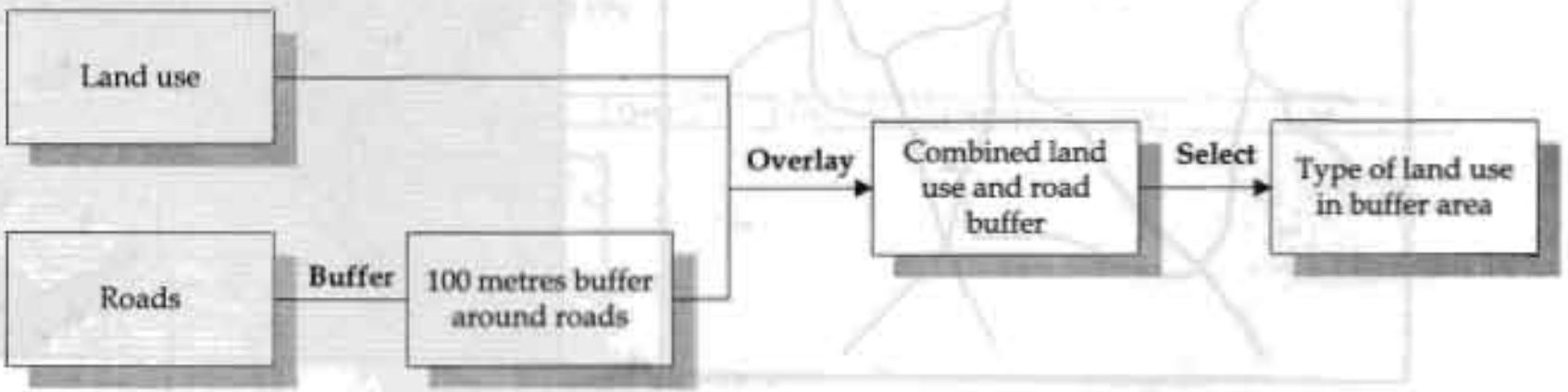
Chapter 5

Using GIS: A Lab Exercise

Using GIS to Solve a Spatial Problem

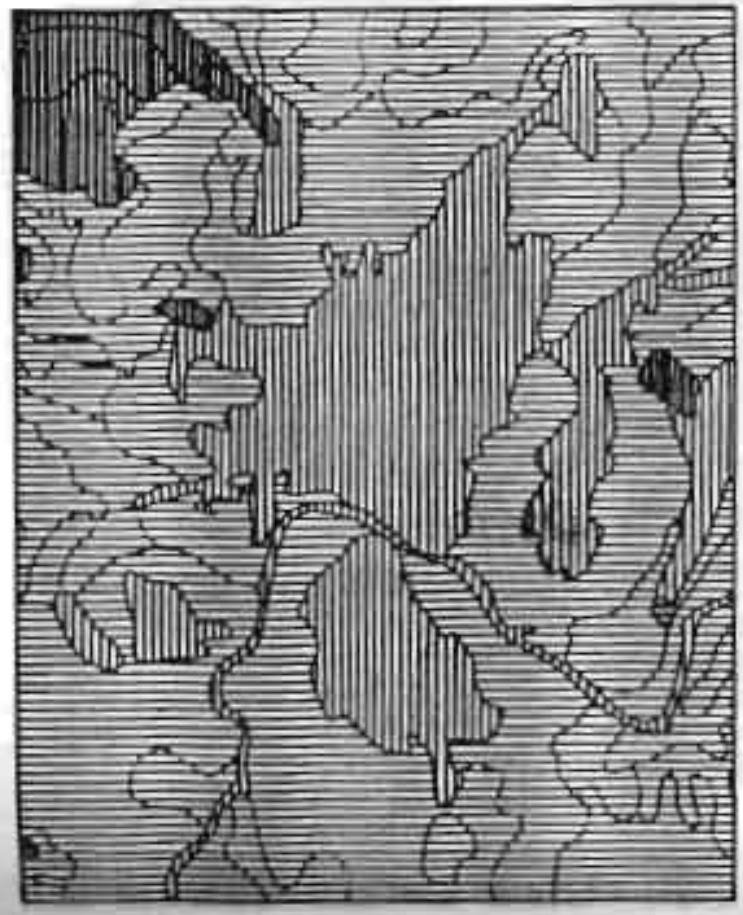
The exercise provides an opportunity to see how GIS can solve a simple spatial analysis problem. In the exercise, we will determine the total area of agricultural land adjoining existing roads. This analysis could be used to determine the rice production lost due to construction or expansion of roads. For this exercise, we will select a rectangular area around the Ring road in Kathmandu Valley. The input land use and road maps, used for analysis, are on a scale of 1:50000 and the Universal Transverse Mercator (UTM) projection. First, we will look at the information on each of these maps. We will then combine the maps and determine the area of agricultural land within 100 metres of the existing roads.

