Data Collection

Topics:

1. Preparing the base map
2. Creating new shapefiles
3. Digitizing Features
4. Modifying Existing Features
5. Adding Data Fields and editing Feature Attributes
6. Displaying and Labelling features
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1. Preparing the base map

Spatial data collection can be done in many ways. The information on the geo-referenced photo image can be generalized and extracted to digital spatial data for later use. In this lab, you will learn how to create a new spatial dataset, collect the spatial information from a georefernced image, and how you can change and update existing spatial data.

Collecting Spatial Data by Digitizing

Digitizing is a process of copying an existing map to create a digital version. During the digitizing process, maps can be selectively digitized and generalized to create a simplified version of the original. Digitizing can be performed by using a digitizing tablet to copy a paper map or by using a "heads-up" digitizing method which involves digitizing on screen. We will be doing "heads-up" digitizing in this lab.

A geo-referenced color image ***campus50cm_2010.tif*** will be used as a base map. This image is in UTM 10N coordinate system and resampled from 20cm resolution air photo.

>   ***campus50cm_2010.tif*** :   **L:\labs\geog300\unbc**.

The spatial data you will collect are ***localroads, buildings, parkings***, and ***ponds*** around UNBC campus. These spatial data will be saved into separated spatial files as the following:

— ***localroads*** - roads around UNBC campus (line feature)
— ***buildings -*** campus buildings (polygon feature)
— ***parking -*** parking lots (polygon feature)
— ***ponds -*** detention ponds (polygon feature)

2. Creating new shapefiles

The new spatial features collected/digitized from photo image need a place to store the information. We will create a shapefile for each spatial layer to store the spatial information. Shapefile is the file format of ESRI's ArcView software for storing spatial data. A spatial dataset stored in shapefile format is described by several associated files (same file name with different extension such as shp, dbf, sbx, sbn, shx).

Four new shapefiles (***localroads, buildings, parking, ponds***) will be created to store the data you will be digitizing. To create a new shapefile, you will need to work in ArcCatalog (You can use ArcCatalog tab in ArcMap instead of launching ArcCatalog)

*   In ArcCatalog, create a folder **data_collection** in your geog300 folder
*   Right-click **data_collection** folder and choose New->Shapefile. A small window pops up asking for the name of shapefile, the type of feature, and the coordinate system information.
*   Give ***localroads*** for the Name and Polyline for the Feature Type (line features).

Next you will specify the coordinate system to be applied to this new dataset. As the base map image (***campus50cm_2010.tif***) is geo-referenced with the UTM 10N coordinate system, the spatial features collected based on this image should have the same coordinate system.

- Click the check box beside Show Details. This will display more detailed information about coordinate system in this dataset.
- Click Edit button. The Spatial Reference Properties window pops up allowing you to specify the coordinate system.
- Click Projected Coordinate Systems->UTM->NAD 1983->NAD 1983 UTM Zone 10N and click OK. You will see the coordinate system information showing in the Description box
- Click OK in Create New Shapefile window

The new shapefile ***localroads*** with UTM 10N coordinate system should be displayed under your **data_collection** folder. If it doesn't show, right-click **data_collection** folder and choose Refresh

The newly created shapefile is empty and will be used for storing the digitized spatial data

Now create a shapefile for each of the following with UTM 10N coordinate system. Save all datasets to your **data_collection** folder. Once finished, you are ready to start digitizing.

- ⎯ ***buildings*** - polygon feature type
- ⎯ ***parking*** - polygon feature type
- ⎯ ***ponds*** - polygon feature type

3. Digitizing features

Line Feature

- Close ArcCatalog window and start ArcMap with a blank map
- Add the data layers ***localroads, buildings, parkings*** and ***ponds*** from your local folder. Note: There is no data displayed as all these datasets are new and empty.
- Add ***campus50cm_2010.tif*** from **L:\labs\geog300\unbc** and move it to the bottom in the table of contents. If the image is showing in black, right-click on the image and open the properties window. Under Symbology tab, change the Stretch Type to Standard Deviations. This will stretch image values to map to visible colors. Click OK.
- Change the ***localroads*** symbol to Red at width 1.5. Change all the polygon features to Hollow symbol and change the symbology for all layers to make them have better contrast from the background (Road in red, building in orange, parking in grey, and pond in blue)

Let's work with the ***localroads*** layer first to trace the local roads around UNBC campus area.

