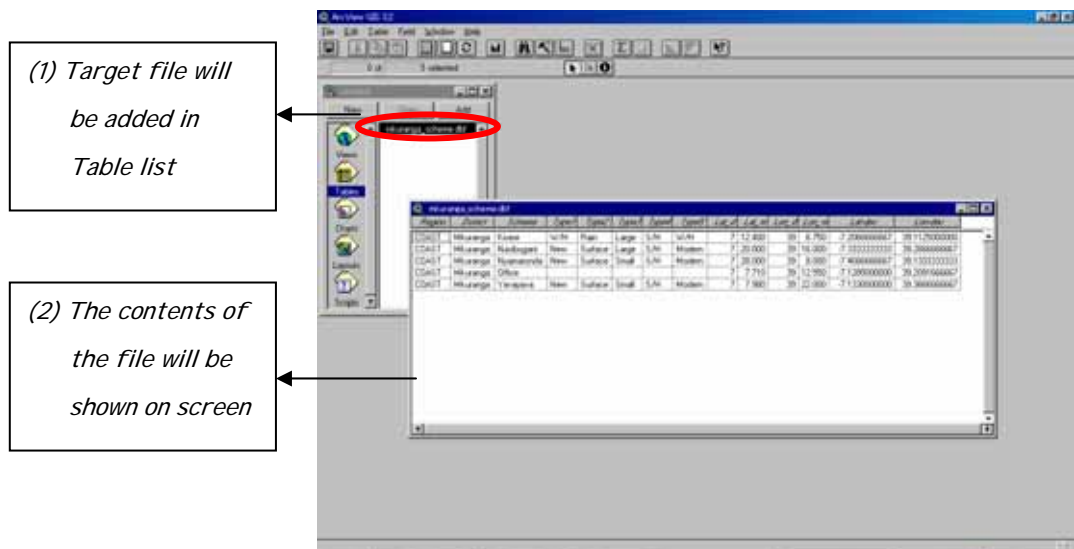
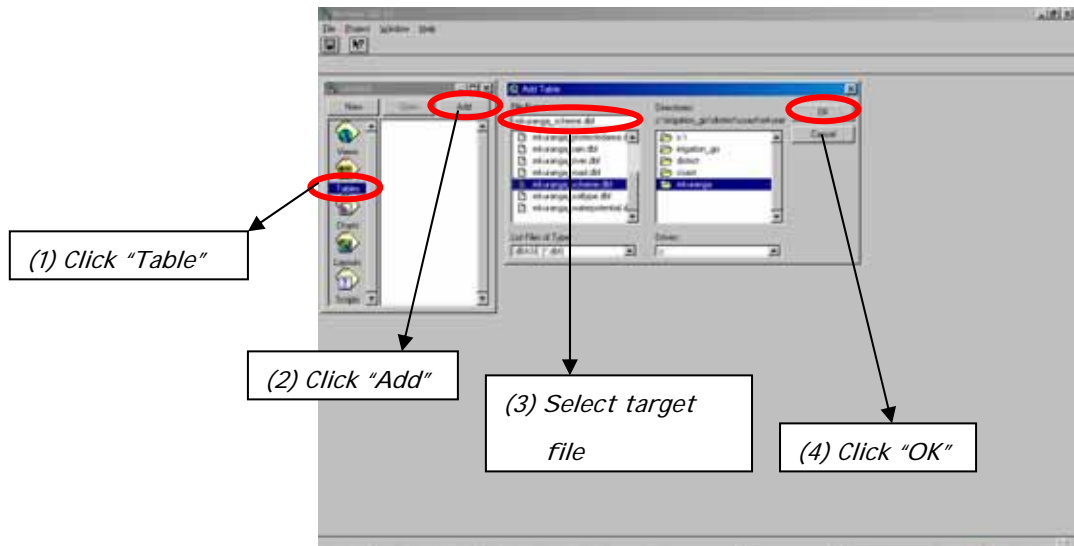
Coordinate data collected should be recorded as an Excel file that also includes other data for the proposed site. Otherwise, the necessary data including coordinate data should be derived from the "Irrigation Database" mentioned previously. Coordinate data should be converted to decimal degree and then this file should be saved as DBF file (see sample file: Mkuranga_Scheme.dbf).

(1) Conversion:
 $lat_dec = -1 * (lat_d + lat_m / 60)$
 $lon_dec = (lon_d + lon_m / 60)$

(2) Save as:
Save as Type =
DBF4

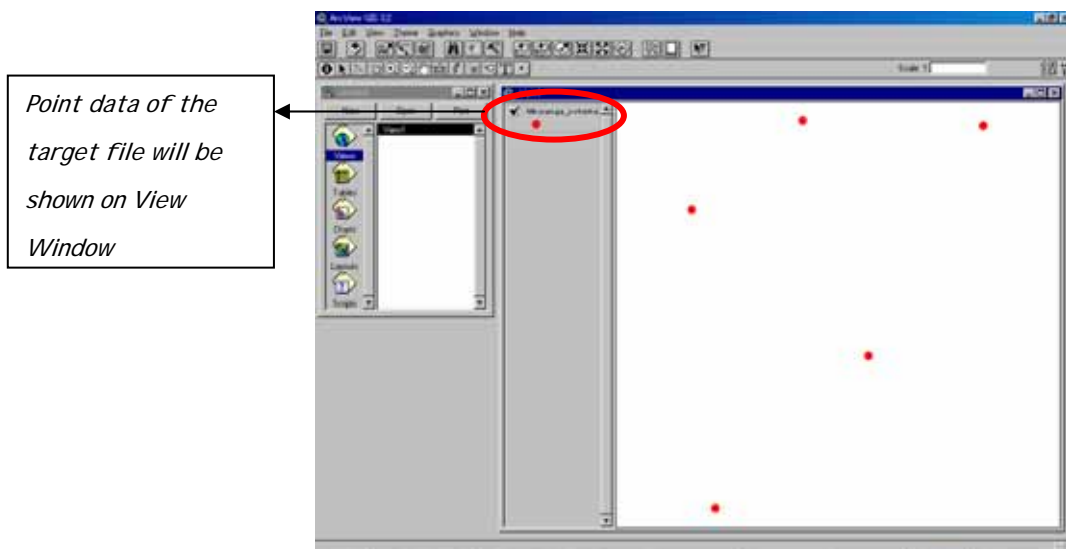
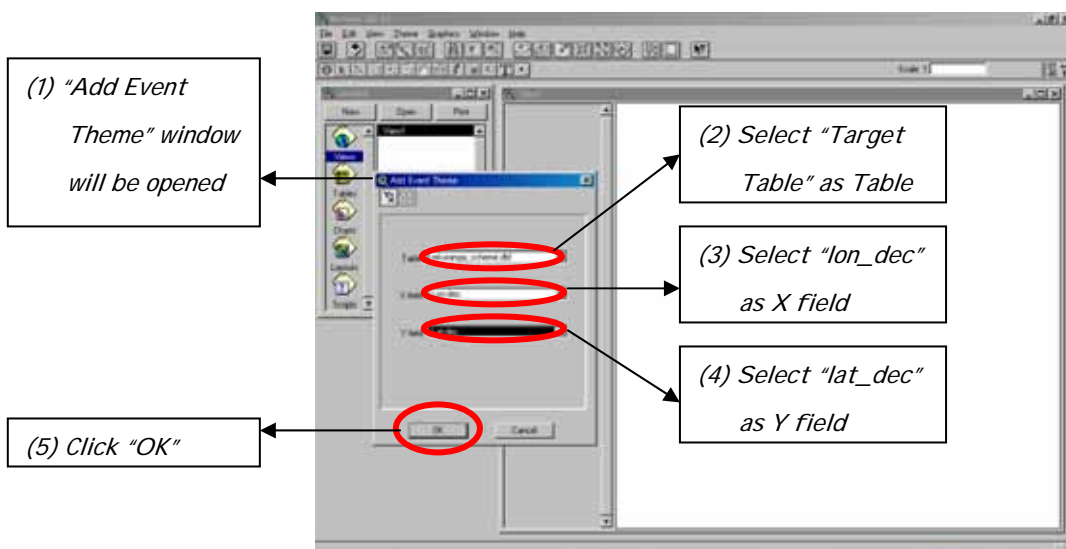
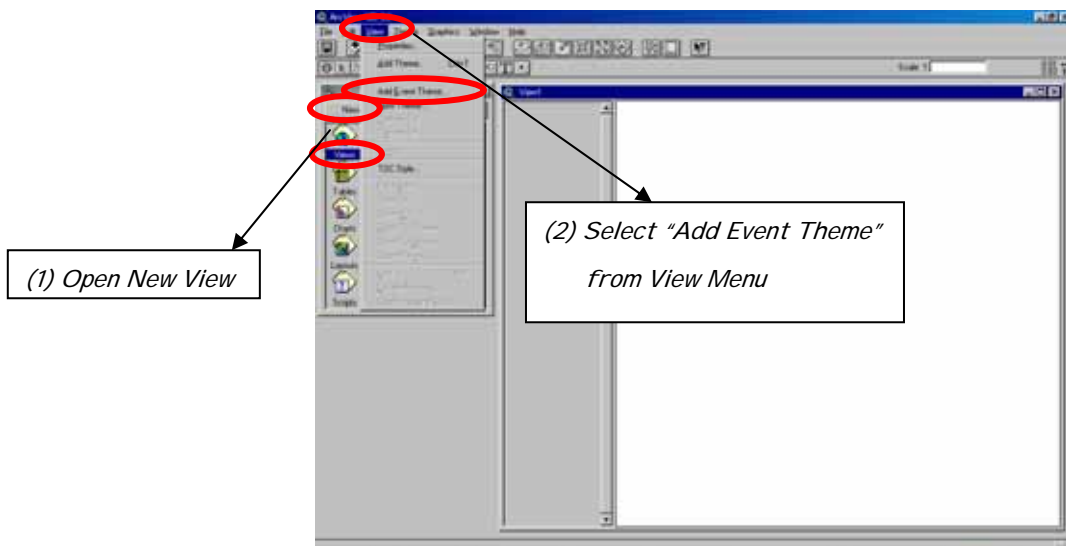
(iii) Add DBF file on GIS

Open Arc View and add DBF file prepared by clicking the button as shown below. Target file (Mkuranga_Scheme.dbf) will then be added to the Table list of Arc View and the contents of dbf file will be shown.



(iv) Show Point Data on Screen

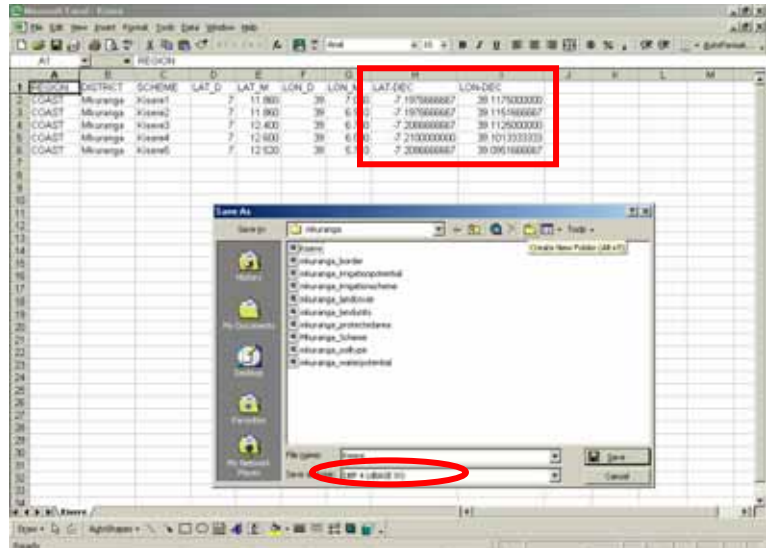
Open new view and show the point data of the target file by using the function of "Add Event Theme" from View window in the following manner.



(v) Preparation of Polygon Data

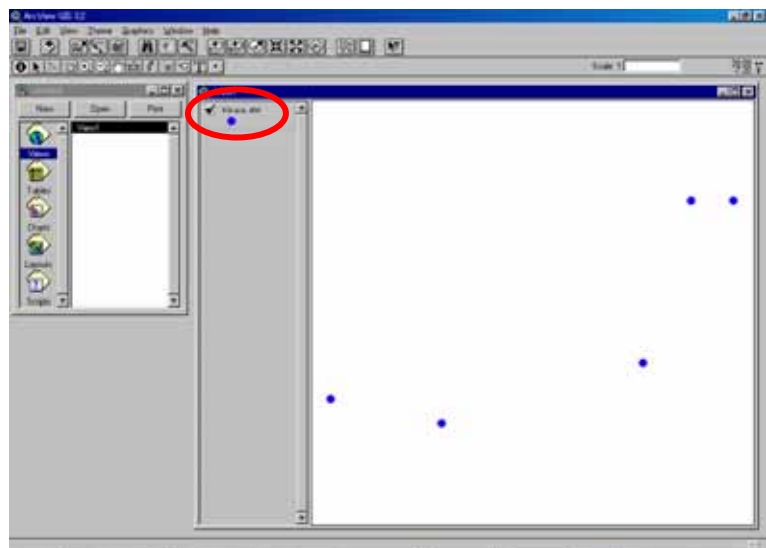
Prepare DBF file for the point data along the perimeter of the scheme and show those point data on screen through the same process described in preceding steps (i) to (iv), (see sample file: Kisere.dbf).

