1. Make `idcities.shp` the active theme. Click the Query Builder button. Set the query expression as `[City_name] = "Sun Valley"` and click New Set. Use the Zoom To Select button and then the Zoom In button to zoom in the area around Sun Valley.

2. Press and hold the Draw Point tool, and choose Draw Circle from the pull-down menu.

3. This step is to draw a circle around Sun Valley and to use the circle as a graphic to select snow stations within the circle. Click on Sun Valley as closely as possible at its location and drag the cursor to make a circle with a radius of 40 miles. The message at the bottom of the computer screen shows you how closely the circle radius is to 40 miles. If you cannot get exactly 40 miles interactively, you can select Size/Position from the Graphics menu and type 40 miles as the radius value.

4. Now select snow stations that fall within the circle. Make sure `snowsite.shp` is active, and click the Select Features Using Graphics button. Those selected snow stations are highlighted.

5. Select Table from the Theme menu. Click Promote to move to the top of the table the highlighted records, that is, records for the selected snow stations.

   * Make charts

1. While the `snowsite.shp` table with its selected records is still active, click the Create Chart button. This part of Task 1 shows you how you can make charts using attribute data of the selected snow stations from the previous section.

2. In the Chart Properties dialog, do the following: rename the chart as Swe-max, click Swe-max as the Field, click Add to move Swe-max to the Group, change Label Series to Swe-max, and click OK. The chart
is basically a histogram depicting the maximum snow water equivalent of each selected snow station. Make another chart using the field of Elev. Elev lists the elevation of the snow station in feet.

3. To see the relationship between Swe-max and Elev, you can make a scatterplot. Click the Create Chart button to open a new chart. Add both Swe-max and Elev to Groups.

4. Click the xy Scatter Chart Gallery button to open options of scatterplots. Select the option in the upper left with the linear scaling of x and y and click OK. The other options are based on the logarithmic scaling of x, or y, or both; x and y. The scatterplot shows a positive relationship between Swe-max and Elev: the higher the snow station is, the more the maximum snow water equivalent is expected.

Task 2. Attribute Data Query

What you need: wp.shp, a vegetation stand coverage; wpdata.dly, a dBASE file containing stand data for wp.shp.

As explained in the text, query or data selection is the most important element of data exploration. Approached from either attribute data or spatial data, results of query are displayed in the linked windows of view, table, and chart. Task 2 focuses on attribute data query.

1. Start ArcView, open a new view, and add wp .shp to view. Open the theme table of wp.shp.
2. Activate the Project window. Click Tables and Add to open the Add Table dialog. Make sure the file type is dBASE. Double-click on wpdata.dly to select it.
3. At this point, you have opened two tables: the theme table (Attributes of wp.shp) and wpdata.dly. To join the data from wpdata.dly to the theme table, do the following: click on Id in wpdata.dly, click on Id in the wp.shp theme table, and then click the Join button to join the two tables. Id is the key relating the two tables.

4. Make sure the wp.shp theme table includes attribute data from wpdata.dly and is active. Click the Query Builder button to open the Query Builder dialog. The top part of the dialog box shows, from left to right, fields in the attributes of wp.shp table, logical operators and Boolean connectors, and values of the selected field. Notice that the name of each field is enclosed in a pair of square brackets. The bottom part of the dialog box has the display area of logical expressions on the left and three buttons for different query methods on the right. The buttons are New Set, Add To Set, and Select From Set. New Set selects a new data subset from the theme table. Add To Set adds a new data subset to the previously selected records. Select From Set selects a new data subset from the previously selected records.

5. Double-click the field of Origin in the Query Builder dialog, click the > operator, and double-click the value of 0. A logical expression, ((Origin) > 0), is now shown in the display area. This is the first logical expression. Click the connector AND, double-click the field of Origin, click the <= operator, and type 1900 to complete the second logical expression. The completed logical expressions should read: ((Origin) > 0) AND ((Origin) <= 1900). Now click on New Set. Records in the theme table that satisfy the logical expressions are highlighted. The upper left corner of the ArcView window shows “175 of 856 selected.” Do not dismiss the Query Builder dialog because you will use it again for refining the query operation.