- Turn on the Editor, click Customize->Toolbars->Editor Toolbar. The Editor tools allow you to digitize different shapes (line, rectangle, circle, ellipse, freehand etc.)

Before editing the data, we need first to set the snapping environment which will help to reduce the digitizing errors and make the digitized feature well snap to the existing features.

- On the Editor toolbar, click Editor->Snapping->Snapping Toolbar to turn on the Snapping toolbar. Four buttons showing on the Snapping bar let you choose how you want to snap the digitized feature to the exiting features. The functions of each button are list below start from the first left button 'Circle'. Put mouse cursor over the button to see the functionalities of each button.

First button:	Point snapping
Second button:	End snapping
Third button:	Vertex snapping
Fourth button:	Edge snapping
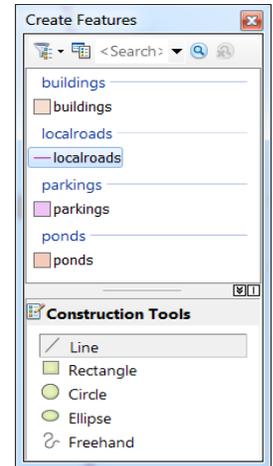
- You can use any combination to set the snapping environment. Now click all four buttons to turn on the snapping environment. This will make the snapping happen whenever you mouse cursor close enough to a point, end of a feature or a vertex and make your digitizing job much easier.
- Click the X at upper right of Snapping window to close it.
- Click Editor->Starting Editing on the toolbar to start editing mode.
- Click the Create Feature button located at end of the Editor toolbar to add a new feature

- A small window 'Create Features' pops up and all visible layers are listed there. You can choose any one to start digitizing. As we will be working on *localroads* first, leave *localroads* on and turn off all the rest of layers but the *campus50cm_2010.tif*

In some cases, the layers are visible but not showing in the Create Features window. If this is the case,

- Click the second button at the top in Create Feature window to create a template for the layers that are not listed here. In the Organize Feature Templates window highlight the layer you want to create a new template and click New Template button at top. In popped up window 'Create New Templates Wizard', place a check mark for the layer you want to have a new template and click Finish button. The layer will be showing in the Create Feature window

- Now we are ready to digitize the data. In the Create Features window, highlight the *localroads* layer. In the lower part of Create Features window, there is a tool set allowing you to construct different shapes. Highlight Line construction tool.

- Click the Straight Segment button on the toolbar. The mouse cursor turns to plus sign and ready for digitizing. This tool allows you to use the left mouse button to trace the feature by clicking a location to place a vertex to make a shape. Each vertex will show as a small square handle which allows you to edit at any time.

- Trace the campus *localroads* line by clicking the left button starting from north end of University Way until you reach the end at the intersection to UNBC. The University Way is collected. A vertex will be added in at each click. When reach the end, right-click mouse button and choose Finish Sketch to finish digitizing. The newly digitized feature is highlighted in Cyan color (selected). Then you can go to next digitizing to trace the rest of road lines.
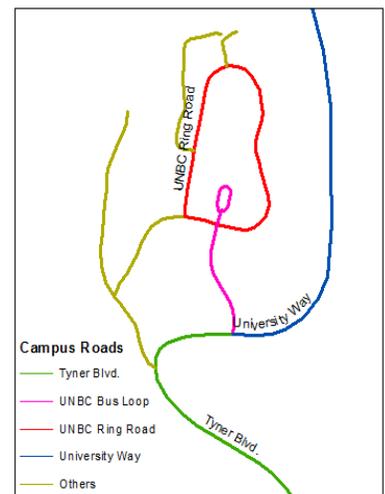
- Save the edits frequently by clicking Editor->Save Edits in case something happen suddenly so you wouldn't lose your work.