- (1) Data Input
- (2) Data Conversion
- (3) Save as DBF4

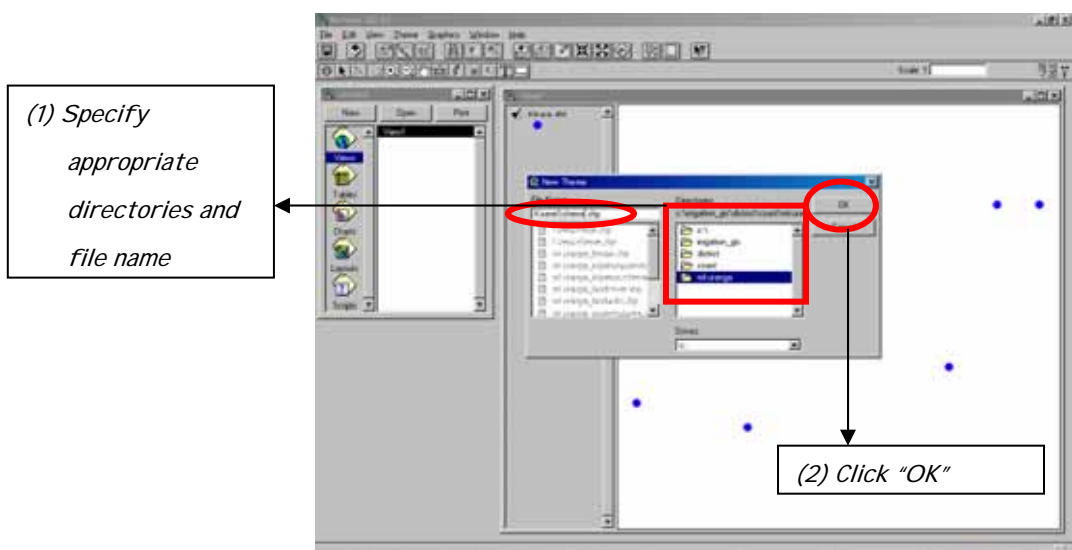
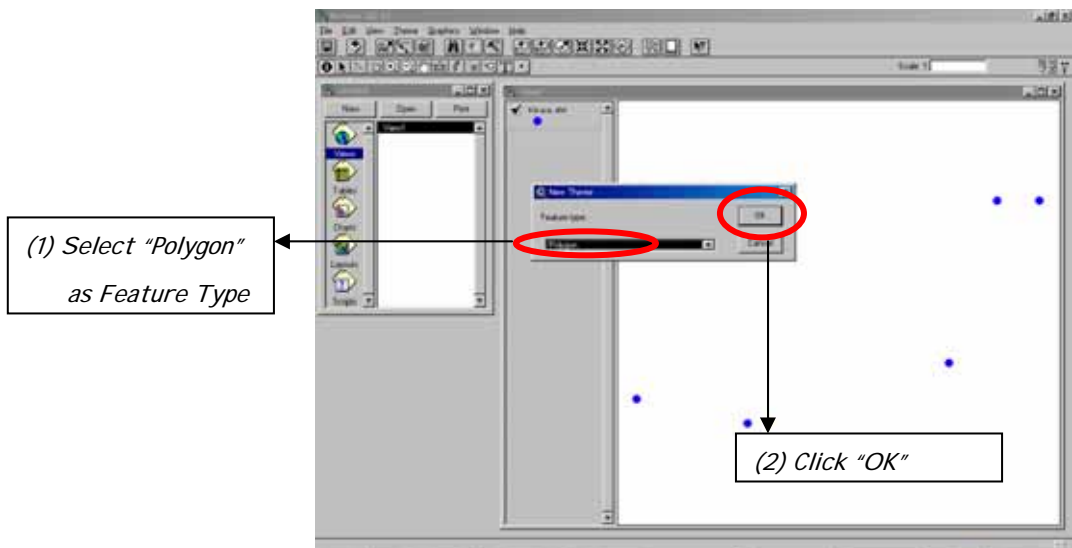
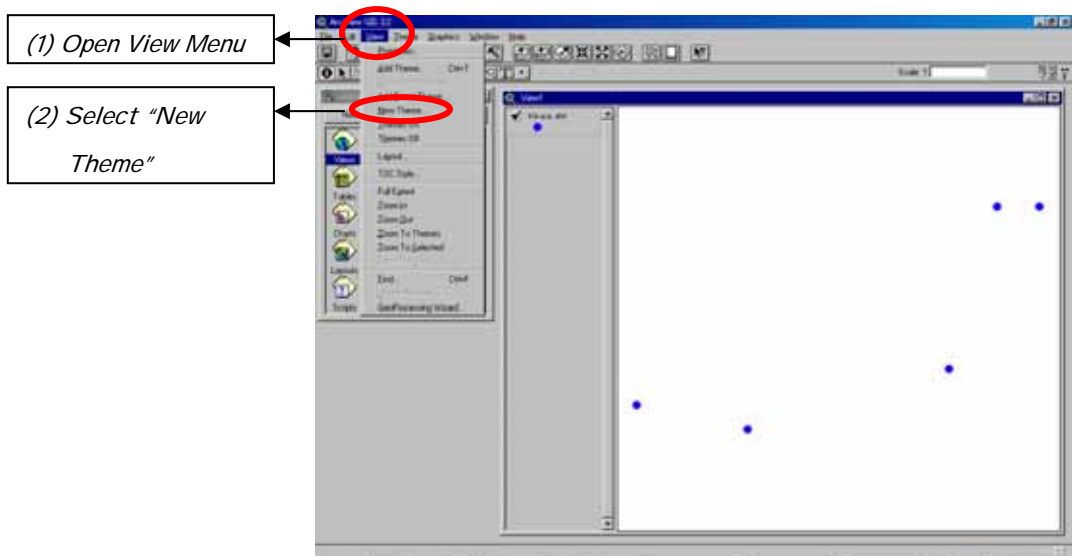


Same Process of (i) to (iv)

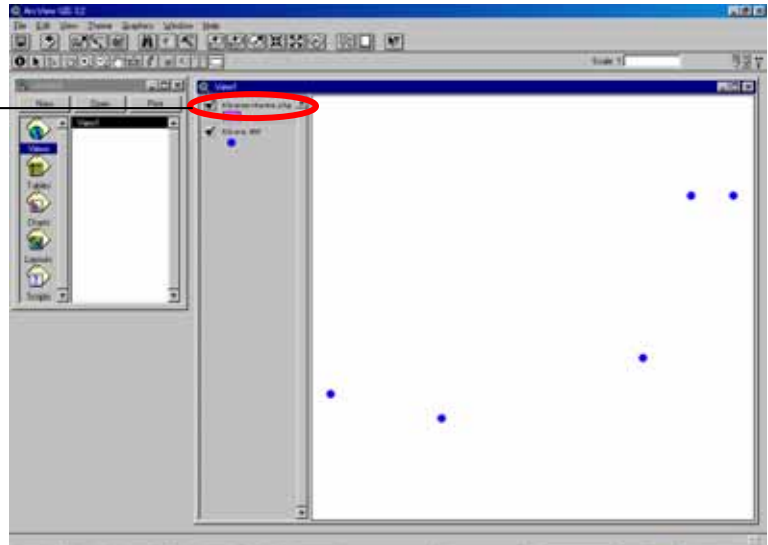
Point data of the target file will be shown in the View Window



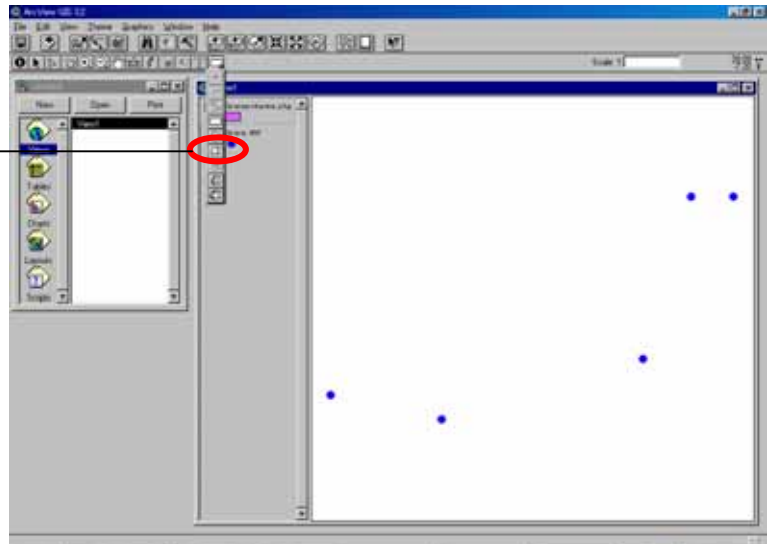
Create Polygon data by connecting the point data by using the function of "New Theme" (Feature type is Polygon) in the following manner.



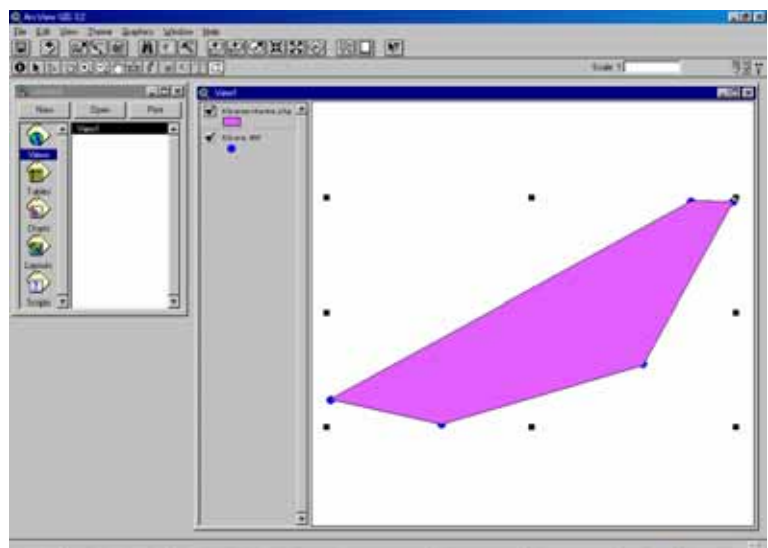
Shape file is automatically shown and ready for editing



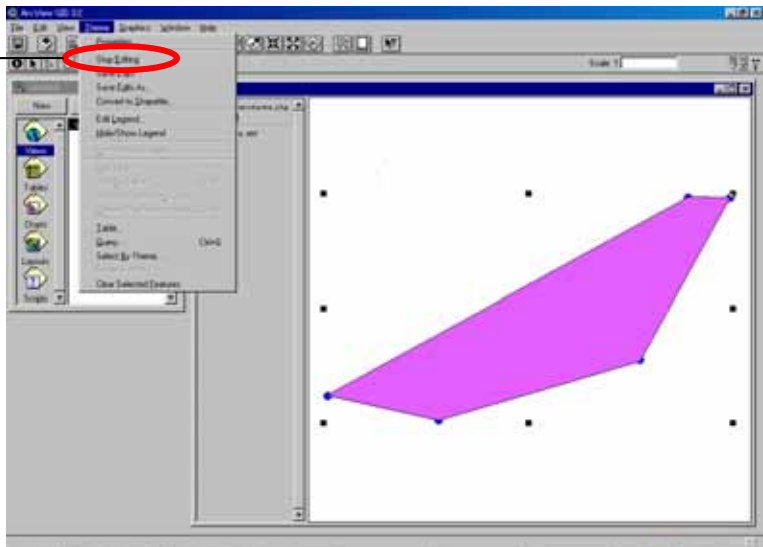
Select "Draw Polygon" from Drawing Menu



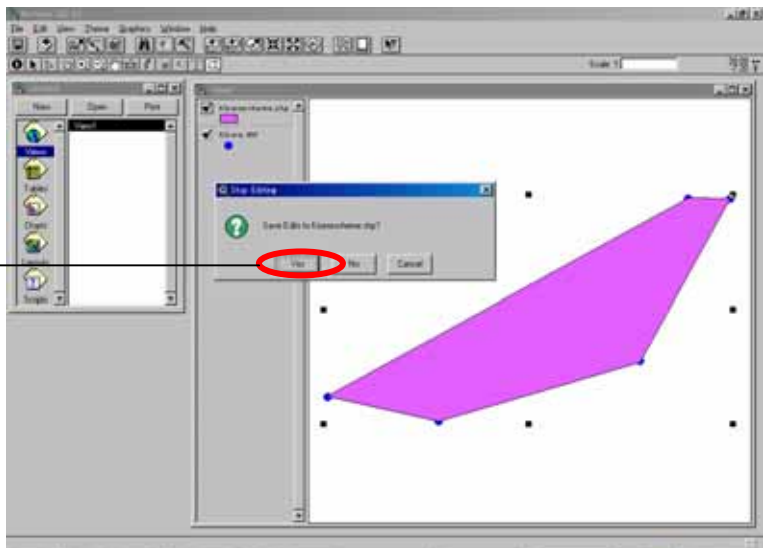
Draw polygon by clicking point data one by one and complete by double click



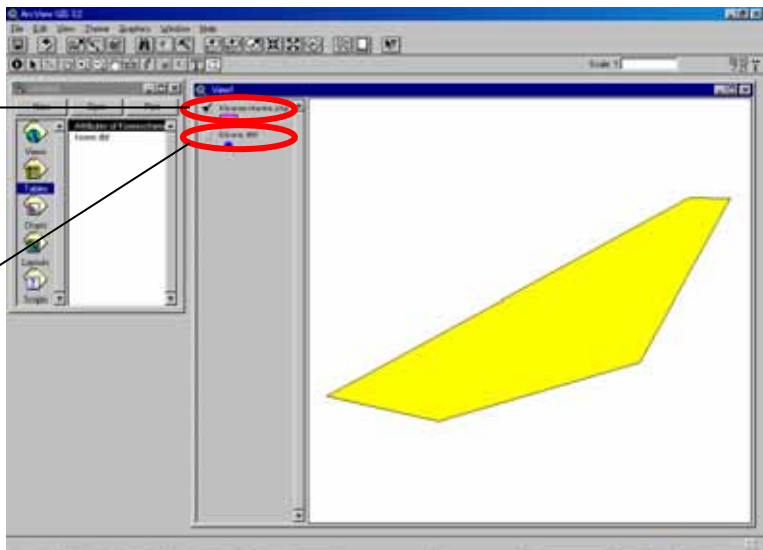
Stop editing by selecting "Stop Editing" from Theme Menu



Click "Yes" for save Edit



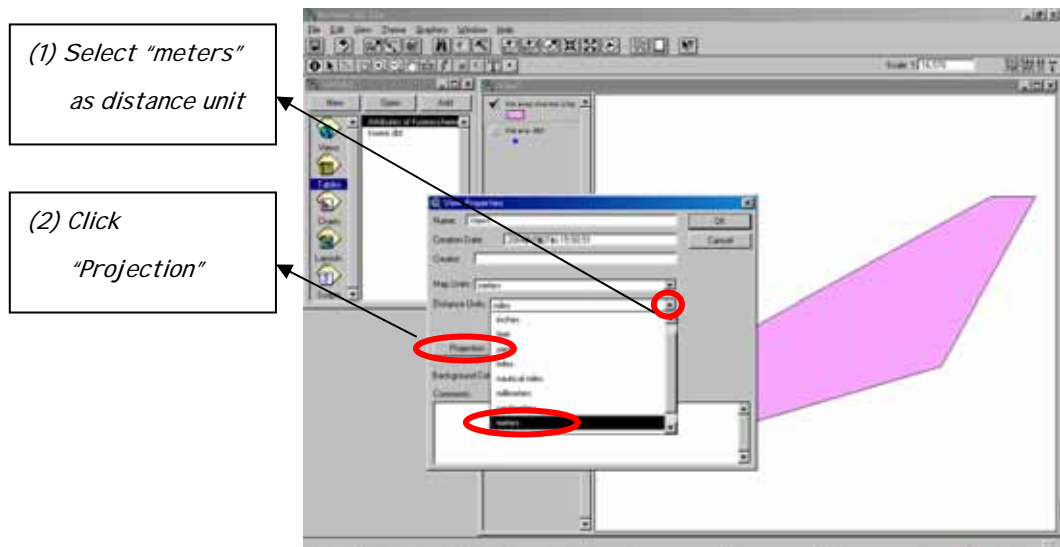
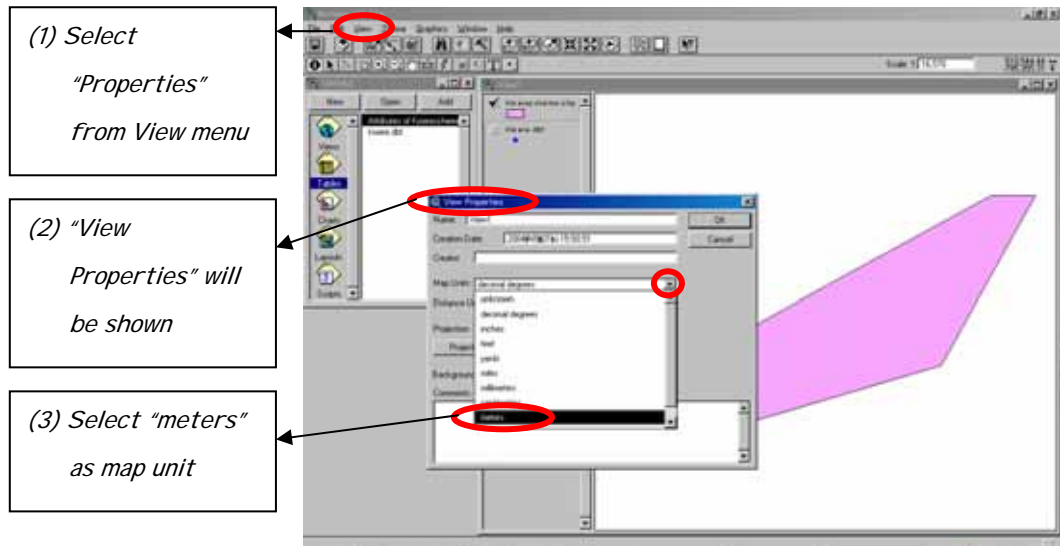
(1) Shape file of Polygon is successfully created