6. The field Origin represents the origin of trees in a stand, expressed in the year trees were planted. The value 0 means that the origin is unknown. Therefore, the logical expressions in step 5 selected stands with trees known to be at least 100 years old. Click the Promote button to bring the selected records to the top of the theme table. Examine the Origin
values of the selected records to see if any of
them are after 1900. Now view the map. Highlighted polygons correspond to the
selected records.

7. Finally, narrow the selected records by
including aspect as an additional criterion.
Return to the Query Builder dialog. Drag and
highlight the logical expressions between the
outer parentheses and delete them. Construct
the following logical expressions: (As = "N") OR (As = "NE") OR (As = "NW").

Then click on Select From Set. The number
of records selected, as shown in the upper left
corner of the ArcView window, is reduced
from 175 to 44. The reduced data subset
shows only old-growth stands that have the
aspects of north, northeast, and northwest.
Again, you can verify that the selected
records do meet both the origin and aspect
criteria. View the map to see where those
stands are located.

3. The next step is to link the tables. The idea is to
keep the four tables separate but dynamically
linked rather than joined. To link two tables,
you need to know which fields to use as keys.
As illustrated in the chapter, musym can link
the theme table and comp.dbf, nmaid can link
comp.dbf and forest.dbf, and plantym can link
forest.dbf and plantrnm.dbf. Linking tables is
directional, that is, from the source table to the
destination table. In data exploration, you want
to be able to search soil attributes from any
table. Therefore, you need to perform link twice
between every two tables. To link the theme
table to comp.dbf, click on musym in the theme
table and musym in comp.dbf, and select Link
from the Table menu. Then, repeat the same
process in the opposite direction: click on
musym in comp.dbf, musym in the theme table,
and select Link from the Table menu. Now, you
have completed the two-way linking between
the theme table and comp.dbf. Do the same
between comp.dbf and forest.dbf, and between
forest.dbf and plantrnm.dbf.

4. At this point, the four tables are linked in
both directions. The chapter asked a question
about what types of plants are found in areas
where annual flooding frequency is rated as
either frequent or occasional. You can now
answer the question by doing the following.
Make comp.dbf active. Click on the Query
Builder button. In the Query Builder dialog,
prepare the query expression as ((Anflood = "FREQ") OR ((Anflood = "OCCAS")), and
click New Set. Records in comp.dbf that meet
the criteria are highlighted as the

Task 3. Relational Database Query

What you need: mosoils.shp, a soil coverage;
comp.dbf, forest.dbf, and plantrnm.dbf, three dBASE
files from the National Map Unit Interpretation
Record (MUIR) database maintained by the Natural
Resources Conservation Service (NRCS).

Task 3 lets you work with the MUIR database.
By linking the tables in the database property, you
can explore many soil attributes in the database
from any table. And, because the tables are linked
to the soil map, you can also see where selected
records are located.

1. Start ArcView, open a new view, and add
mosoils.shp to view. Open the theme table of
mosoils.shp.

2. Next, add the dBASE files to the computer
screen. Activate the Project window. Click on
Tables and Add. Navigate to the three
dBASE files and add them as tables. You
should now have four tables and the soil map
on the monitor. Arrange them so that you can
work with each one of them.

5. You can try another query with the tables.
You probably want to first clear the selected
records by clicking the Select None button. Now,
made plantrnm.dbf active and click the
Query Builder button. Prepare the query statement as ("Comname" = "lupine"). Click New Set. The selected record in plantnm.dbf and its corresponding records in the other tables are highlighted. You can also see where lupine can be found on the map.