- Trace the local roads Tyner Blvd., University loop and two or three other campus roads. Save the edits

Adjust, change and modify feature

Mistakes, errors, and other things may require edits. You can use Edit Tool button to edit or delete a feature. For example, we want to edit the road line we just digitized,

- Click Edit Tool button ⊳, and double click the element you want to edit. The feature is selected and highlighted in cyan color with many small handles (squares in green). These small squares are the vertices which can be deleted, moved, and edited. You can change the shape of the feature by editing the vertices along the feature. Each small square indicates a vertex location. You can click a square and drag the mouse cursor to move the vertex. The shape of the feature will be changed. Try it. Place the mouse cursor over a vertex. Click and hold and drag it to move.
- You can also insert a vertex to smooth the shape by right-click the selected feature (not on an existing vertex location) and choosing Insert Vertex.
- If you are not happy with, you can delete an element by clicking the Delete button (X) with element selected.
- Play around with these digitizing techniques and finish the rest of digitizing for *localroads*
- Once you are satisfied with everything, save the data by clicking Editor->Save Edits.

Polygon features

Now we are going to build the rest of layers: **buildings, parking, ponds**. These are all polygon features.

Now start with campus **buildings.** You should have the Editor Toolbar displayed and still under editing mode.

- Zoom in to UNBC campus area. Make sure you have saved the Edits for *localroads*. Turn off the *localroads* layer in the table of contents.
- In order to see better when digitizing, change the symbol for all polygon layers to Hollow symbol. Change the outline of each polygon layer to brighter color with appropriate line width (eg. **buildings** in orange, **parking** in black and **ponds** in blue)
- Turn on **buildings** layer in the table of contents if necessary and turn off the rest except the image
- In the Create Feature window, highlight the **buildings** layer to make it the current working layer and highlight Polygon in the Construction Tools.
- Start tracing **Teach & Learning** building (north end building) and then the rest of buildings. Remember to save your work frequently, especially, after finishing each feature layer's editing.
- Click the ▱ button to start tracing building footprint.
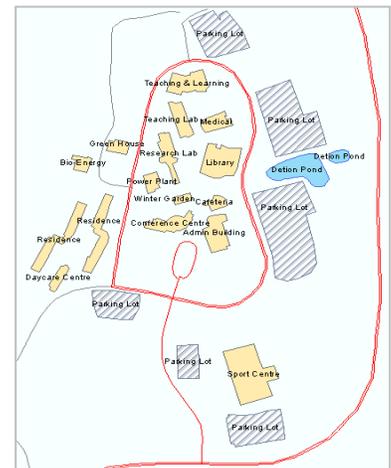
When digitizing a polygon feature, the feature is showing as a closed feature. This is because you created a shapefile with the polygon feature type. Digitizing polygon features is similar to digitizing the line features.

Now finish tracing the rest of building footprints

Library, Admin Building, Conference Center, Research Lab, Teaching Lab, Teaching & Learning, Power Plant, Sport Centre, Daycare, Bio-Energy

- Remember to save the edits frequently. Adjust the features if necessary.
- In the same way trace the boundary of **parking**, and **ponds.** Turn off the layers you are not currently working on. Remember to change the target layer to **parking** and **ponds** respectively.
- Make necessary changes to better match the features on the photo (Check the Adjust, change and modify features). Save your edits frequently.
- Once you finish all digitizing, you can end editing mode by clicking Editor->Stop Editing. Save all changes and click OK
- Save the map file to your **geog300\data_collection** folder and give the file name **digitizing.mxd**.