Geographical Analysis

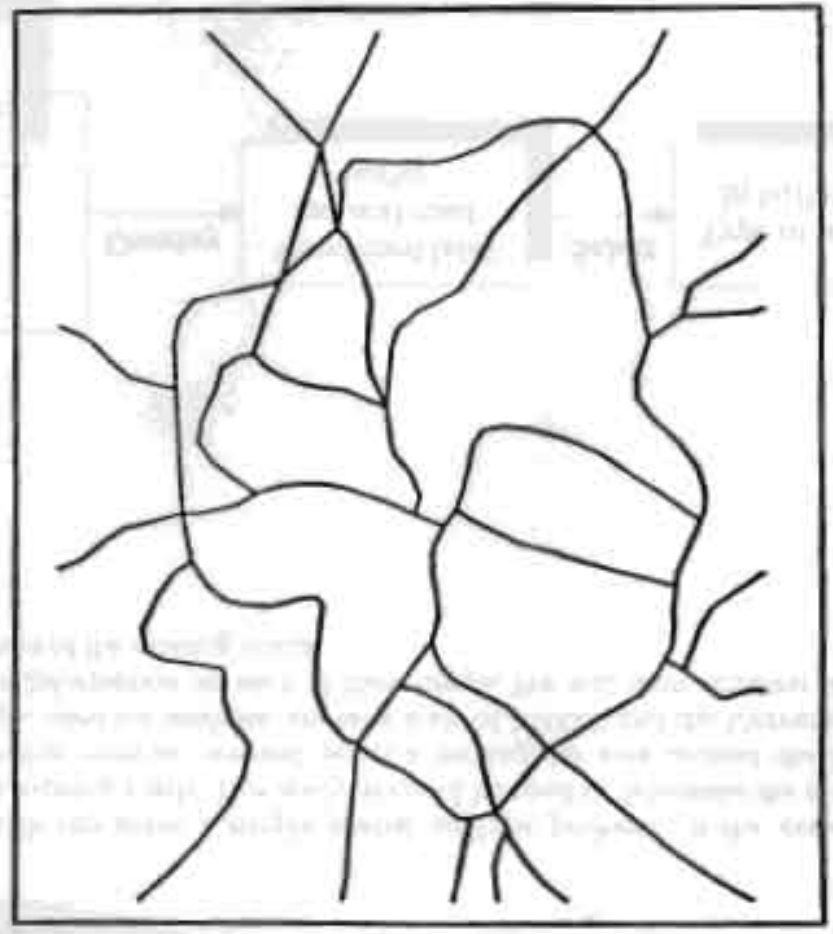


Here is what the maps look like.

Land Use



Roads



Step 1

Start ARC/INFO, and the menu system in the demo workspace

```
>> C>CD \GISTRN\DATA
>> C, ARC
```

The [ARC] prompt appears.

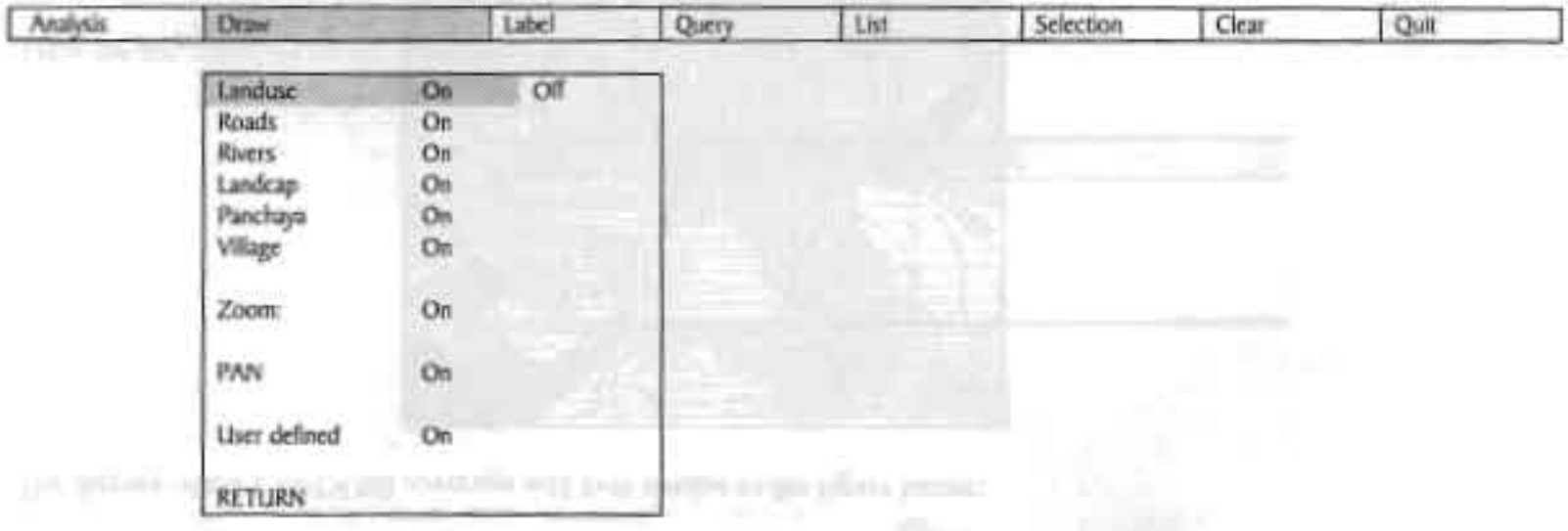
Start the menu system and begin this demo;