**Task 4. Combining Spatial and Attribute Data Queries**

*What you need:* `thermal.shp`, a coverage with 899 thermal wells and springs; `idroads.shp`, showing major roads in Idaho.

Task 4 assumes that you are asked by a company to locate potential sites for a hot spring resort in Idaho. You are given two criteria for selecting potential sites:

- The hot spring must be within 2 miles of a major road.
- The temperature of the hot spring must be greater than 60°C.

The field type in `thermal.shp` uses `s` to denote springs and `w` to denote wells. The field temp shows the water temperature in °C.

1. Start ArcView, open a new view, and add `thermal.shp` and `idroads.shp` to view. Select Properties from the View menu. In the View Properties dialog, set the Map Units as meters and the Distance Units as miles. Both `thermal.shp` and `idroads.shp` have meters as the map units.

2. Activate `thermal.shp` theme. Click Select By Theme from the Theme menu. In the dialog, set the query statement to read: "Select features of active themes that are within Distance of the selected features of `idroads.shp`" and the Selection Distance to be 2 miles. Click New Set. Those highlighted thermal springs and wells are within 2 miles of major roads in Idaho.

3. Next, narrow the selection of map features by using the second criterion. Select Tables from the Theme menu. Use Promote to move the selected records to the top of the table. Click on the Query Builder button. Prepare the query expression as: ("Type" = "s") AND ("Temp" > 60). Because you want to select from the previously selected records, click on Select From Set. Disable the Query Builder dialog.

4. Again, use Promote to move the selected records to the top. The Type value of the 15 selected records should be all `s` for springs, and the Temp value should be all above 60. In fact, one of the selected records has the name of "Zim's Resort," a hot spring that has already been developed into a resort area. The map shows you where those 15 hot springs are located.

5. As explained in the chapter, this task can also be solved by first selecting hot springs with water temperatures above 60°C through attribute data query and then selecting those springs that are within 2 miles of major roads through spatial data query. The final answer should be the same.

**Task 5. Raster Data Query**

*What you need:* `slope_gd`, a slope grid; and `aspect_gd`, an aspect grid.

Task 5 shows you different methods for querying a single grid or multiple grids.

1. Start ArcView, and load Spatial Analyst. Open a new view, and add `slope_gd` and `aspect_gd` to view. `Slope_gd` has the following slope classes in degree: 1 (0–10), 2 (10–20), 3 (20–30), and 4 (30–40). `Aspect_gd` has the following aspect classes: 1 (flat), 2 (north), 3 (east), 4 (south), and 5 (west).

2. Select Properties from the View menu, and set the Map Units to meters and the Distance Units to kilometers. First query `slope_gd` using the graphic method. Click the Draw Circle tool. Then click a point in `slope_gd` and drag the cursor to make a circle with a radius of 1.5 kilometers. If you cannot get exactly 1.5 kilometers interactively, select Size/Position from the Graphics menu and type 1.5 kilometers as the radius value.
3. Click on the Histogram button. The histogram shows the cell values and their frequencies within the circular area. You can also click on the Identify tool and then the bar graph of a cell value to find its exact frequency (count). To remove the circle, make it active and select Delete Graphics from the Theme menu.

4. Map Query is the tool for querying a grid by its cell values. Select Map Query from the Analysis menu. In the Map Query 1 dialog, set the query expression as: ((Slope_gb) = 2) AND (Aspect_gb = 4). Click Evaluate. Map Query 2 shows areas that satisfy the logical expression.

5. Map Query can also query both slope_gb and aspect_gb to find areas having slopes between 10 and 20 degrees and the south aspect. Select Map Query from the Analysis menu. In the Map Query 2 dialog, set the query expression as: ((Slope_gb) = 2) AND (Aspect_gb = 4). Click Evaluate. Map Query 2 shows areas that satisfy the logical expression.

6. To save the result of a map query, first activate the output to be saved and then select Save Data Set from the Theme menu. In the next dialog, specify the name and the path for saving the data set.

**REFERENCES**