(2) Remove check from DBF theme to show only the polygon on screen

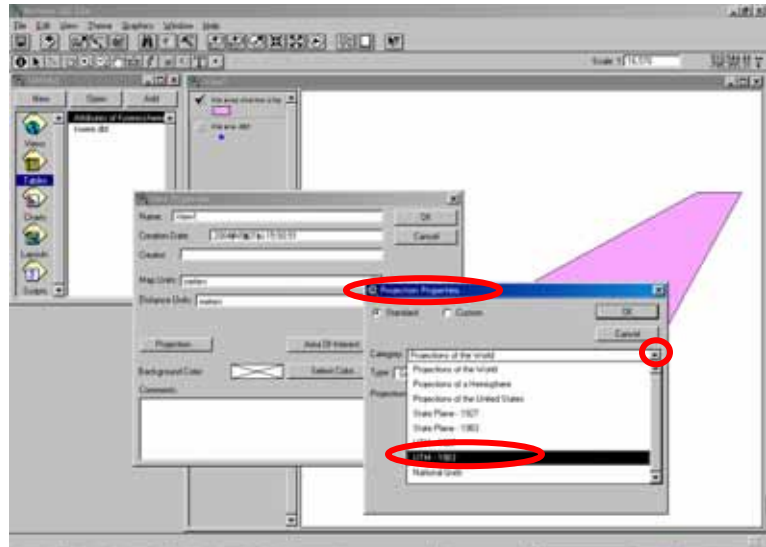
(vi) Area Size Calculation of Polygon Data

In order to calculate the area size of a newly created polygon, the map should be projected to give proper length. The area size will then be calculated in the following manner.



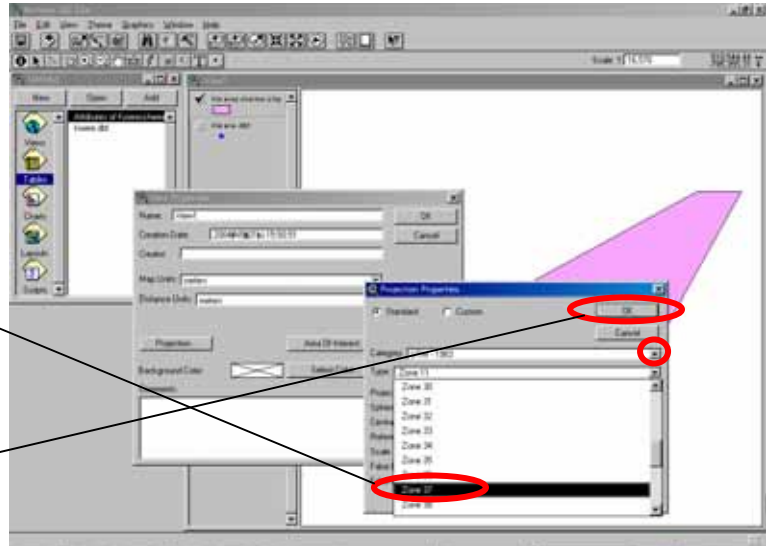
(1) "Projection Properties" will be shown

(2) Select "UTM-1983" as Category

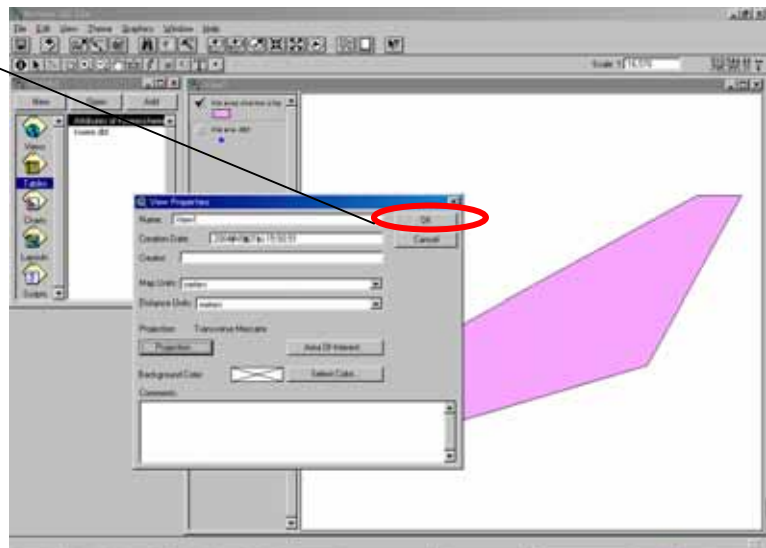


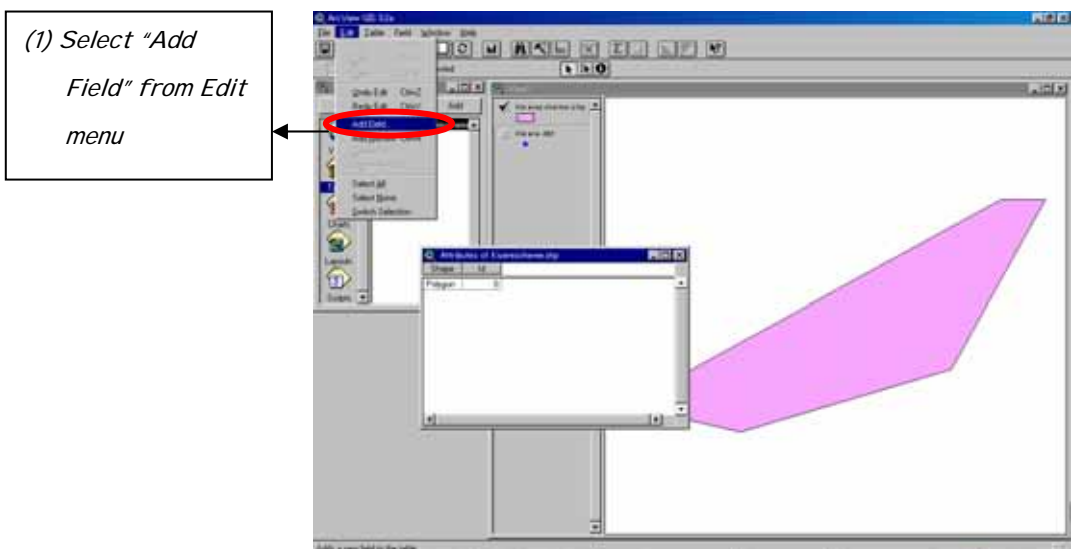
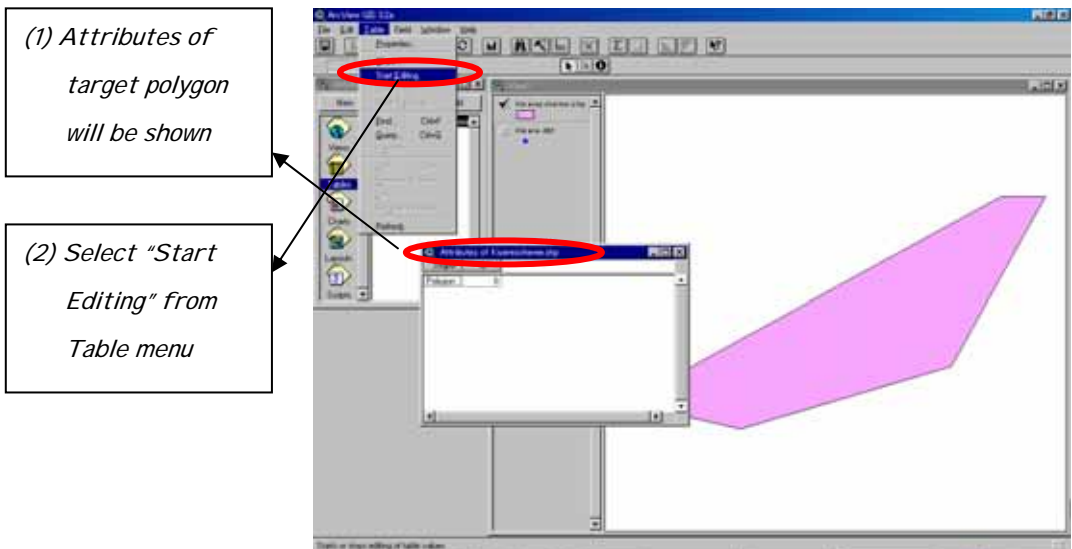
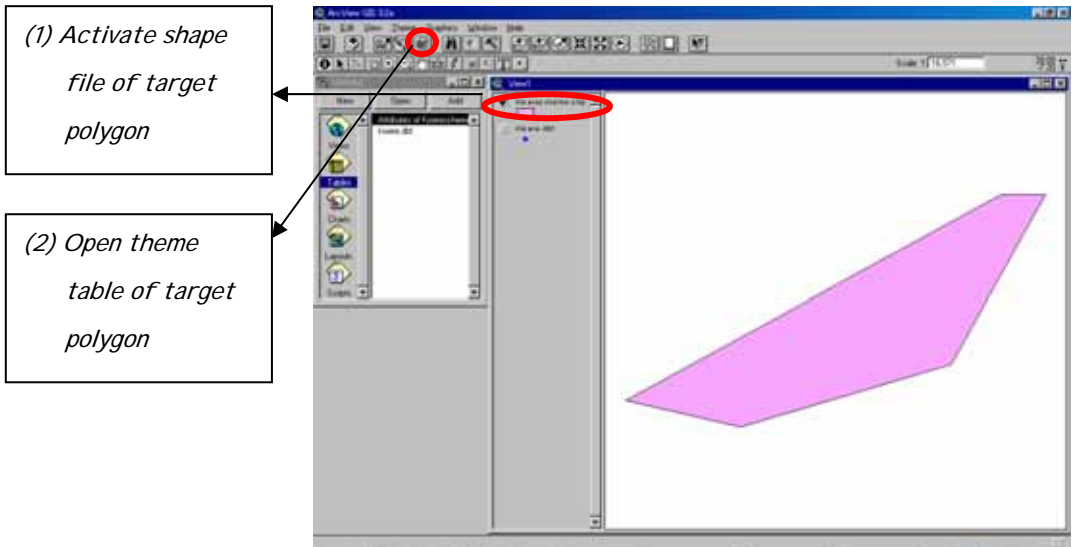
(1) Select "Zone 36" for the area of longitude 30-36 or "Zone 37" for the area of longitude 36-42 as Type

(2) Click "OK"



(2) Click "OK"





(1) "Field Definition" will be shown

(2) Type the name of the field ("Area" for example)

(3) Arrange width and decimal if necessary

(4) Click "OK"

(1) New field "Area" will be added

(3) Confirm "Area" field is activated

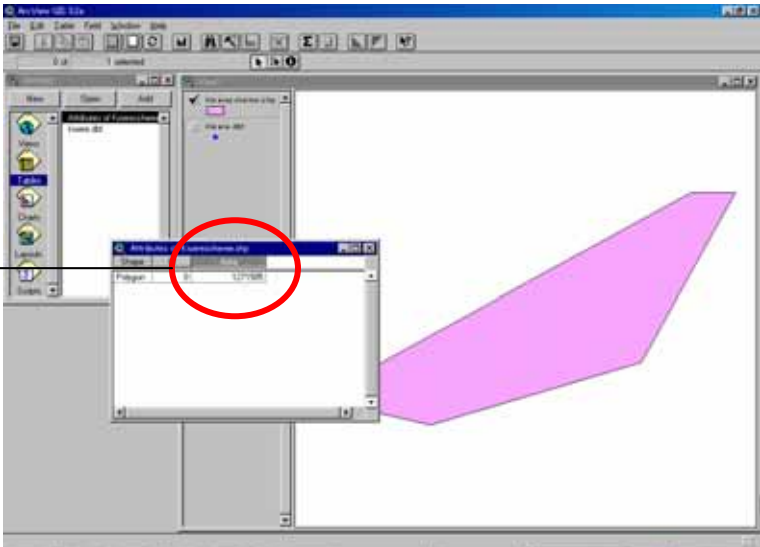
(4) Click "Calculate"

(1) "Field Calculator" will be shown

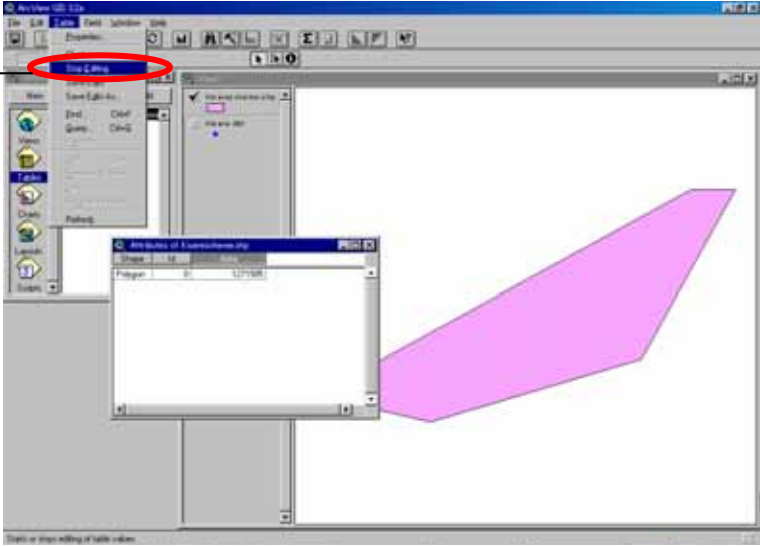
(2) Type [Area]=[Shape].ReturnProjected (av.FindDoc ("View1").GetProjection).ReturnArea

(3) Click "OK"