[ARC] **&RUN INTRO.**

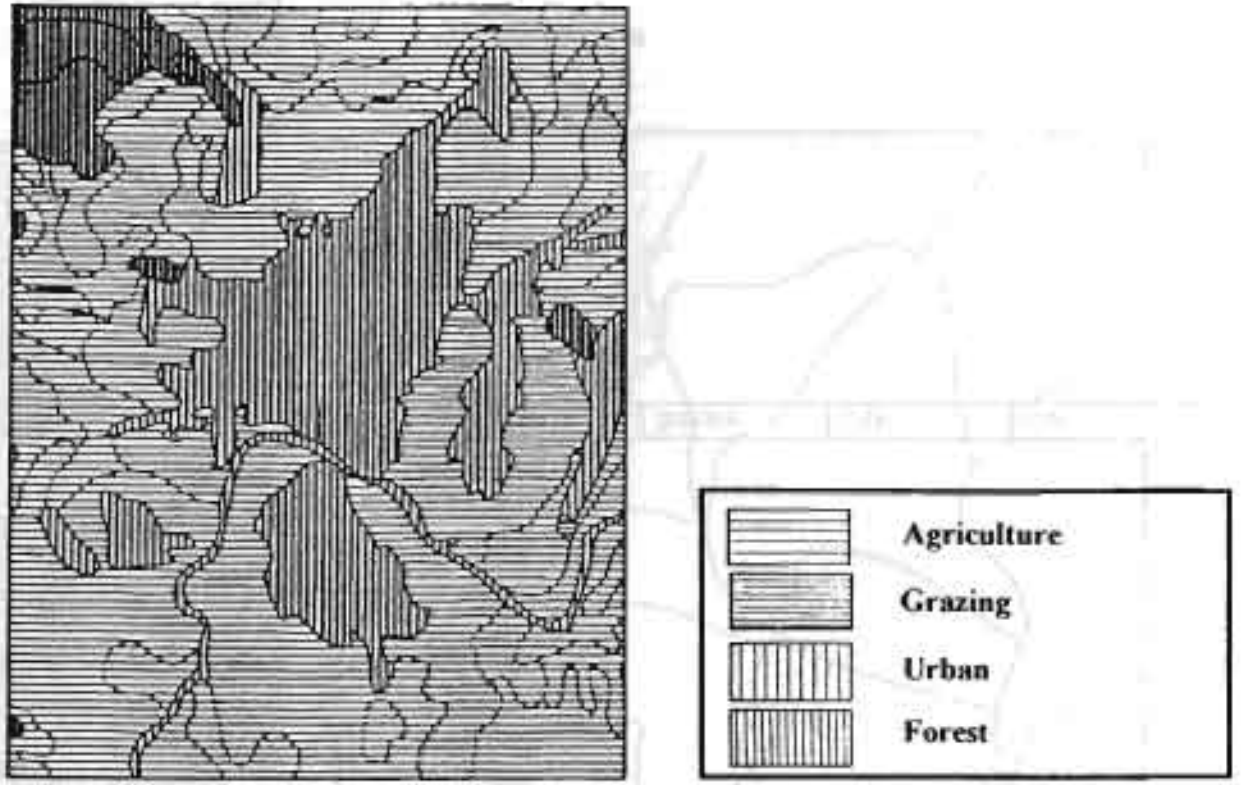
Step 2

Draw and query the contents of the LANDUSE and ROADS coverages

Choose the **DRAW** option and select **LANDUSE ON**

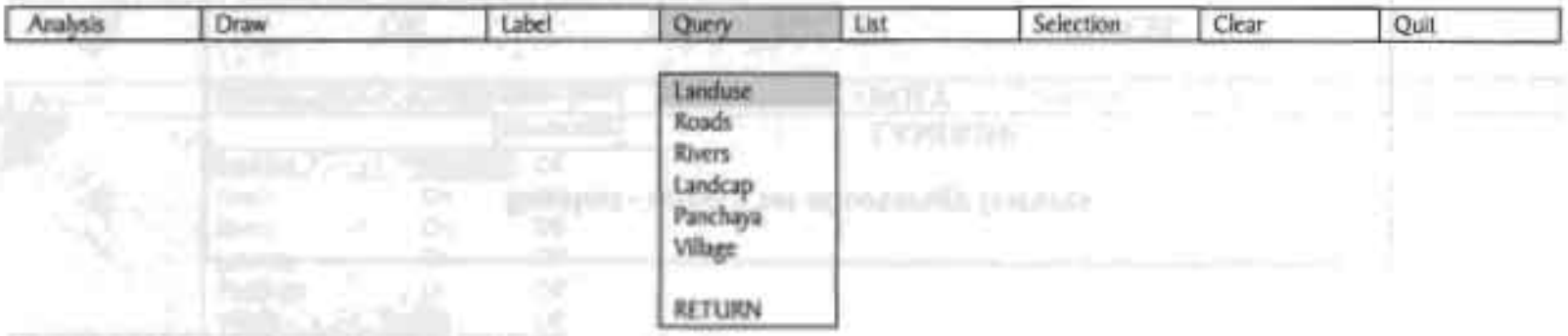


The display of the LANDUSE coverage will look similar to the figure below:



Each polygon is shaded according to the type of land use. Here is what the shades represent.

Select **QUERY** and choose the **LANDUSE** option



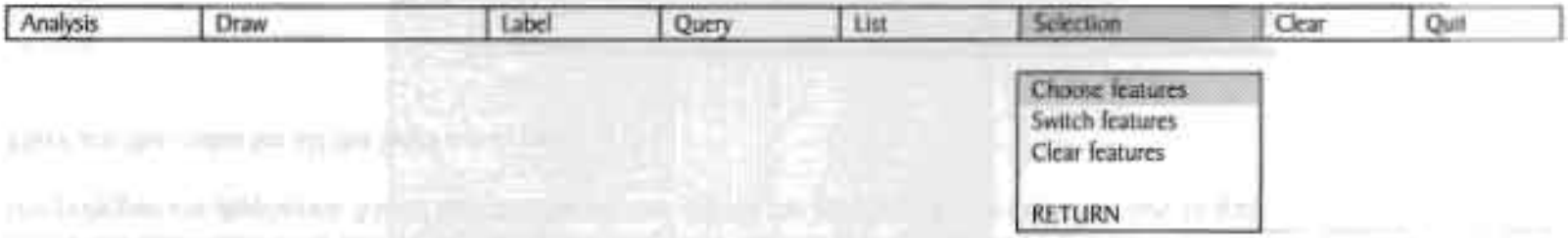
Move the crosshairs over one of the polygons and press the left mouse button or the enter key on the keyboard. The attributes of the polygon are displayed. Move the crosshairs over one of the lines and press the enter key to **quit**.

Here are the codes for all the land use types.

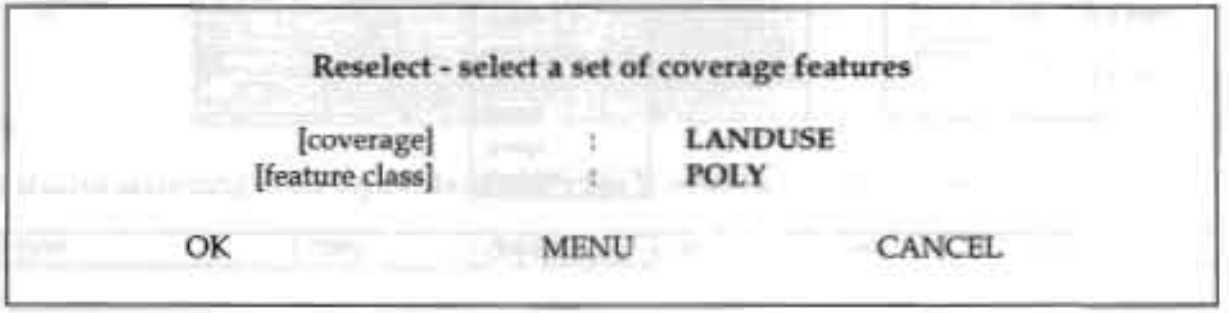
TYPE	LUCODE
Agriculture	2
Grazing	3
Urban	4
Forest	5

To select and draw only the agriculture polygons, first clear the screen.

Select **CLEAR** from the menu to erase the screen.