4. Modify Existing Features

Now we have done digitizing for new data collection. We have another dataset *fcover* containing vegetation information for this area which is out of date comparing to the latest air photo and need to be updated to reflect the reality.

- Leave the *campus50cm_2010.tif* on and turn off the rest of layers
- Copy the *fcover* dataset from **L:\labs\geog300\unbc** to your local **data_collection** folder.
- Add your local copy of *fcover* to ArcMap. Arrange the order of layers to make them all visible.
- Symbolize *fcover* with Hollow symbol and set the outline color to bright yellow and outline width at 2.
- Use the Identity button to query the polygon (*fcover*) in the area of Sport Center. You may notice that the polygon was cover by Spruce trees (SPEC_CD_1, leading species). Now the area is turned to buildup area and no trees anymore. So we need to update the *fcover* to make this area have no tree (SEPC_CD_1 set to "").

To modify the *fcover*, we need to draw the area of sport centre and use the drawn shape to cut off from the *fcover*.

- Start Editing and set *fcover* for Editing Layer.
- Click the Sketch tool to trace the boundary of Sport Centre area (image above). Once finished right-click and choose Finish Sketch.
- With the digitized feature selected (highlighted), on the Editor Toolbar, click Editor->Clip. This will cut off the area from *fcover* with selected feature (we just digitized).
- In the popped window (Clip), Set Discard the area that intersects. Click OK. The area covered by the selected feature will be clipped
- Click the scissors button to delete the cookies cutter
- Click Editor->Save the edits

Use Identity button to query the *fcover* polygon that covers Teaching and Learning building area. This area was covered by Douglas Fir species and it should be changed to non vegetated area. Try to clip this area from *fcover*.

- Save the edits and stop editing

5. Adding Data Fields in Attribute Table

Now we have the spatial data in digital version. Let's examine the attribute of these data.

- Remove the image *campus50cm_2010.tif* layer by right-click on the layer and choose Remove.
- Turn off *fcover* layer. Open the attribute table of *localroads* and *buildings*

There are only two or three data fields in the each table: FID tells you the unique feature ID, Shape indicates the type of feature and ID field is left as a zero value. By default, when you create a dataset, the associated attribute table is generated automatically with basic information such as ID, Shape fields etc. In most cases, we need more information to describe the spatial features such as the name of street, surface of road, area of park etc. This information is usually called non-spatial data and can be added into the attribute table manually.

We want to have name, height, and the area information for each campus building. We will add three data fields NAME, HEIGHT, and AREA to store the information. To do this, you need to create new data fields for storing the attributes.

Adding data fields can be done in either ArcCatalog or ArcMap.

- Right-click *buildings* and choose Open Attribute Table.

- In the attribute table window of **buildings**, click the first button at upper left corner and choose Add Field. Here you can add a new field and specify the properties of the data field.
- In the Add Field window, type in NAME in Name box, specify the data type to Text and set the text length to 30. This means the data field will have the name of NAME, store text string and maximum length of 30 characters.
- Click OK to finish. A new data field NAME will show at the end of the attribute table.
- Now create another data field HEIGHT for holding the building height. Set the Type to float, Precision to 10 and Scale to 1.
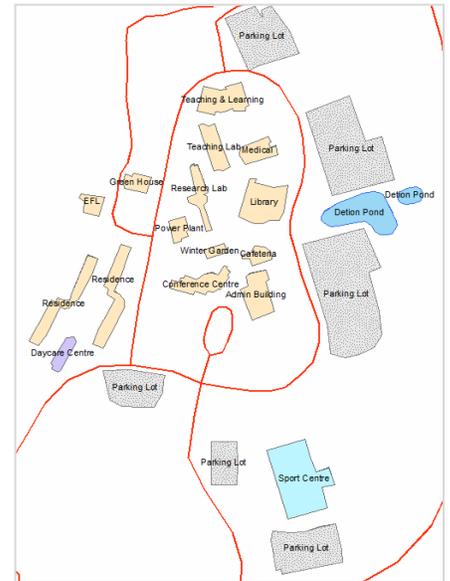
Float and Double data type allow storing decimal values.