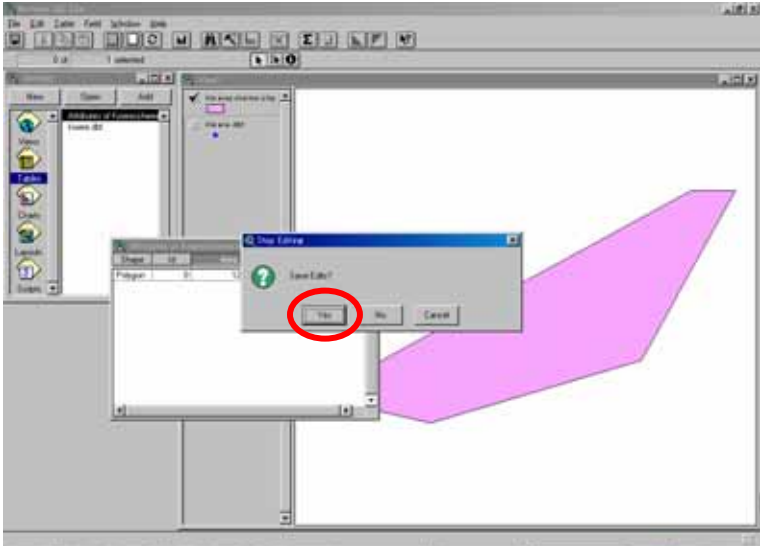
(1) The result of calculation is now shown in the field of area (Unit is square meter)



(1) Select "Stop Editing" from Table menu



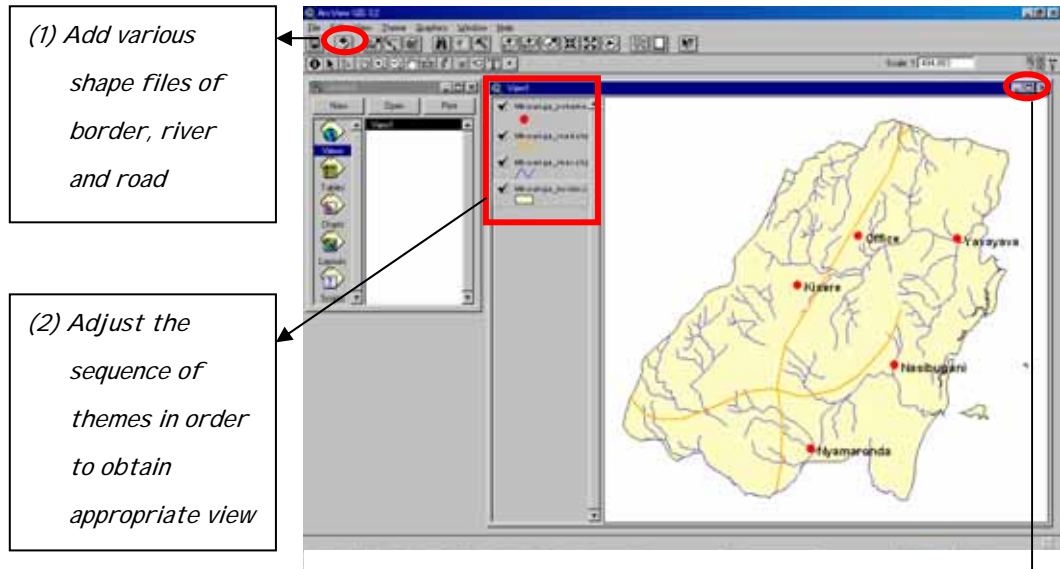
(1) Click "Yes" to stop editing and finish the work



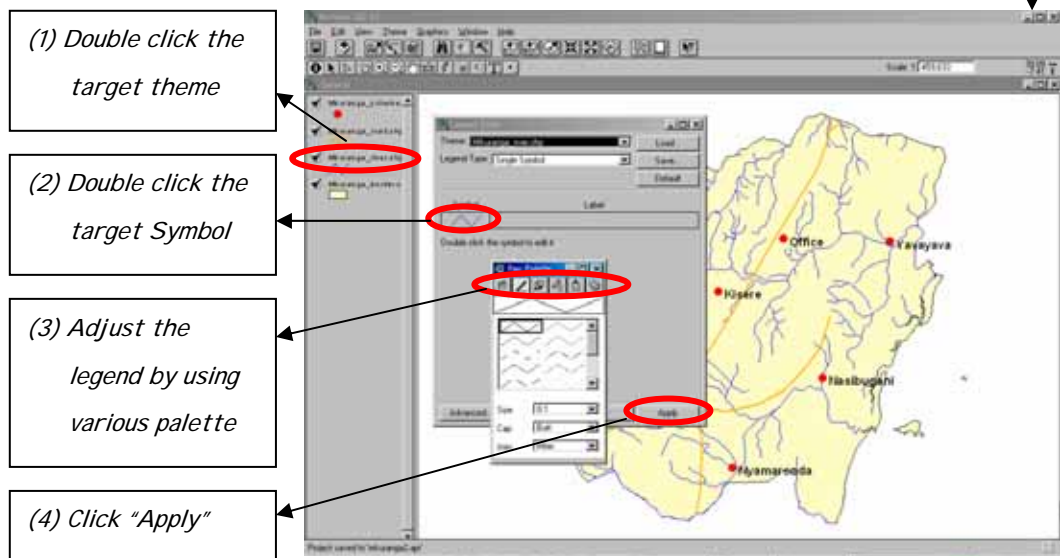
(c) Superposition of Thematic Maps on GIS

(i) General features such as administrative boundaries, rivers and roads

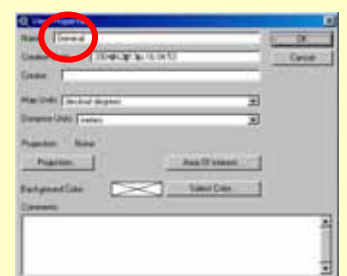
On the point or polygon data of irrigation sites, various themes on general features such as administration border, river and road can be superposed as a background.



Legend can be further adjusted by using various palette as shown below.

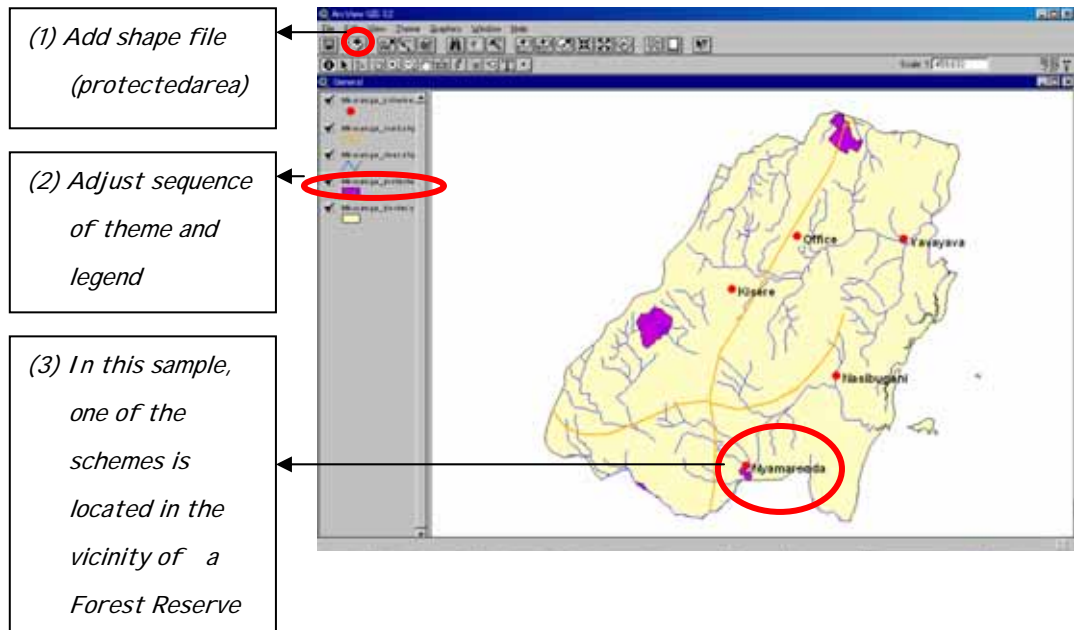


Note: Completed view can be saved by giving view name in "View Properties Window" as shown in the right. This window can be shown on screen by selecting "Properties" from View Menu. Furthermore, the whole project including many views can be saved by selecting "Save Project As" from File Menu.



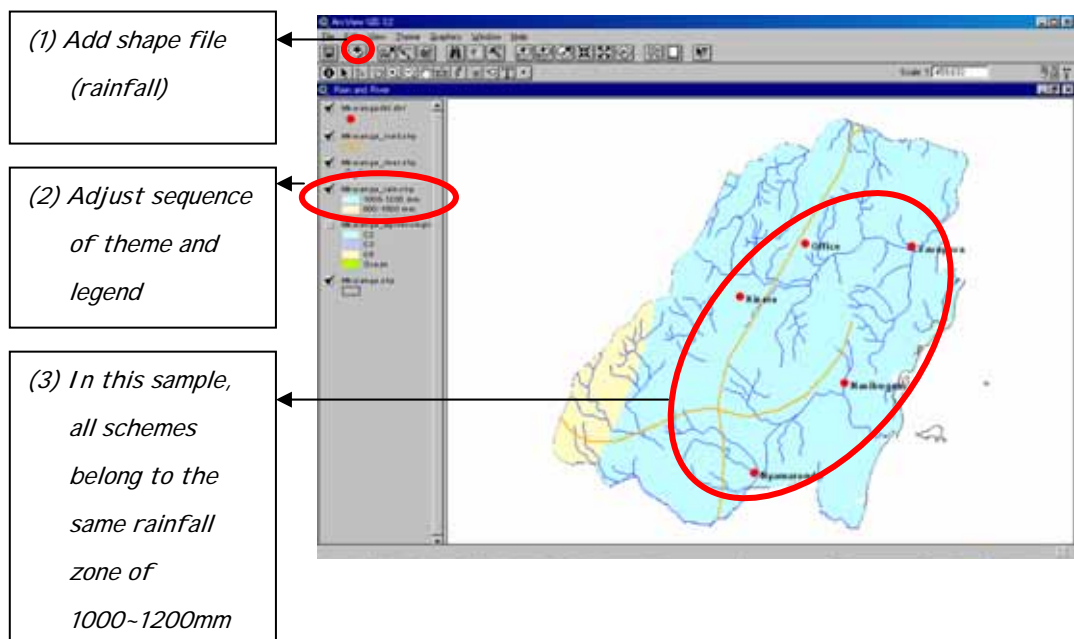
- (ii) Protected areas such as national parks, forest reserves, game reserves and conservation areas

Add the shape file of protected areas in order to know whether some of the proposed scheme is located within or in the vicinity of a protected area or not.



- (iii) Natural conditions such as rainfall and agroecological zones

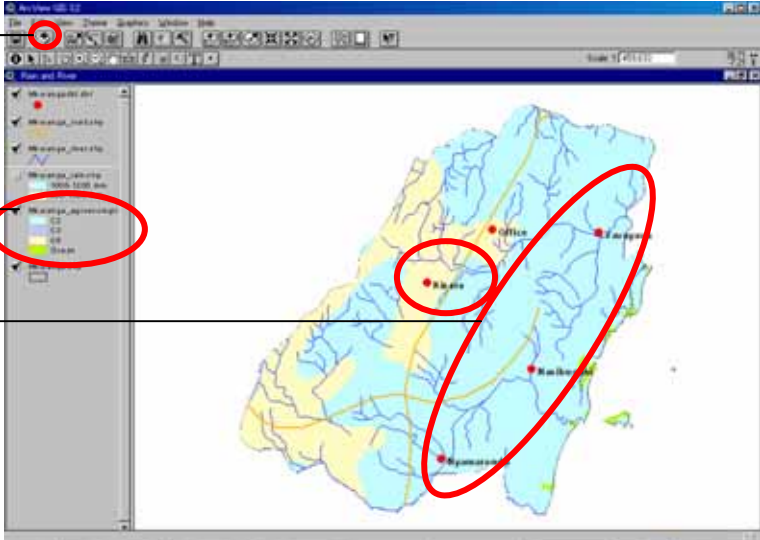
Add the shape file of rainfall and agroecological zones in order to investigate the meteorological and agroecological characteristics of the proposed irrigation site.



(1) Add shape file
(agroecological)

(2) Adjust sequence
of theme and
legend

(3) In this example,
only one scheme
belongs to C5
and all the other
schemes belong
to C2



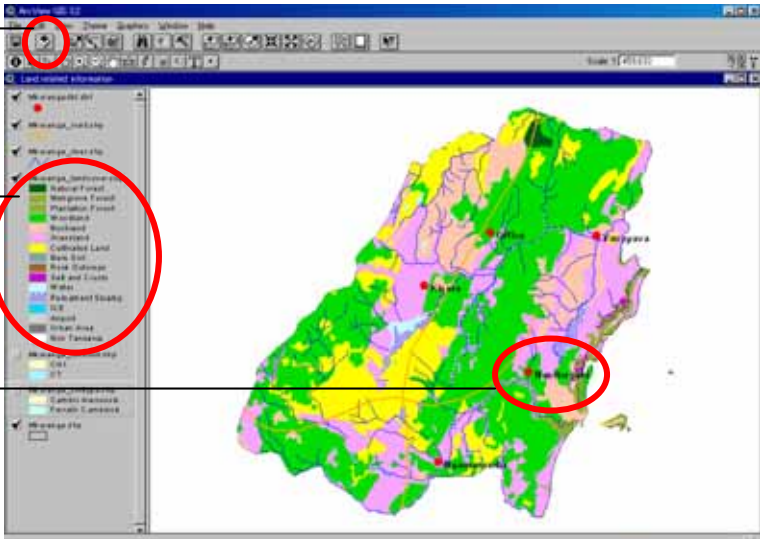
Note: Agroecological zone provides various information on soil/topography, growing period, major farming systems and others. These information might be useful for agricultural planning such as suitable crops to be cultivated, cropping season and farming practices. Descriptions of agroecological zones are available in the Master Plan Report.

- (iv) Land related information such as land cover, land unit and soil type
Add land related shape files in order to investigate the land and topographic characteristics of the proposed irrigation site.