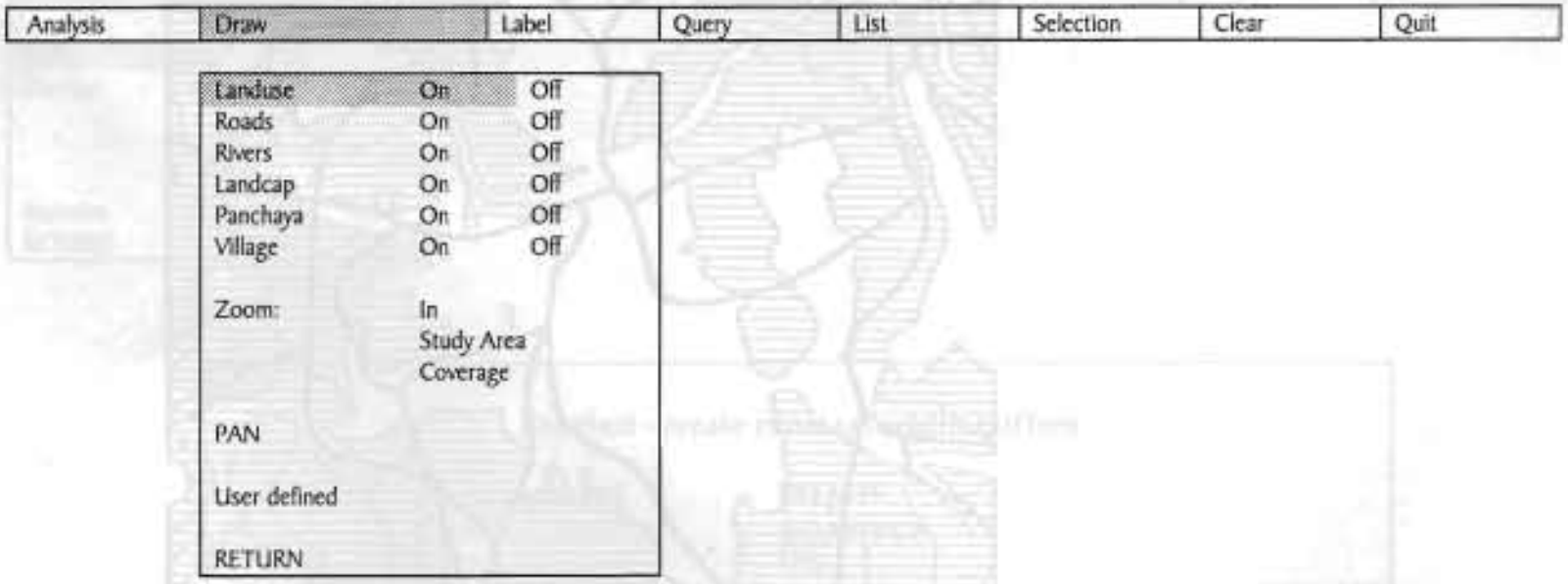
Choose **SELECTION**, then Choose features.



Now in the next menu that appears, enter LUCODE =2. Press <ENTER> to start the selection process.

LANDUSE polys: 53 of 71 selected.

Now the agriculture polygons are selected. To draw them, select the **DRAW** option and then choose **LANDUSE ON.**



Only the agriculture polygons are drawn.

Now draw the roads.

Choose **DRAW** again, and then **ROADS ON**
The display of agricultural land areas and the roads will look similar to the figure below.

Before proceeding to the next step, select **CLEAR** to clear the display.

Step 3

Create a 100-metre buffer area around the roads.

Select **ANALYSIS** and choose **BUFFER.**

Reselect - create constant width buffers

[input coverage]	:	**ROADS**
[feature class]	:	**ROADBUF**
[buffer distance]	:	**100**
[buffer feature]	:	**LINE**

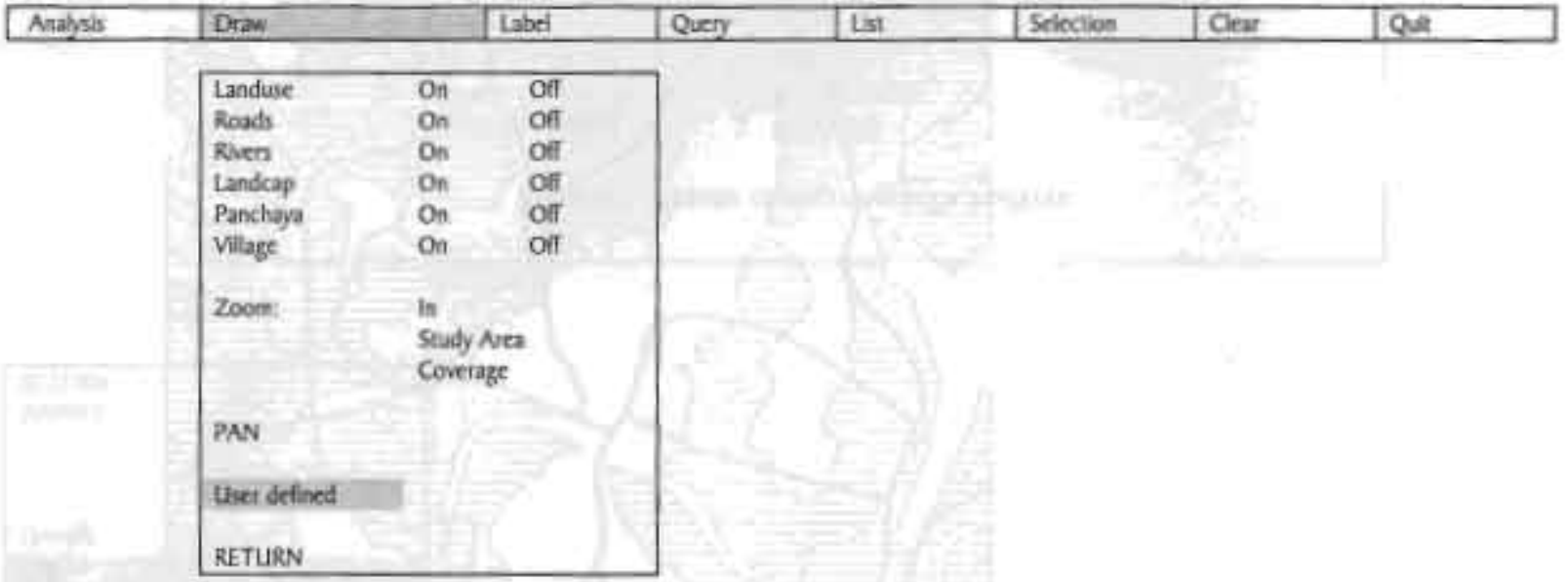
OK MENU CANCEL

After you've filled out the form correctly, press the **OK** button.