- — Precision defines the total number of digits including decimal period and,
- — Scale specifies the number of decimal places.

The values in this data field have maximum 10 digits and one decimal place.

- In the same way add AREA field with the same setting as HEIGHT field and close the attribute table

Use the following guidelines for choosing the correct field type for a given precision and scale:

When you create float and double fields for floating point values, you need to specify a precision and scale.

For a Float or Double Type, the Precision describes the number of digits that can be stored in the field, while the Scale defines the number of decimal places for float and double fields.

- If your precision is greater than 6, use a double; otherwise use a float.
- If you create a double field and specify a precision of 6 or less, a float field is created in the database.
- If you create a float field and specify a precision greater than 6, a double field is created.
- If you specify a scale of 0 and a precision of 10 or less, you should be creating integer fields.
- When creating integer fields, the precision should be 10 or less.

Assign Field Values

Now we want to assign values to the data field (NAME)

- Turn off all layers except **buildings**.
- Start an editing session and make **buildings** the current editing layer.
- Right-click **buildings** in the table of contents and choose Zoom to Layer.

We want to assign a name for each campus building (refer the image above)

- Click Edit button . This button allows you to select, change and modify a spatial feature and its attribute.
- Open the attribute window of **buildings**. Move the window around so that you can see both attribute table and the features in the display area.
- Click on the polygon for the Teaching lab in the display area. The polygon is selected and you should see attributes of this feature is also highlighted in the table.
- Click the NAME field on the selected record in attribute table and type in 'Teaching Lab' (no quotation).
- Type in 60 (feet) for the in HEIGHT field
- Repeat the steps to assign values to the NAME and HEIGHT fields for all the rest of the features in **buildings** (give an appropriate height value, about 12 feet for one floor)
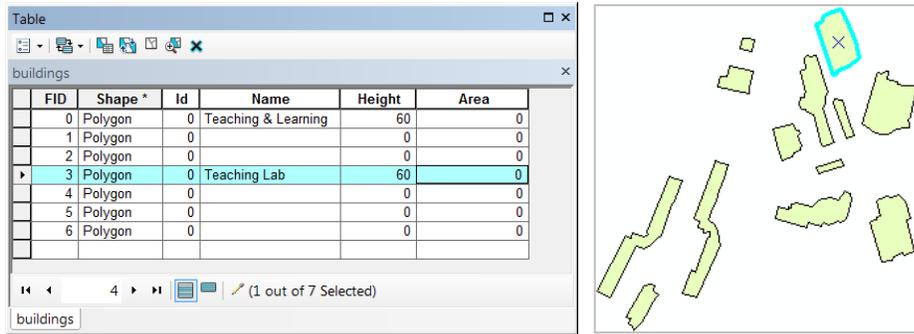
Teaching & Learning, Teaching Lab, Medical, Research Lab, Library, GreenHouse, Bio-Energy, Cafeteria, Conference Centre, Admin Building, Residence, Day Care, Sport Centre

- Save the edits

Calculating Geometry

The values of AREA for each polygon can be calculated with Calculate Geometry tool

- In order to modify the structure of the table, you need first to end the editing mode. Click Editor->Stop Editing. Save all the changes when prompted.

Remember to end the editing mode first before modifying a table structure

- In the attribute table of *buildings*, right-click AREA->Calculate Geometry
- Set Property to AREA (calculating area)
- Set Units to Square Meters and click OK.
- Check the AREA field in the attribute table

With Calculate Geometry tool, you can also calculate length, perimeter etc.

Calculating Field Values

Now examine *parkings*. For the parking lots around campus, we want to have an IDENTITY field to hold the value of "Parking Lot"
- Add a data field IDENTITY in *parking*
- Set the Type to Text and the length to 15. Click OK to close the table.