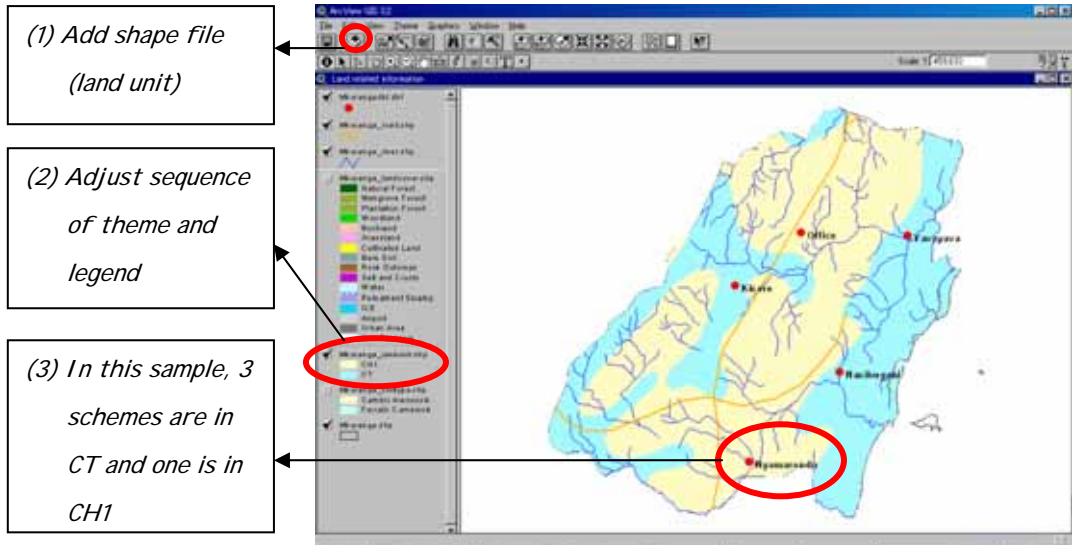
(1) Add shape file
(land cover)

(2) Adjust sequence
of theme and
legend

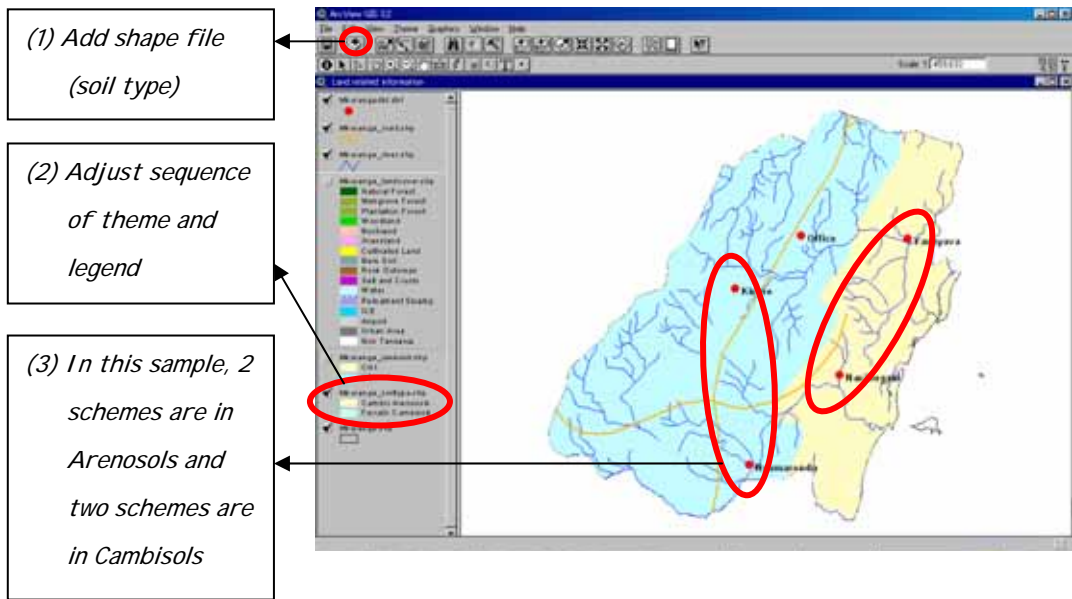
(3) In this sample, 3
schemes are in
grassland and
one is in
woodland



Note: The shape file of land cover gives the detailed information on land cover and land use based on the Landsat TM scenes obtained during 1994 and 1996. Detailed information on the distribution of land cover in each District is available in the Master Plan Report



Note: The shape file of land unit gives topographic information such as altitude and slope conditions together with drainage and salinity situation. Descriptions of each land unit are available in the Master Plan Report.



Note: The shape file of soil type gives general information of major soil types based on the classification of the FAO/UNESCO Soil map. The key soil properties of each soil type are available in the Master Plan Report. More detailed soil survey was carried out during the 1980s by the Department of Research and Development. Soil maps were prepared based on these survey works and these maps are now being digitized.

(v) Utilization of readily available legend

An appropriate legend can be arranged according to requirements. For some themes such as land cover and soil type, however, a ready-made legend can be utilized as shown below.

(1) Double click
"Theme" added
(land cover for
example)

(2) Click "Load" in
Legend Editor
window

(3) Select
"Landcover.avl"
in Load Legend
window

(4) Click "OK"

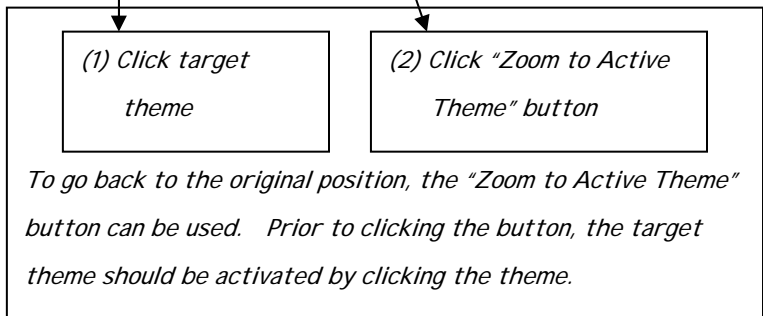
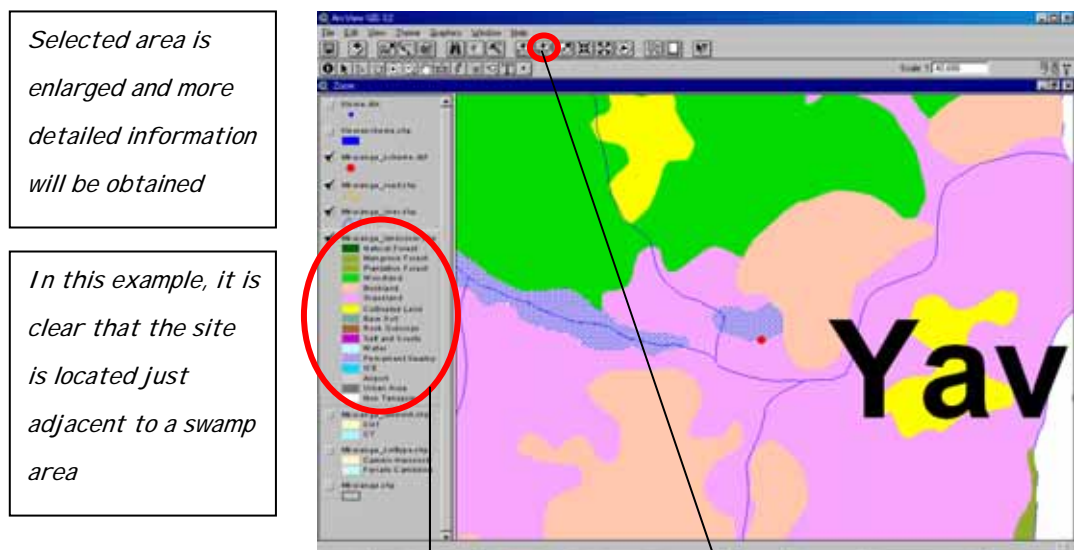
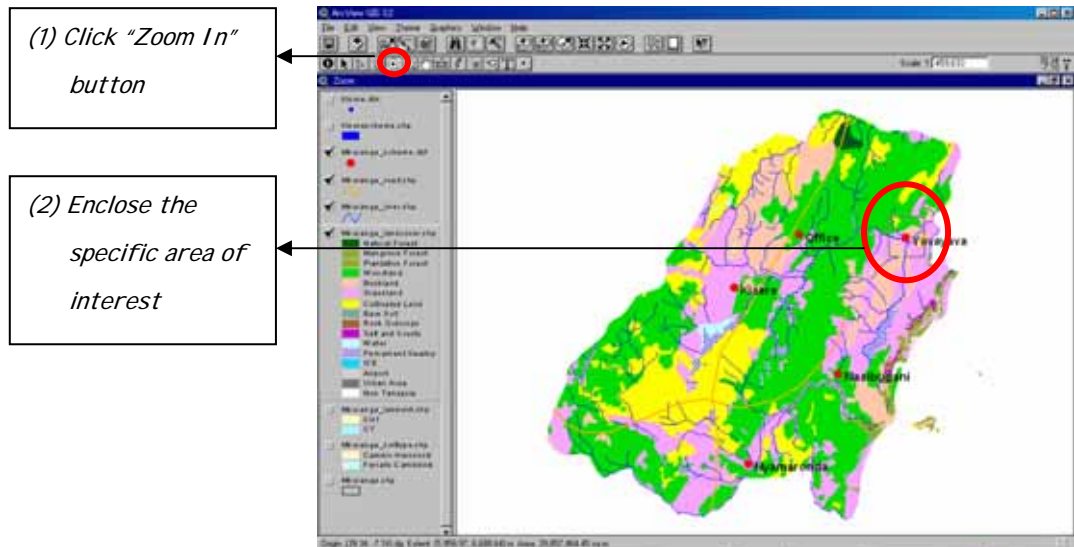
(5) Click "OK" in
Load Legend
window

(6) Click "Apply" in
Legend Editor
window

(7) The ready-made
legend such as
"Landcover.avl"
will be applied

(vi) Utilization of "Zoom In" function

For data that has high resolution, such as land cover, the "Zoom In" function can be effectively utilized to observe the details of the specific site in the following manner.



Polygon data of the scheme can be added to observe the details of surrounding land cover and distances can also be measured in the following manner.

(1) Add prepared Polygon data

(2) Click "Zoom In" button

(3) Enclose the area around polygon data

(4) In this example, it is clear that the site is located in glassland but there is bushland and woodland in between the road and the site. The distance between the two points can be measured by the using "Measure" function.

(5) Click "Measure" button

(6) Click one end and drag to the other end

(7) The distance is shown at the bottom

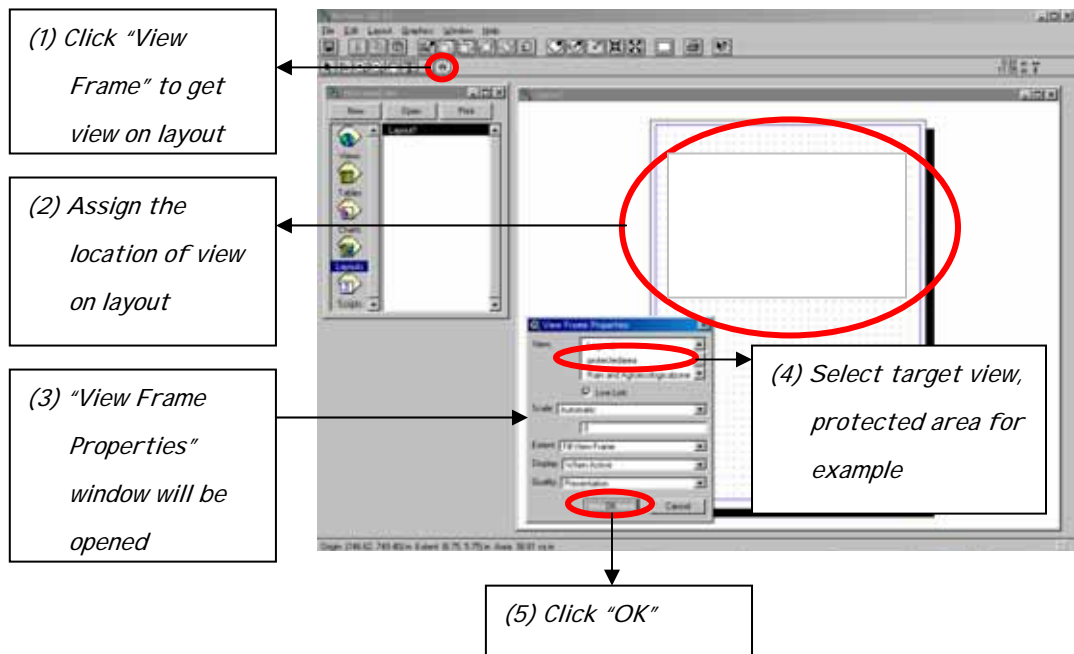
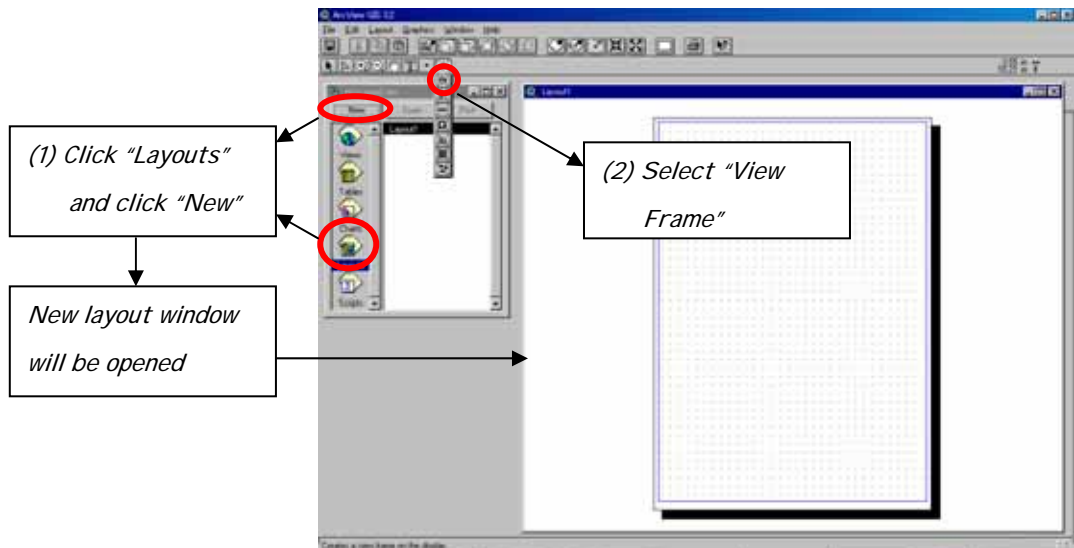
Note: In order to get proper distance measurement, "View Properties" should be adjusted prior to the measurement. "View Properties" window can be shown on screen by selecting "Properties" from View Menu. Select "decimal degrees" as Map Units and select "meters" as Distance Units in View Properties Window as shown at right.



(d) Printout of appropriate layout

(i) Preparation of layout

The data obtained through the Irrigation GIS should properly be printed out in order to distribute them to regional and district levels. A layout appropriate to the requirement can be prepared by using "Layouts" function as shown below.



Note: It is recommended to set up the "Printer to be Used" and "Paper Size" prior to layout arrangement. For such setting up, "Print Setup" can be selected from File Menu. Plotter can be used for large size papers such as A0 and A1.