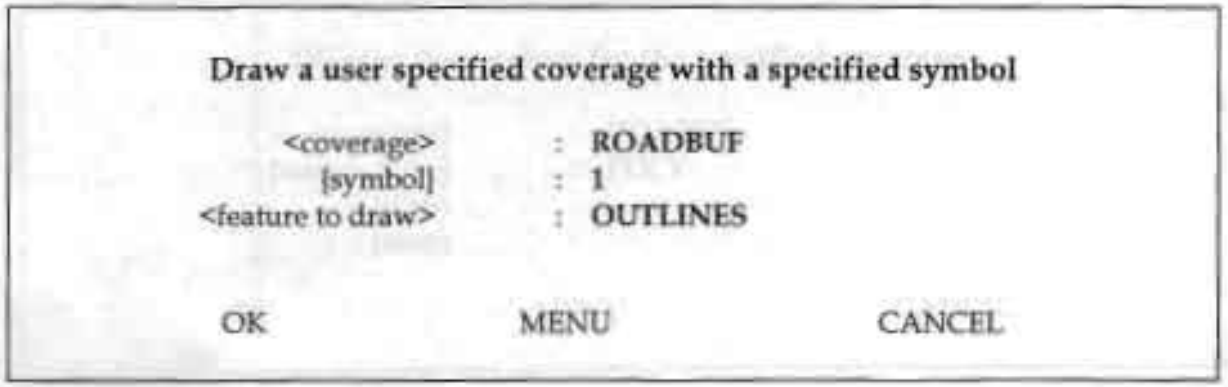
When the buffer is finished, the main menu appears.

Now display the buffer area.

To draw buffer around roads,
select **USER DEFINED** from the **DRAW** column.

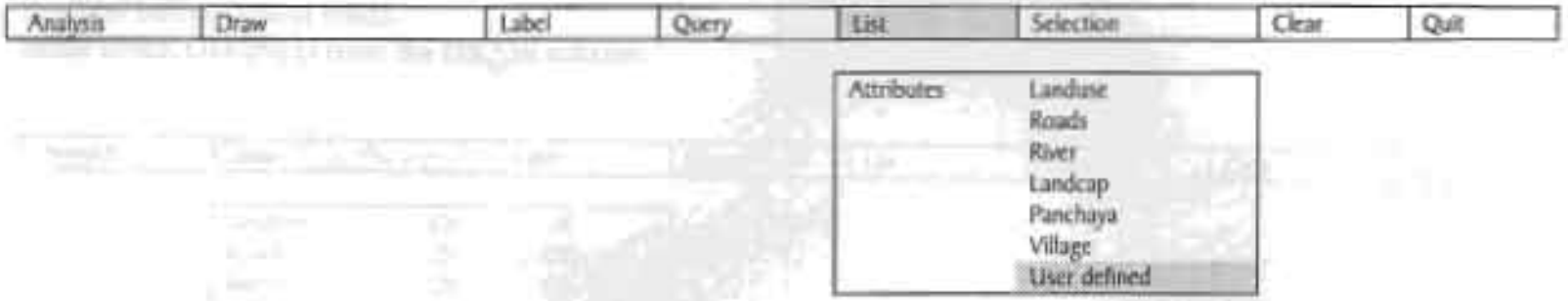


Fill in the form below to draw the outline of the buffer area polygon.

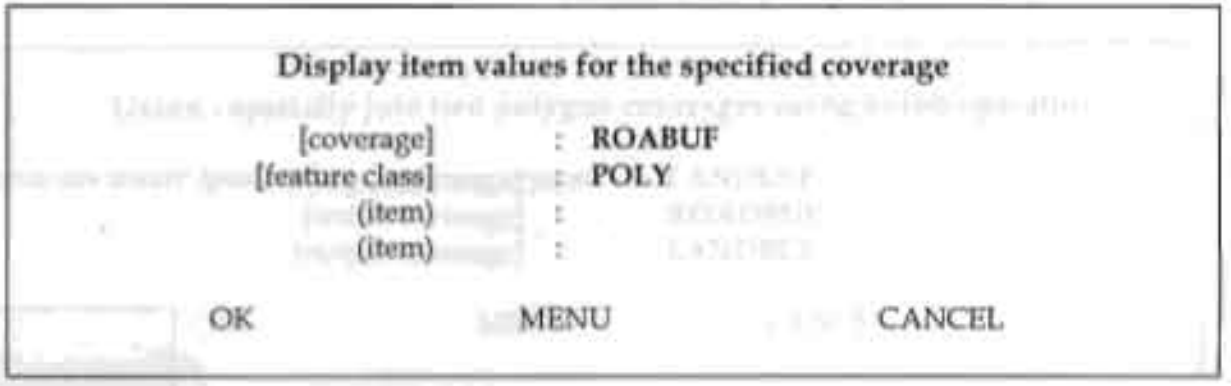


Press the **OK** button.

To view the attributes for the buffer polygons, choose **LIST** and then **USER DEFINED.**



Fill in the form below with the coverage name as ROADBUF and feature class as POLY to display the attributes.



Press the **OK** button to view the attributes.

$RECNO	AREA	PERIMETER	ROADBUF	ROADBUF_ID	INSIDE
1	-.5359674E+08	88988.1600	1	0	1
2	18316940.0000	177013.9000	2	1	100
3	3663801.0000	10565.6300	3	2	1
4	9629993.0000	16837.9600	4	3	1
5	154748.6000	2216.9650	5	4	1
6	1743105.0000	5567.6010	6	5	1
7	1284580.0000	7813.0810	7	6	1
8	2800595.0000	7482.5050	8	7	1
9	3304787.0000	7689.3590	9	8	1
10	5213054.0000	10844.6300	10	9	1
11	5545882.0000	4963.2200	11	10	1
12	694351.2000	5280.3910	12	11	1
13	1244905.0000	4714.3490	13	12	1

Press the <ENTER> key or click the mouse.
Before proceeding to the next step,

Analysis	Draw	Label	Query	List	Selection	Clear	Quit

select **CLEAR** to clear the display.