As all parking lots will have the same identity value of "Parking Lot". Instead of assigning value for each feature, we can just recalculate the field for all records in the dataset.

- In the attribute table, right-click IDENTITY field and choose Field Calculator. Type the value of "Parking Lot" (with the quotation) in the value box and click OK.
- Add an AREA field to *parking* and calculate the area with Calculate Geometry tool.

The last dataset is the *localroads* layer. We want to add three data fields to this layer: NAME, SURFACE and TYPE

- Add three data fields NAME, SURFACE and TYPE to the *localroads* attribute table with Text type and length of 30.

The possible values for NAME, SURFACE and TYPE are listed in the table

- Start Editing mode and set the target layer to *localroads*.
- Add values to **NAME, SURFACE** and **TYPE** fields respectively. For all roads without name, give "Gravel" for SURFACE and Local Road for TYPE.

NAME	SURFACE	TYPE
University Way	Paved	Major Road
Ring Loop	Paved	Local Road
Tyner Blvd.	Paved	Major Road
UNBC Bus Loop	Paved	Local Road
Others	Gravel	Local Road

- Once finished, save all edits and stop editing session.
- Add LENGTH field to *localroads* with Float type, precision of 10 and scale of 1.
- Calculate LENGTH for *localroads* with Calculate Geometry tool.
- Right-click LENGTH->Statistics. Here you can find the total length of *localroads*

Now you can use the attributes to display and query the datasets.
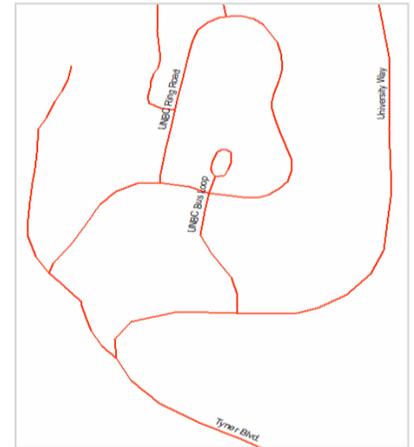
6. Displaying and labelling features using the attributes

You have the attributes added into the attribute tables for *buildings, parking,* and *localroads*. This information can be used to display, query and perform analysis.

Now display the *buildings* in a different color using the **Name** field. Do you remember how to do it?

- Right-click *buildings* in the table on contents and choose Properties.
- Click Symbology tab. Click Categories->Unique Values. Set the Value field to Name from dropdown list.
- Click the Add All Values button to add values from the Name field. Click OK to apply the changes.

Each building is in different color. We also want to label each building using the Name field.

- Right-click *buildings* and choose Properties.
- Click Label tab. Click the check box beside 'Label features in this layer'
- Click the dropdown arrow for Method and set method to 'Label all features the same way'.
- Choose Name from the dropdown list for Label Field.
- Click the Symbol button and set the font size to 8 and click OK. Click OK in the Layer properties window. Each building is labelled with its name.
- Symbolize *localroads* based on Surface type.

Now label the *localroads* using the value from Name field.
- Leave *localroads, parking, ponds* and *buildings* on and turn off the rest of the layers.
- Make a simple map to show campus features and save the file to **unbc_campus.mxd** in your local folder

Assignment 2 & 3: Data preparation (10%) due Oct 2,3,4

The purpose of this assignment is to practice the skills learned from this lab and next week's lab for data preparation. The study area is the Joffrey lake Provincial Park located 35 km east of Pemberton in British Columbia.

Data location: L:\labs\geog300\joffre_lake

The spatial data we have are park boundary (*joffre_park*), the georeferenced park map **joffre_map.tif** in UTM zone10 coordinate system, a CSV file (**point_interest.csv**) for the point of interest and TRIM data in SAIF format for this area. You are required to prepare the spatial data *trails, point_interest, lakes, rivers, roads, glacier.*

The trail lines can be digitized with park map **joffre_map.tif** as the visual guide. The point of interest feature can be generated from the CSV file by using Create a feature class from XY table and the rest of features can be extracted from TRIM data.