(1) Select "Legend Frame" to get legend on layout

(2) Assign the location of legend on layout

(3) "Legend Frame Properties" window will be opened

(4) Select target view

(5) Click "OK"

(1) Select "Scale Bar Frame" to get scale bar

(2) Assign the location of scale bar on layout

(3) "ScaleBar Frame Properties" window will be opened

(4) Select target view and arrange style, units and interval

(5) Click "OK"

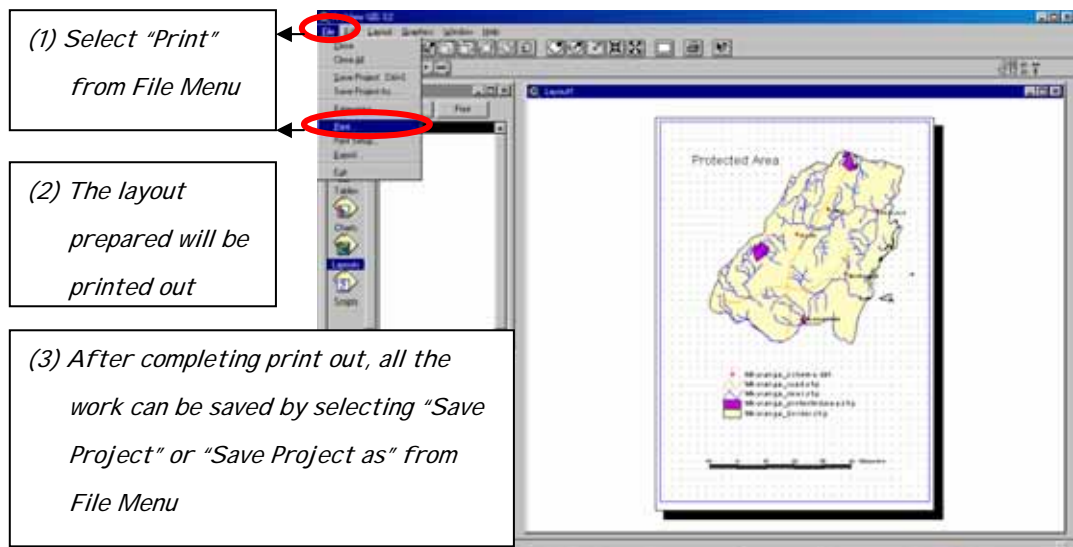
(1) Click "Text" to give Title on layout

(2) Assign the location of title on layout

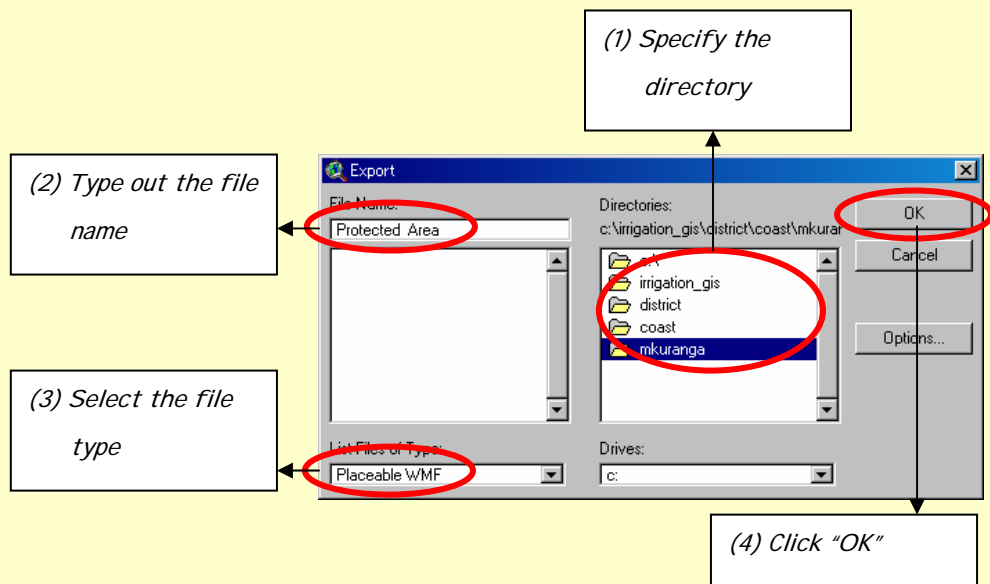
(3) "Text Properties" window will be opened

(4) Type "Title" and arrange alignment

(5) Click "OK"



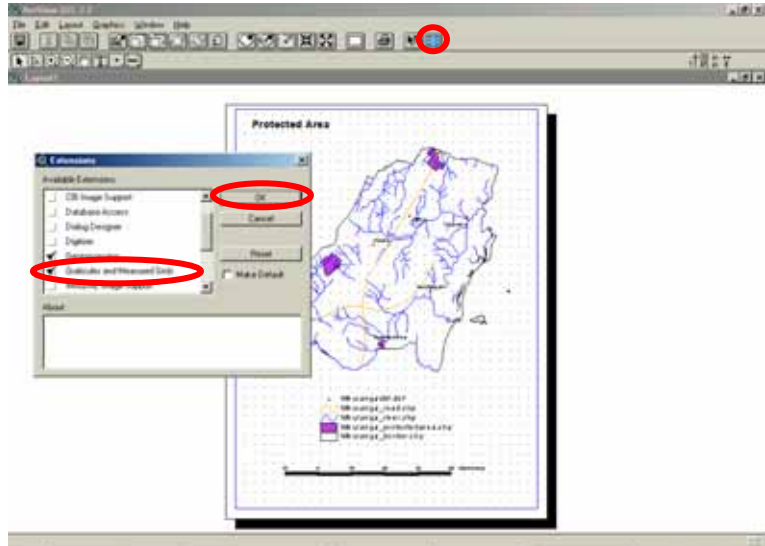
Note: Instead of printing through the "layouts" function, any views or layouts can be exported to a specified folder in different file formats such as Placeable WMF, Windows Metafile, Windows Bitmap, JPEG and others. Such files can easily be pasted into Word, PowerPoint and other files. For exporting, activate the target view or layout and select "Export" from File Menu. Export window will be opened. Specify the directory, type the file name and select the file type as shown below.



(ii) Add graticule to layout

Graticules can be added to the layout by activating the function of "graticules and measured grids" in "Extension" in the following manner.

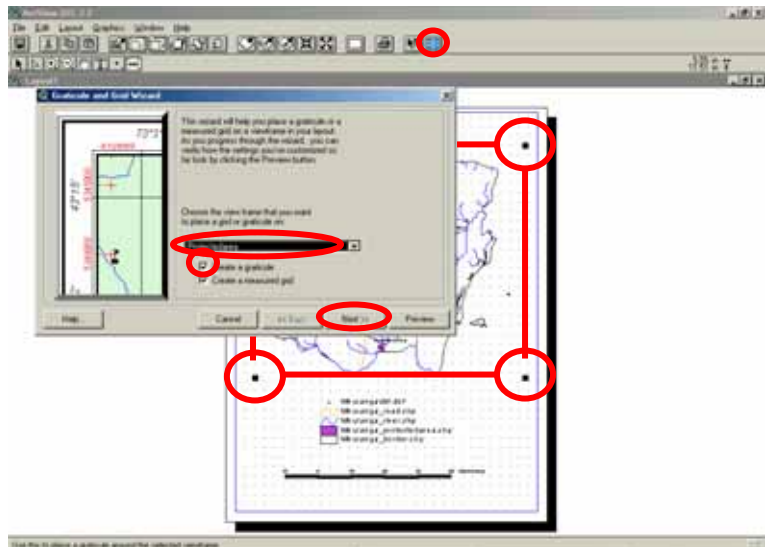
(1) Select "Extensions" from File menu



(2) Put check mark on "Graticules and measured grid" and click OK

(3) "Graticules and Grids" button will be created in the menu bar

(1) Select the target view frame



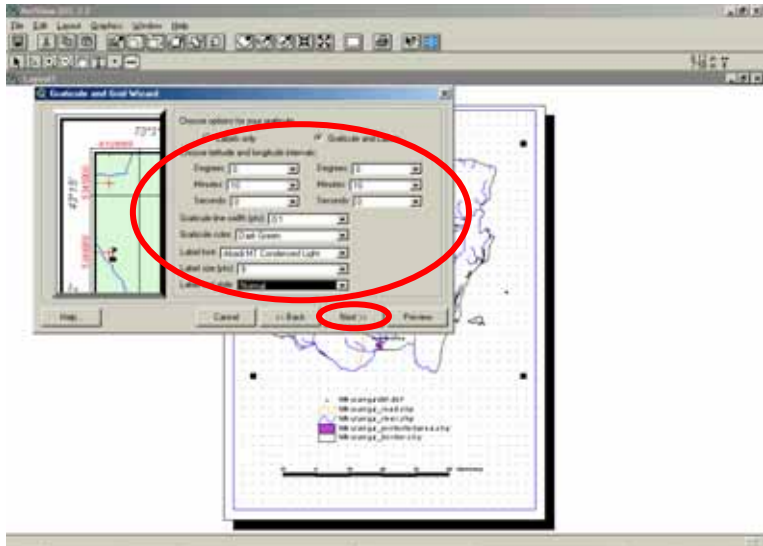
(2) Click "Graticules and Grids" button

(3) Confirm the name of target view frame

(4) Select graticule or measured grid and click "Next"

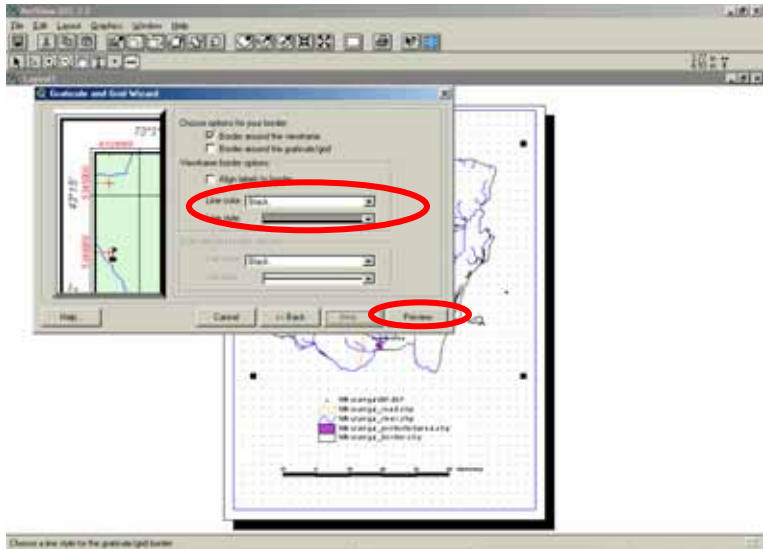
(1) Adjust all settings such as intervals, line width, line color, label font and label size

(2) Click "Next"

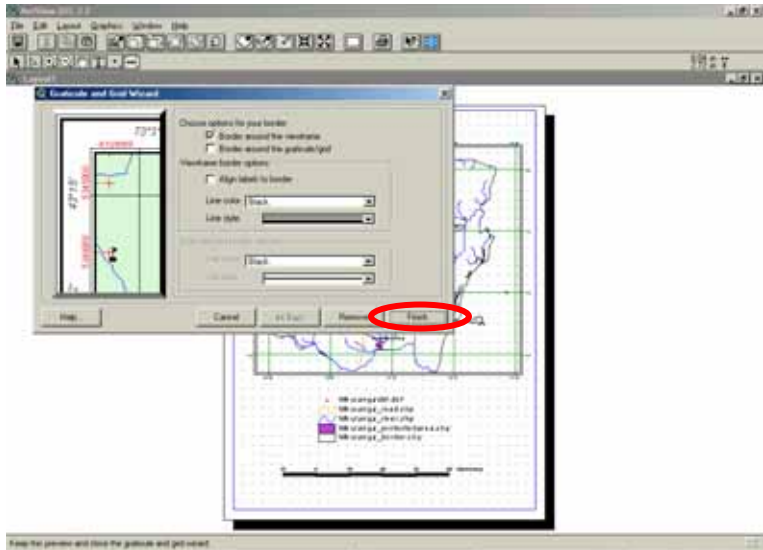


(1) Adjust view frame border such as line color and line style

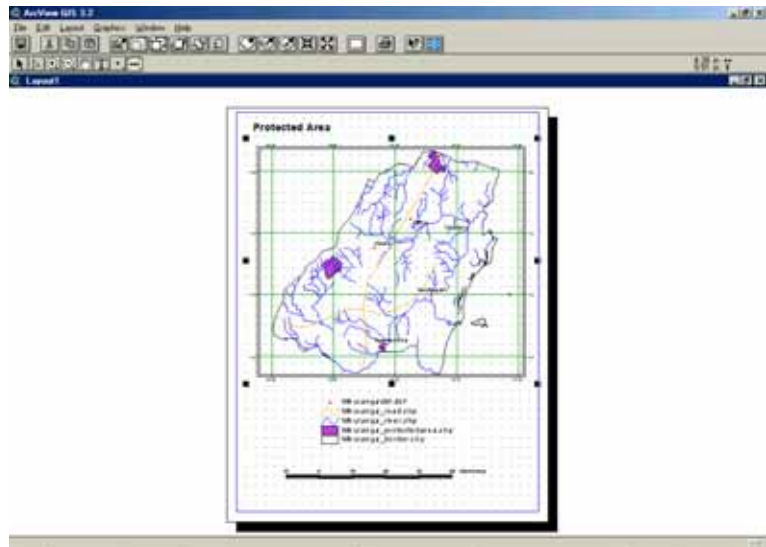
(2) Click "Preview"



(1) Click "Finish" when OK



*Graticule is
successfully added
to the layout*

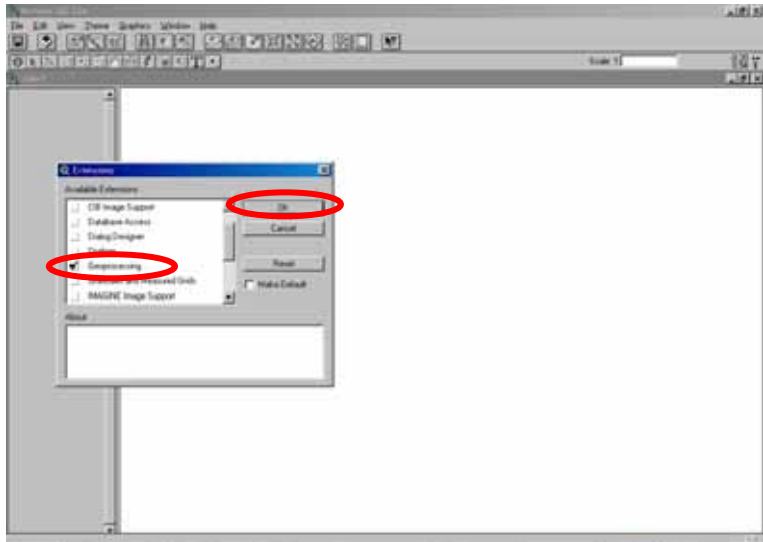


- (e) Other useful functions
- (i) Dissolve features based on an attribute

In case of the modification of the administration boundaries, for example, the function “dissolve features based on an attribute” is needed. This function can be operated after activating the Geoprocessing in the extension menu. Following is an example procedure to create a new shape file for a new region.