Step 4

Overlay LANDUSE and ROADBUF using the UNION command and display the results

Analysis	Draw	Label	Query	List	Selection	Clear	Quit

Buffer
Overlay: Union
Intersect
Identify

Statistics
RETURN

Select **ANALYSIS** from the menu, then select **OVERLAY:** Union

Fill in the form below to create composite coverage LANDBUF from the two input coverages LANDUSE AND ROADBUF.

Union - spatially join two polygon coverages using union operation

[input coverage]	:	**LANDUSE**
[union coverage]	:	**ROADBUF**
[output coverage]	:	**LANDBUF**

OK MENU CANCEL

Press the OK button to execute the form.

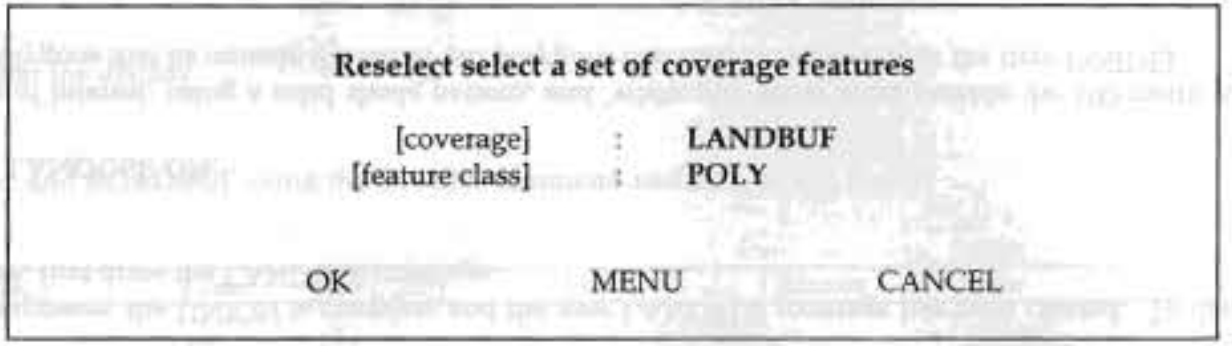
When the menu reappears, the UNION is complete and the new LANDBUF coverage has been created. To display the results of the Union operation, first draw the LANDUSE coverage.

Select **DRAW** and **LANDUSE ON.**

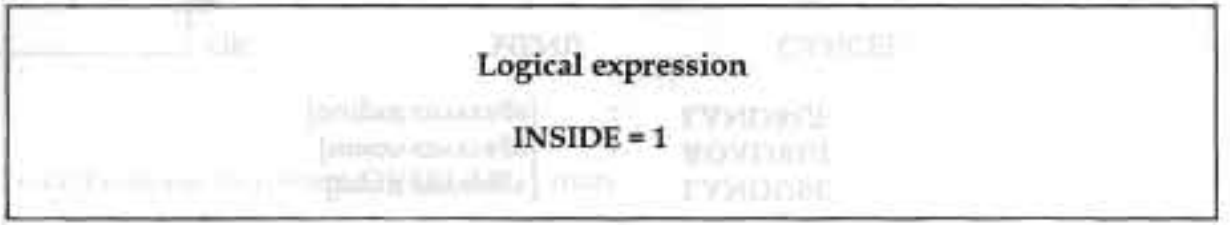
Highlight the area of interest, using a solid shade pattern, and 'white out' those areas outside the 100-metre road buffer. To do this, select those polygons that lie outside the buffer (all polygons that have a value of 1 for the item INSIDE).

Choose **SELECTION**, then **CHOOSE FEATURES.**

Fill in the form as shown.
Press the **OK** button.



In the next menu that appears, enter the selection criterion.

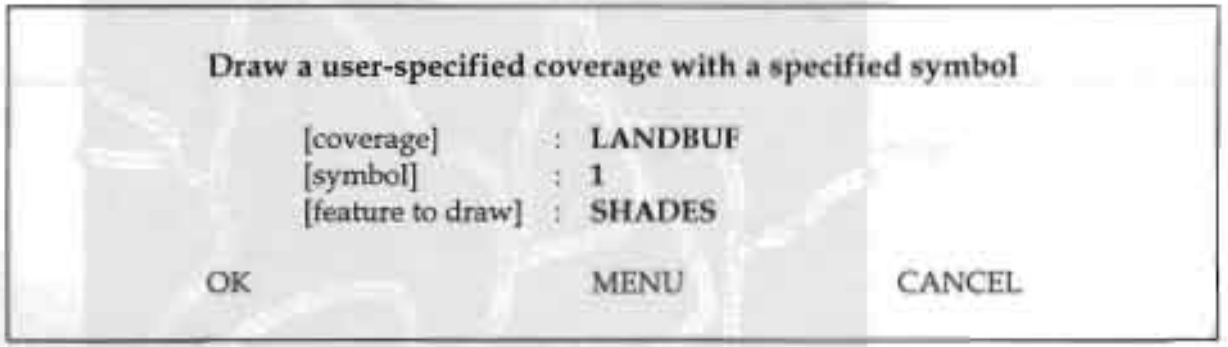


Press the <ENTER> key to start the selection process. A message appears:

LANDBUF polys 170 of 275 selected.

Now, shade these polygons.

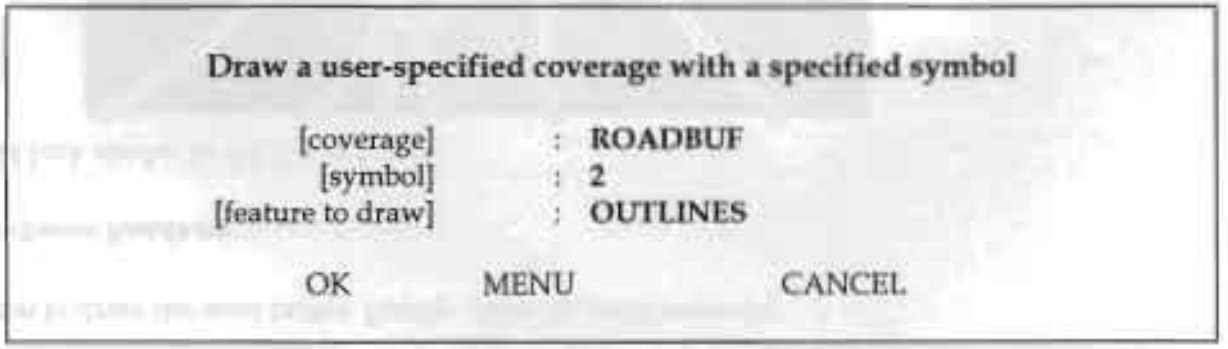
Fill in the form as shown.