First you will need to trace trail lines in the park by using the georeferenced image **joffre_map.tif**. Save the trail lines as *trails.shp*

1. Create a new shape file ***trails.shp*** with line feature in ArcCatalog and add a field LENGTH (Double) and TYPE (Text string)
2. Trace the Joffre lake trails (trails in red dash lines from the top north to the upper lake)
   Note: If the color of TIFF image looks wired, open the properties of the image and under Symbology tab, change the Stretch Type to None and uncheck the Apply Gamma Stretch box
3. Assign the value of "Joffre Lake Trails" to the TYPE field.
4. Trace other trails (the green dash lines) inside the park and assign the value of "Park Trails" to TYPE field. Calculate the length in meters.
5. Make necessary changes if needed.

For the following part, you may need to check next week's lab.

6. The CSV file (**point_interest.csv**) contains the locations and the names for the point of interest. Create a point feature class from this file and save the result data as ***point_interest.shp***
7. <u>Produce a map showing the ***joffre_park, trails*** symbolized based on TYPE and ***point_interest*** symbolized based on IDENTITY. The symbols used to symbolize each point of interest should be meaningful. The map should come with proper title, legend, scale and your name. Export the map to image (JPG, or PNG).</u>
   Note: <u>Do not include the TIFF image in any of maps</u>
8. The ***lakes, rivers, roads*** and ***glacier*** layers can be extracted from TRIM data. First find which TRIM sheet cover the study area (92 j.038). With FME software, convert TRIM sheet **92j.038.saf** to shape files(check next week lab for details). You should have layers ***tlake, trivr, troad, twtrl*** etc. after conversion.
9. <u>Produce a map showing the TRIM features ***tlake, trivr, troad*** (TYPE: paved road only), ***twtrl*** (CLASS: ice mass only) and ***joffre_park*** with proper symbol. The map should come with proper title, legend, scale and your name. Export the map to image (JPG, or PNG)</u>
10. Examine ***tlake, twtcl*** layers. These two layers contain lakes and wetland information. As all TRIM layers are either in line or point features, you will need to create polygon from feature outline for lakes and ice mass (twtrl: CLASS Ice Mass). Save the polygon features as ***lakes*** and ***glacier*** respectively.
11. Add a field AREA and calculate the area for ***lakes*** and ***glacier*** respectively. Add another field NAME for ***lakes*** and assign the name for each lake polygon inside park (check the TIFF image)
12. Export ***troad*** as ***roads*** and ***trivr*** as ***rivers*** by right-click on the layer->Data->Export Data. Make sure to choose the SHAPE file for File Type.
13. <u>Make a map showing the park area with ***joffre_park, point_interest, lakes, rivers, glacier, trails*** and ***roads*** (paved road only).</u>
    a. Symbolize the ***point_interest*** based on TYPE with meaningful symbol
    b. Symbolize the ***trails*** and ***roads*** based on TYPE (only show Paved roads)
    c. Symbolize the rest of features properly according cartographic conventions
    d. Label the three big lakes inside the park and the highway 99 (paved road)
    e. Give the total length of Joffre Lake trails (***trails***)
    f. The map should be well layout and come with proper title, legend, scale, and your name. Export the map to image (JPG, or PNG)

Deliverable: Make a title page with the course name, assignment number, your lab session, your name and studentID. Insert all exported images from to Word file and give a brief description for the area and each map. Save the file as **lastname_firstname_geog3002018_A23.pdf**. Email the file to your TA with subject <u>Geog300 A23</u>

NOTE: **Please name the file correctly (*lastname_firstname_geog3002018_A23.pdf*)**
                 <u>Assignment is due (Oct. 2,3,4).</u> NO late assignment is accepted