(1) Select
“Extensions”
from File menu

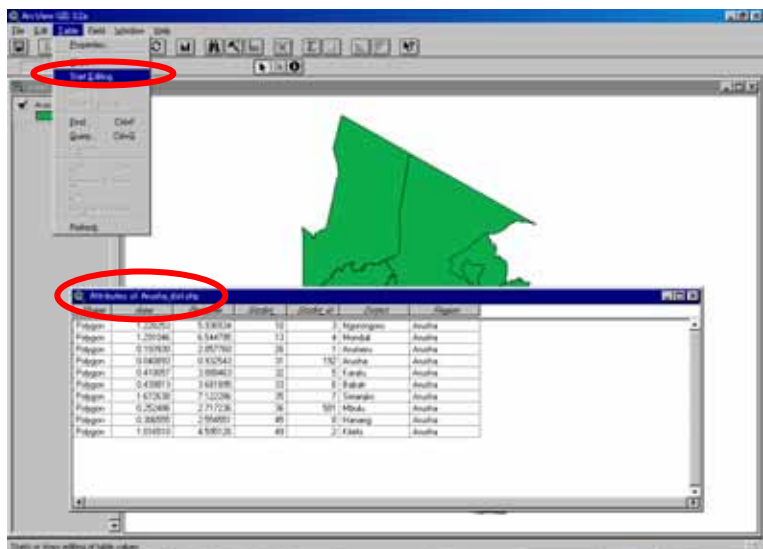
(2) Put check mark
on
“Geoprocessing”
and click OK



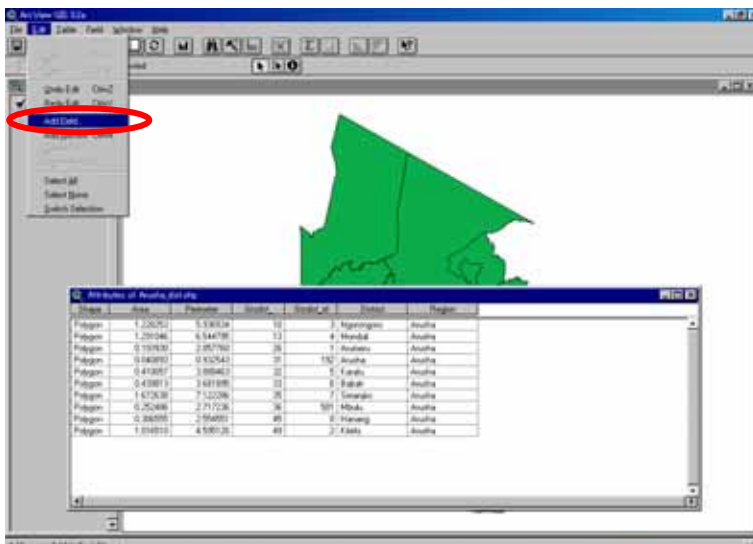
(1) Add the shape
file of target
region

(2) Open theme
table

(3) Select “Start
Editing” from
Table menu



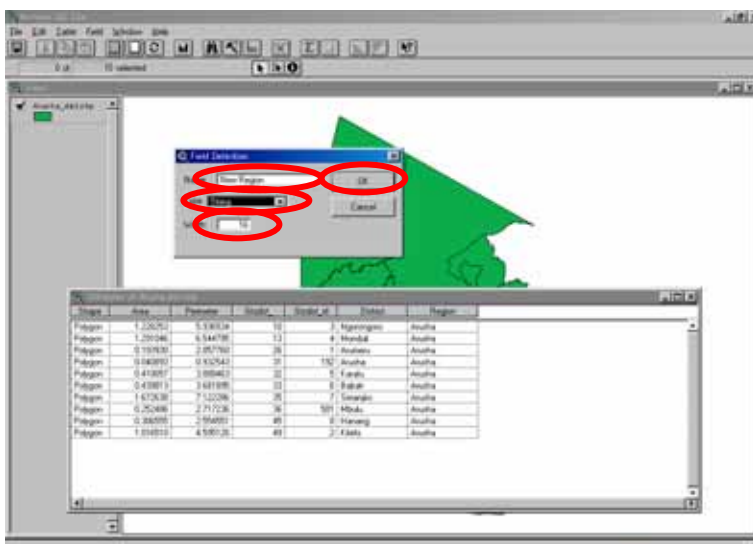
(1) Select "Add Field" from Edit menu



(1) "Field Definition" box will be shown

(2) Type out the field name and select suitable type

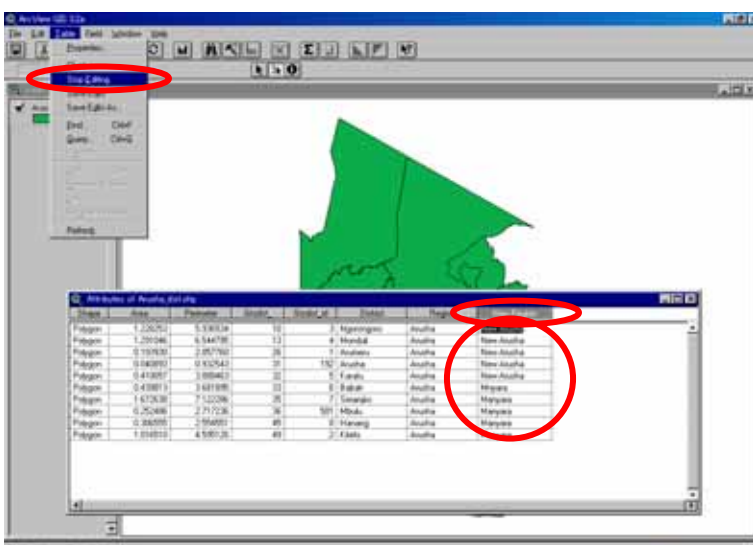
(3) Click "OK"



(1) New Field is added to the ThemeTable

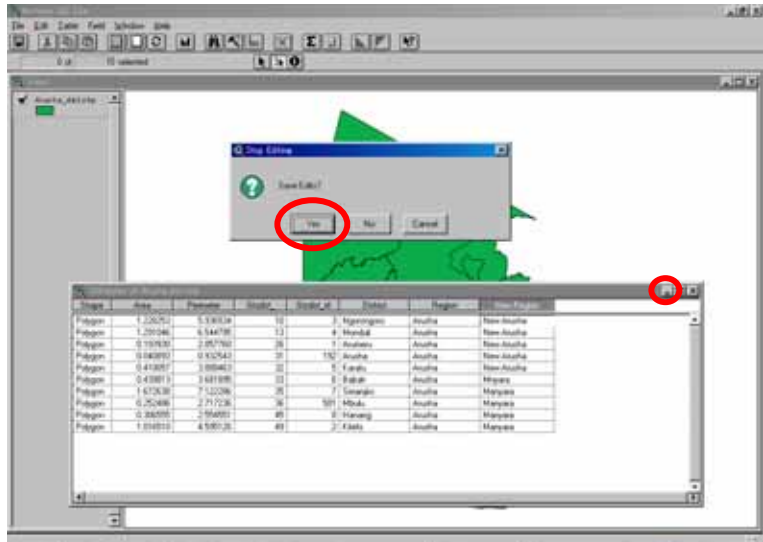
(2) Type out the new region name

(3) Select "Stop Editing" from Table Menu

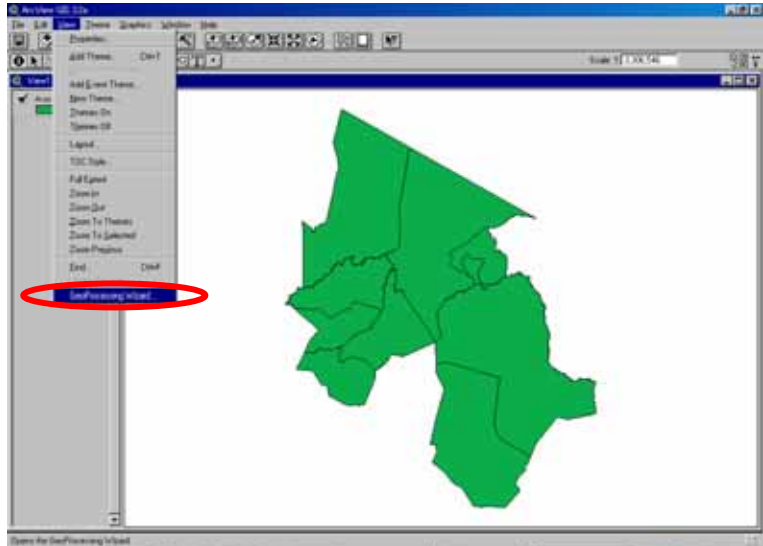


(1) Select "Yes" to stop editing

(2) Hide the Theme Table



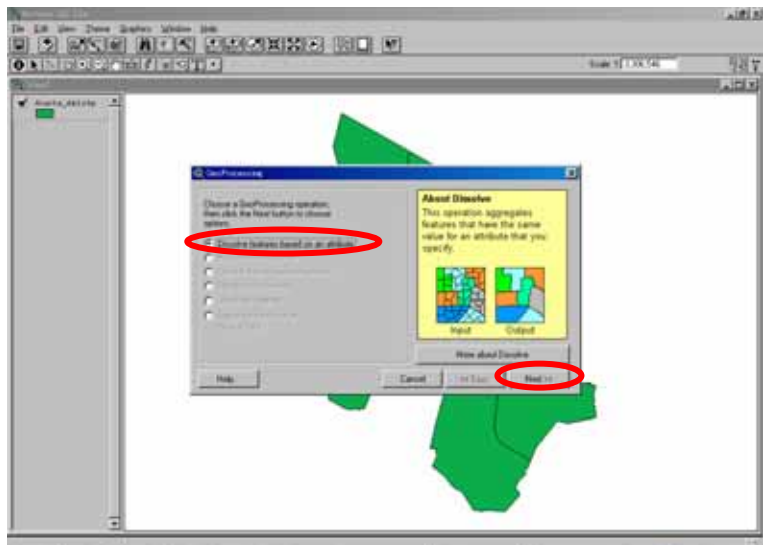
(1) Select "Geoprocessing Wizard" from View menu



(1) Geoprocessing Wizard will be shown

(2) Select "Dissolve features based on an attribute"

(3) Click "Next"

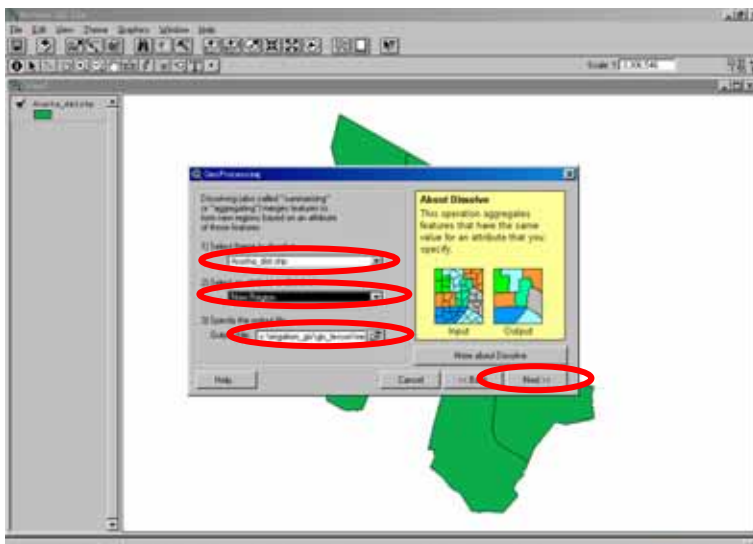


(1) Select theme to dissolve
(Arusha_dist)

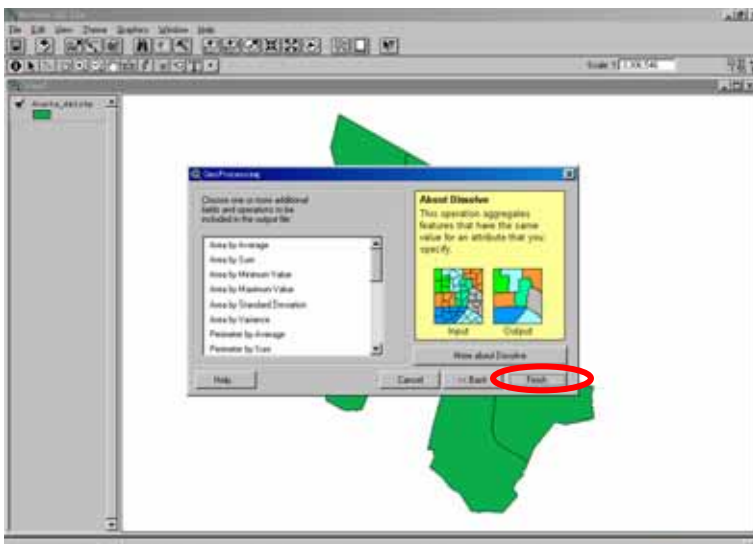
(2) Select an attribute to dissolve (New Region)

(3) Specify the output file

(4) Click "Next"



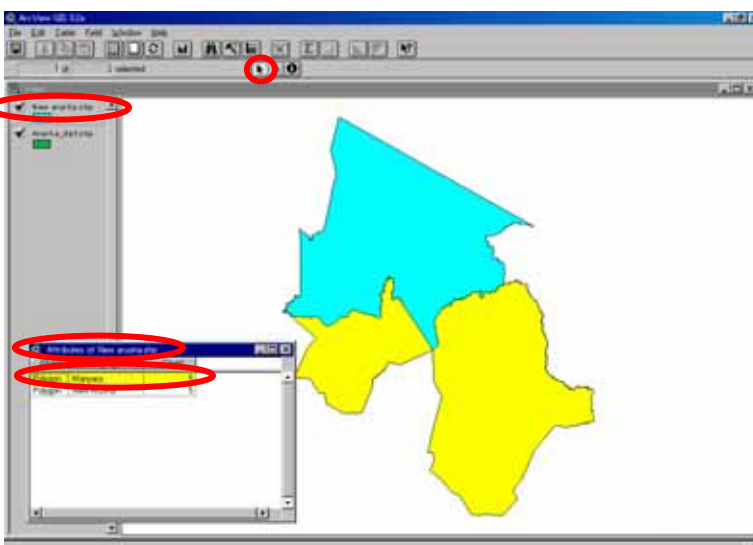
(1) Click "Finish"



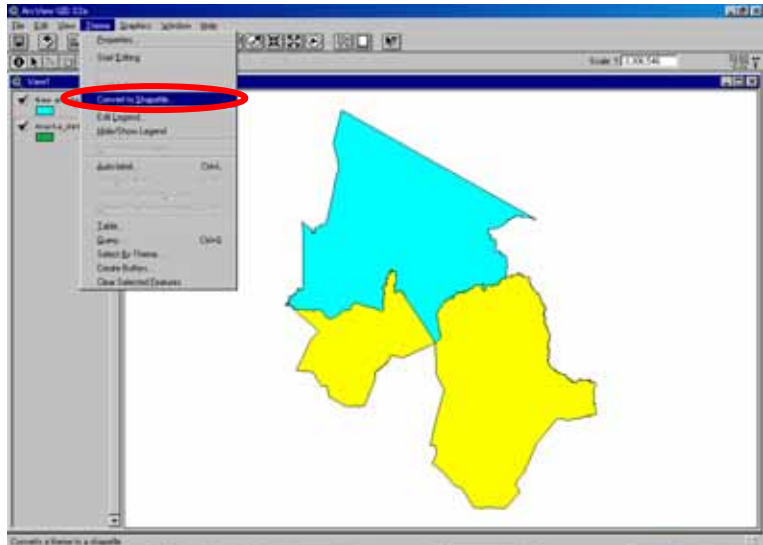
(1) New shape file will be shown

(2) Confirm the attribute of new shape file by showing the Theme Table

(3) Select Manyara



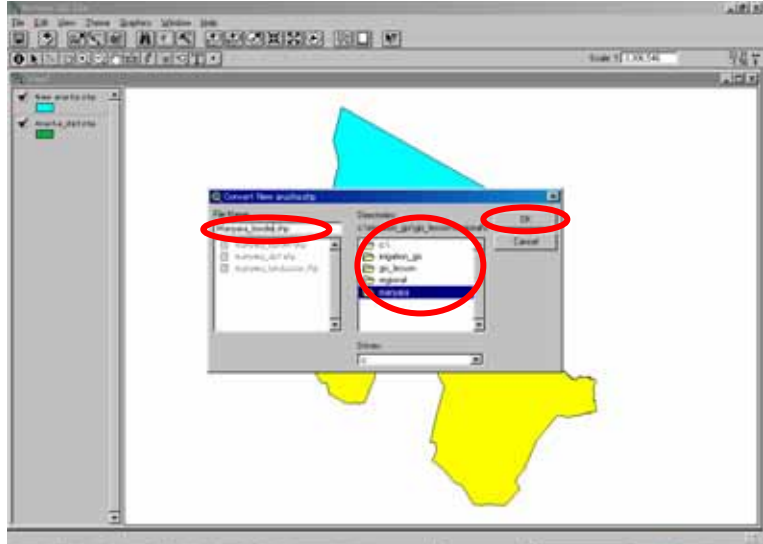
(1) Select "Convert to shapefile" from Theme menu