Press the **OK** button to shade the polygons outside the buffer.

You can clearly see all the land-use types within the 100-metre buffer. Now highlight the buffer by drawing the ROADBUF coverage.

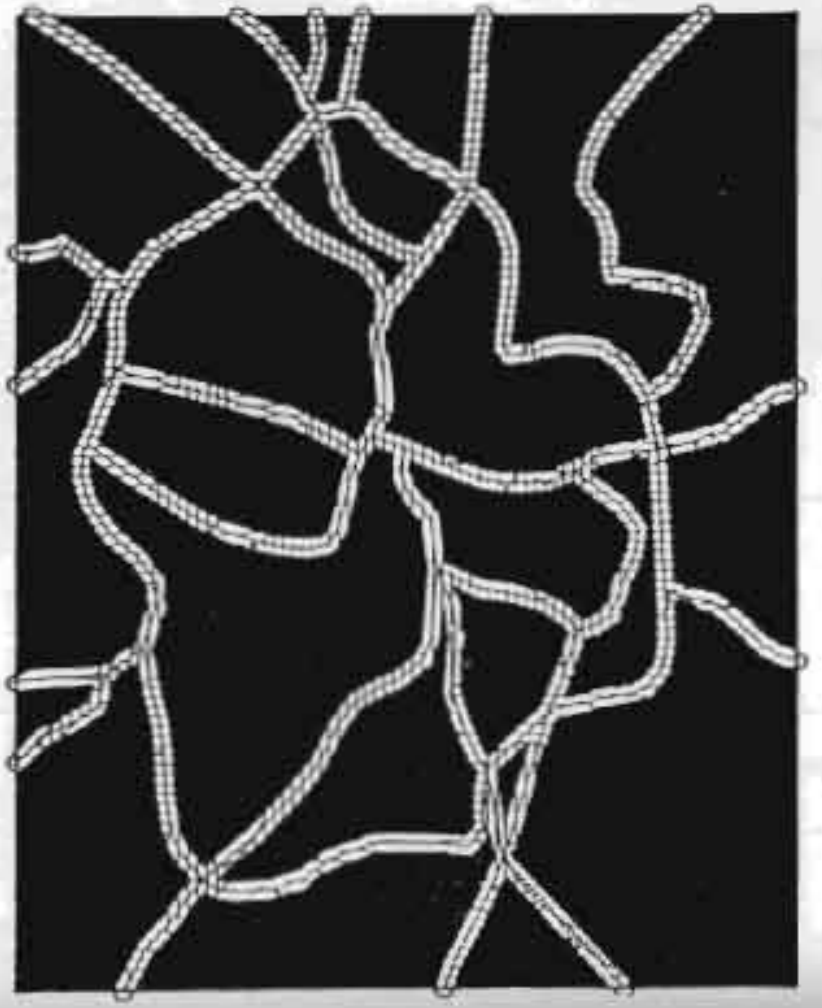
Select **Draw**, then choose **User defined**.
Fill in the form as shown.



Press the **OK** button to draw the road buffer. Finally, draw the road network.

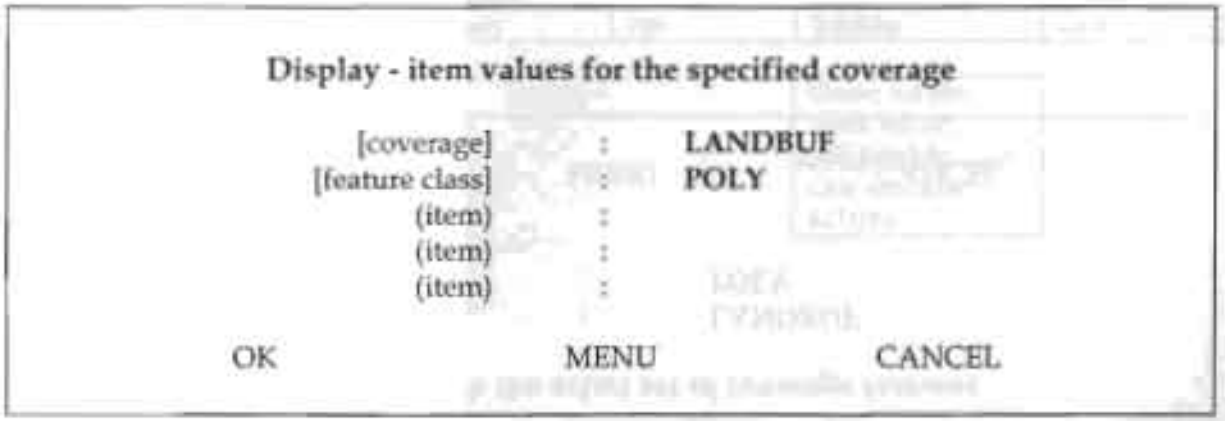
Select **Draw**, then choose **Roads on**.

The display should look similar to the figure below.



Select **List**, then choose **User defined**.

Fill in the form as shown.



Press the **OK** button.

Notice how the polygons have attributes from both the LANDUSE and the ROADBUF coverages, including LUCODE and INSIDE, respectively. Next, find the total area of agricultural land within 100 metres of the roads.

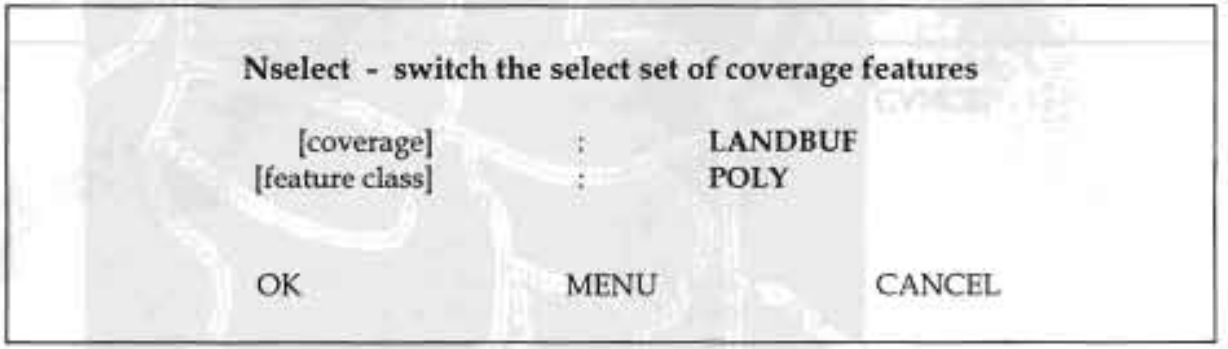
Step 5

Generate statistics for the analysis

Select those polygons that are inside the buffer.

Choose **Selection**, then **Switch features.**

Fill in the form menu as shown.

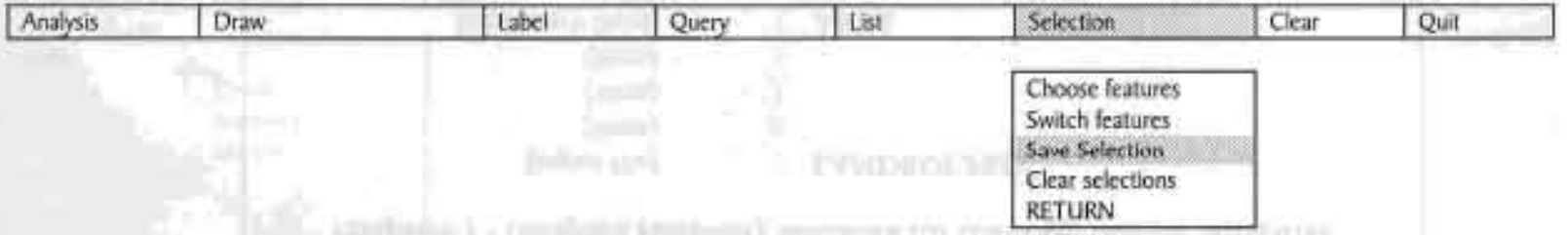


Press the **OK** button to switch the selected set of polygons.

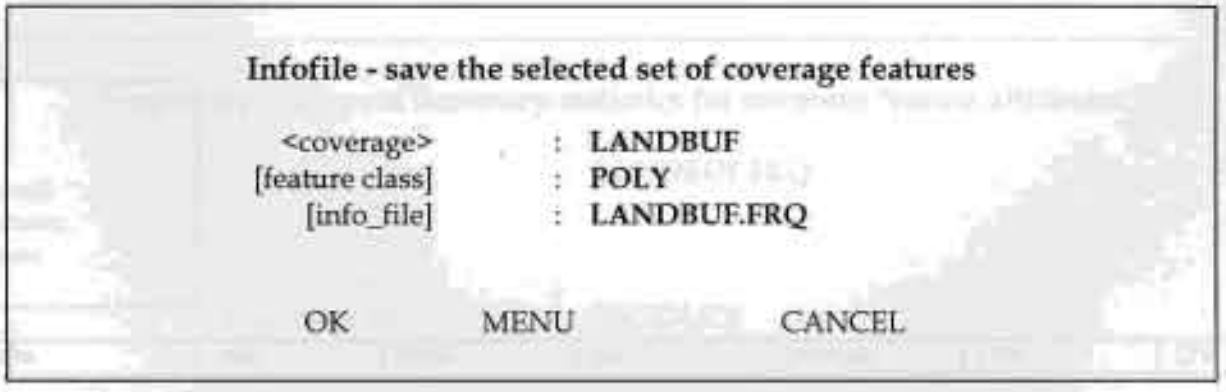
LANDBUF polys: 105 of 275 selected.

Only polygons with the buffer are selected. Save these selected features on a file on which statistical analysis is to be performed.

Choose **SELECTION**, then **SAVE SELECTIONS.**



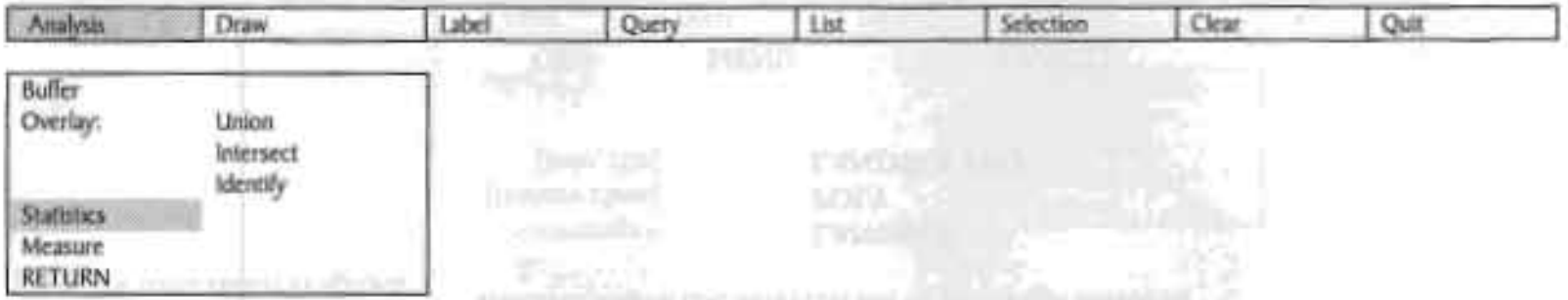
Fill in the form menu as shown.



Press the OK button.

Now, calculate the total area of each land use type within the 100-metre road buffer.

Select **ANALYSIS**, then choose **STATISTICS**.



Fill in the form menu as shown.

Frequency - compute summary statistics for coverage feature attributes

[input file]	:	**LANDBUF.FRQ**
(item)	:	
(item)	:	
(item)	:	
[summary item]	:	**AREA**

OK MENU CANCEL

Press the OK button to execute the form.

Now, calculate the total rice production lost within the 100-metre road buffer.

Select **Analysis,** then choose **Statistics.**

Fill in the form menu as shown.

Frequency - compute summary statistics for coverage feature attributes

[input file]	:	**LANDBUF.FRQ**
(item)	:	
(item)	:	
(item)	:	
[summary item]	:	**PRODUCE**

OK MENU CANCEL

Press the **OK** button to execute the form.