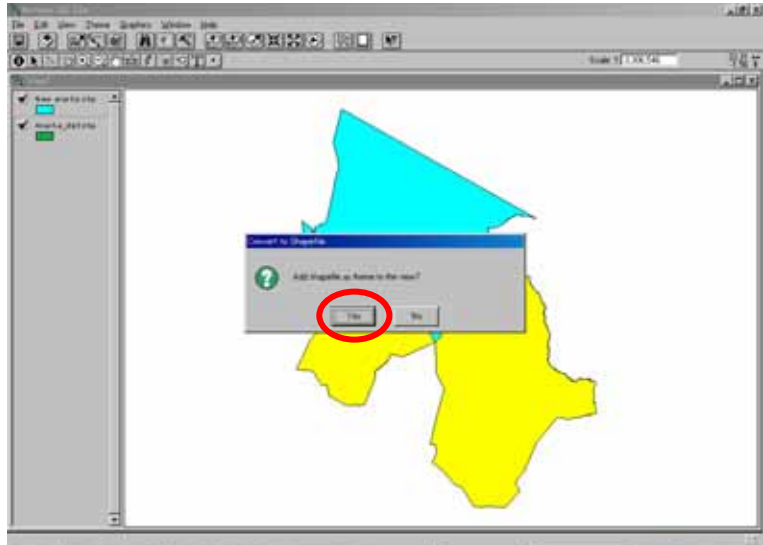
(1) Adjust Directories

(2) Type out "File Name"

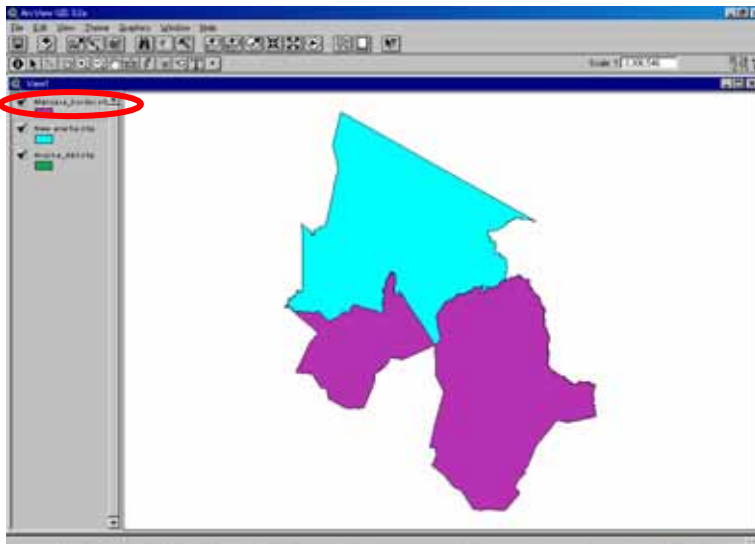
(3) Click "OK"



(1) Click "Yes" to add shape file as theme to the view



(1) Shape file of new region is shown as theme to the view

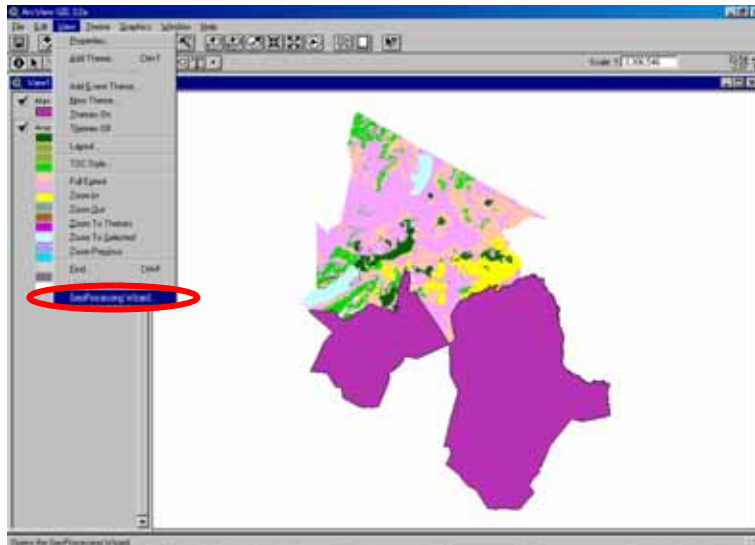


(ii) Clip one theme based on another

The function "clip one theme based on another" is then needed to complete the modification. Following is the sample process to clip Manyara region based on Arusha region.

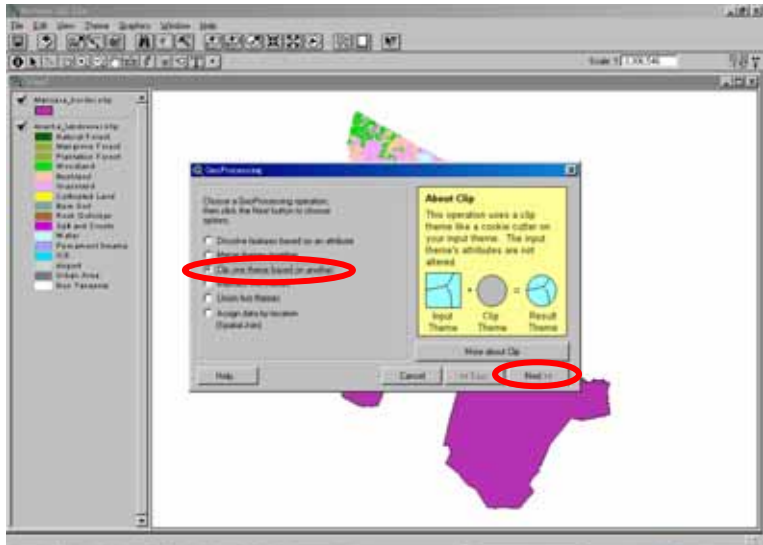
(1) Add Arusha_landcover as input theme and Manyara_border as clip theme

(2) Select "Geoprocessing Wizard" from View menu



(1) Select "Clip one theme based on another"

(2) Click "Next"

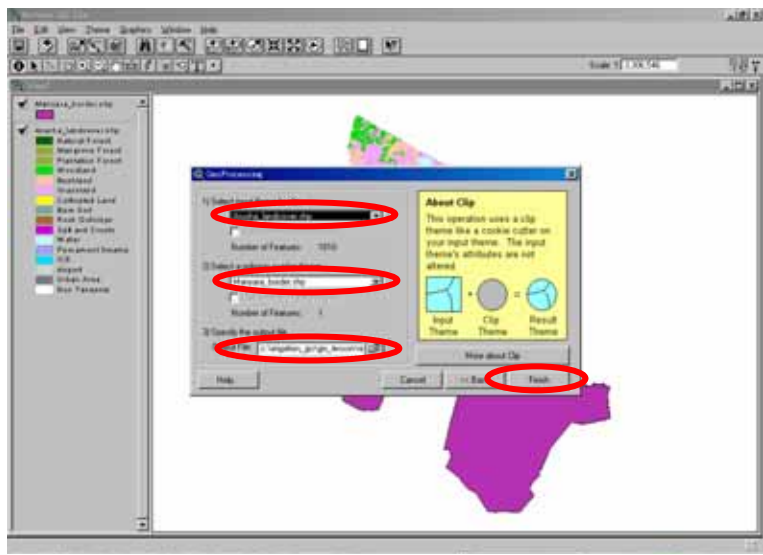


(1) Select input theme to clip
Arusha_landcover

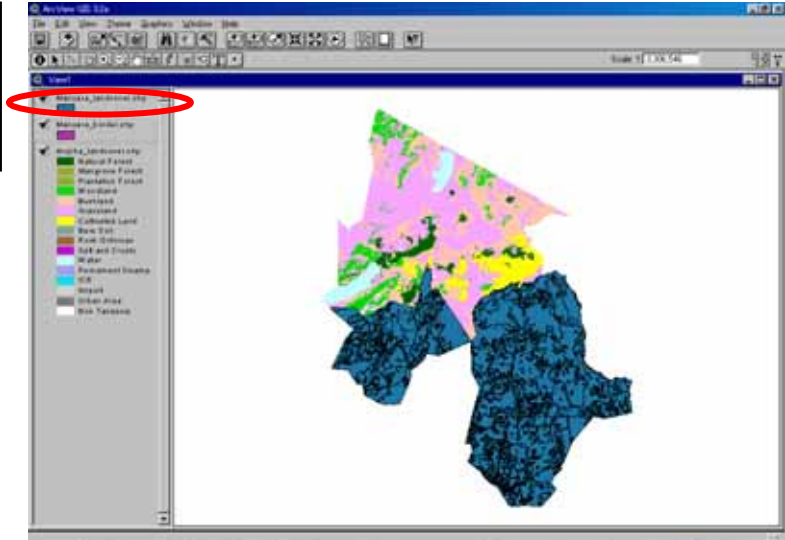
(2) Select clip theme
Manyara_border

(3) Specify the output file
Manyara_landcover

(4) Click "Finish"



(1) Manyara_landcover will be shown in the view



(4) Other GIS Data

(a) Department of Research and Development

Various GIS data are available in the Department of Research and Development. Data on agro-ecological zone utilized in the current Master Plan Study were obtained from this source. Under the Department of Research and Development, GIS data are mainly handled by three sections: the GIS Laboratory in Kilimo 2 (Dar Es Salaam) and the Agricultural Research Institute in Mlingano (Tanga) and in Naliendele (Mtwara).

The department is now keen to prepare GIS data on farming system zones. This work is being implemented zone by zone and the work has been completed for five of the seven zones in the country as shown below. The detailed descriptions such as physiography, major soils, precipitation, land cover, major crops, soil fertility management, socio-economic characteristics, constraints and opportunities are given for each farming system zone. This information might be useful for evaluating the irrigation potential of a proposed site.

- Eastern Zone (Tanga, Coast, Morogoro, Dar): Completed,
- Southern Zone (Mtwara, Lindi, +Tunduru): Completed,
- Southern Highland (Mbeya, Iringa, Rukwa, Ruvuma-Tunduru): Completed,
- Western Zone (Tabora, Kigoma): Completed,
- Central Zone (Dodoma, Singida): Completed,
- Northern Zone (Arusha, Kilimanjaro): In progress, and
- Lake Zone (Mara, Mwanza, Kagera, Shinyanga): In progress.

Detailed soil survey has been carried out under various projects including Regional Integrated Development Program by World Bank (Tabora, Lindi, Mtwara, Coast, Dar, Kilimanjaro), Regional Master Plan by the Government (Tanga, Mbeya, Rukwa, Iringa), Capital Development Authority (Dodoma) and National Soil Service during 1980s. Soil maps were prepared based on these survey works and these maps are now being digitized by the Department of Research and Development.

The following GIS data are also available at the national level.

- Soil and Terrain: Soil type, Altitude, Erosion hazard,
- Annual Rainfall: More than 30 years data,
- Hydrology: Distribution of lakes and rivers, and
- Land Cover/Use: Based on Landsat TM obtained during 1994 and 1996.

(b) Soil Conservation and Land Use Planning Section

Various GIS data are also available in the Soil Conservation and Land Use Planning Section. Most of these data are the area focused detailed and focused on specific areas, so those will be useful for evaluating the potential of proposed sites for irrigation development. Data available at present are as follows;

	Land cover/use	Farming systems	Soils	Roads	Rivers	Villages	Wards	River distributaries	Forest reserves	Game reserves	Landsat images	Railways	Contours	Rainfall	Rainfall stations
Lake Victoria Basin	0	0	0	0	0	0									
(District) Bariadi	0	0	0	0	0	0									
(District) Biharamlo	0	0	0	0	0	0									
(District) Bukoba	0	0	0	0	0	0									
(District) Bunda	0	0	0	0	0	0									
(District) Geita	0	0	0	0	0	0									
(District) Kahama	0	0	0	0	0	0									
(District) Karagwe	0	0	0	0	0	0									
(District) Kwimba	0	0	0	0	0	0									
(District) Magu	0	0	0	0	0	0									
(District) Maswa	0	0	0	0	0	0									
(District) Meatu	0	0	0	0	0	0									
(District) Misungwi	0	0	0	0	0	0									
(District) Muleba	0	0	0	0	0	0									
(District) Musoma	0	0	0	0	0	0									
(District) Mwanza	0	0	0	0	0	0									
(District) Ngara	0	0	0	0	0	0									
(District) Ngorongoro	0	0	0	0	0	0									
(District) Serengeti	0	0	0	0	0	0									
(District) Shinyanga	0	0	0	0	0	0									
(District) Tarime	0	0	0	0	0	0									
(District) Ukerewe	0	0	0	0	0	0									
(Catchments) Duma	0	0	0					0							
(Catchments) Grumeti	0	0	0					0							
(Catchments) Kagera	0	0	0					0							
(Catchments) Mara	0	0	0					0							
(Catchments) Mbalagati	0	0	0					0							
(Catchments) Simiyu	0	0	0					0							
(Catchments) Smithsouth	0	0	0					0							
(Catchments) Suguti	0	0	0					0							
Tanga Region	x			x	x	x			x	x					
Handini District	0			0	0	0	0		0		0				
Kilosa District	0			0	0	0	0		0			0	0		
Morogoro District			0	0	0							0	0	0	0

Note: 0 for available data in UTM system, x for available data in decimal degrees

(5) Recommendations

Various GIS data are available in different Departments and Sections under the Ministry of Agriculture and Food Security as mentioned above. Each Department and Section is so far establishing the data system according to its own strategy. Map data are prepared, for example, by UTM system on the one hand and by Decimal Degree on the other. The data of decimal degree need conversion for superposition on UTM data. In order to avoid such inconveniences, all GIS data should be managed in a more integrated manner. Furthermore, it is recommended to upload the data system to the Internet through Arc-IMS (Internet Map Server) as a future program for effective data sharing. Under data sharing through the Internet, data can be shared by various parties even they have no GIS software.