# Tracing Trails:
## Proposed Loop Extension of the Arrowhead Trail
## GIS Lesson in ArcView 3.x

**Lesson Difficulty: ADVANCED**
**Length of Lesson: 1:20 – 1:40**

**In this lesson students will:**
1. Display RMNP's road and trail network
2. Propose an extension of the Arrowhead trail to the Lake Katherine trail.
3. Select sites for garbage bins and benches along the new trail.
4. Insert project information, north arrow, scale bar, and descriptive text box.

**GIS Skills acquired through this lesson:**
- ➢ Thematic mapping
- ➢ Formatting, viewing, and identification of spatial data
- ➢ Inserting new line and point features within an editing session
- ➢ Proper understanding of map layout and functions in ArcView.

**Required Data and Software:**
- ArcView 3.x (ArcView GIS 3.3)
- Data layers (enclosed within CD-ROM): *New_Benches.shp, New_GarbageBins.shp, New_trail.shp, rmnp_0625.ecw, RMNPtrails.shp,* and *Roads.shp*
- ECW Extension file (available at **http://www.erdas.com/tabid/84/currentid/2508/default.aspx** - check ReadMe file for the correct version)

**Teacher Summary**

As is the case with most national parks, Riding Mountain National Park (RMNP) maintains an extensive network of trails. According to the level of service offered, trails are designated as either front-country or back-country and they are maintained throughout the four seasons for the enjoyment of all Canadians.

Specifically in regards to the environment, RMNP's trail network plays an important role in enhancing the public's understanding and appreciation of the principles of environmental stewardship and sustainable development. There is no better way to start thinking about these pressing concepts than by taking a hike, bike or horseback ride on any of the park's scenic trails.

More recently, park authorities have noticed that trail use is declining. It seems that the recreational needs of Canadians are changing and less people today are interested in "roughing it" in the back-country, where service and amenities are at a minimum. Rather, Canadians nowadays show greater interest in shorter trails not far from the amenities of towns, such as RMNP's townsite of Wasagaming.

To ensure RMNP's trail network addresses change and remains relevant to Canadians, park authorities have begun public discussions to learn what changes to the trail network could increase visitation. This lesson will sensitize students to the on-going discussion on trails. It will also foster their appreciation of the work and thought that goes into RMNP's trails as they will be asked to draw out a trail extension for themselves.

It is suggested that students first learn the basics about RMNP and successful trail design. Fact Sheets, Web links and various Challenge Options have been included to help with this process. Next, students can proceed to the GIS lesson itself. The first-person scenario will help set the scene and detailed instructions will guide students and teachers each step of the way. Lastly, consult the Challenge Options section to see how the GIS activity can be extended into other subjects.

**For students:**

<div style="border:2px solid black; padding:1em;">

# This is Your Mission

After a challenging interview process, you've been hired by Riding Mountain National Park (RMNP) to work as a part-time GIS assistant. For your first assignment, your supervisor has asked you to work with the trails committee. It was recently convened to review RMNP's 400 km of front-country and back-country trails to ensure they meet today's visitors' needs and expectations.

As part of their review, the trails committee wants to propose a new long loop extension of the Arrowhead trail. The committee believes that this, along with other measures, would address the public's demand for more short to medium length trails near the community of Wasagaming. You have been asked to follow the instructions in this document to complete a map entitled *Proposed Long Loop Extension of Arrowhead Trail.*

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## Part A: Getting Started

- Launch the **ArcView** program. If you have a shortcut to **ArcView** on your desktop, double-click it.
- Otherwise, click **Start > Programs > ESRI > ArcView GIS 3.3**
- In the Welcome to **ArcView GIS** startup dialogue box click **as a blank project** then click ok.
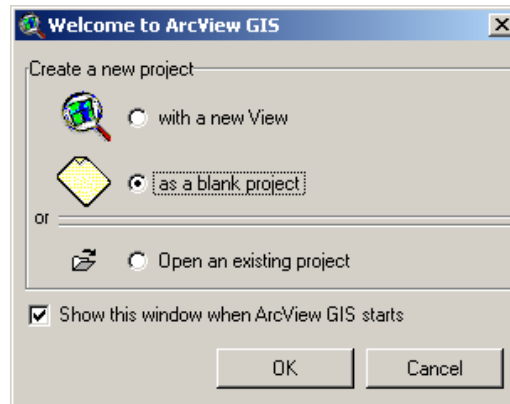


- Expand your screen by clicking on the square at the top right corner.
- Double-click on **Views**.
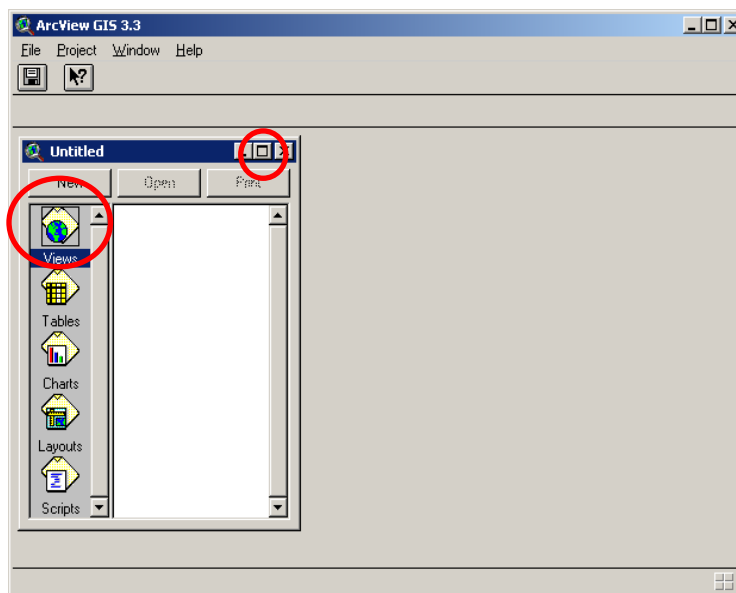
- Click on the **Save Project** button  and save your project as *Proposed_Trail_Extension.apr* within your working directory. Check with your teacher if you are unsure where to save your project.
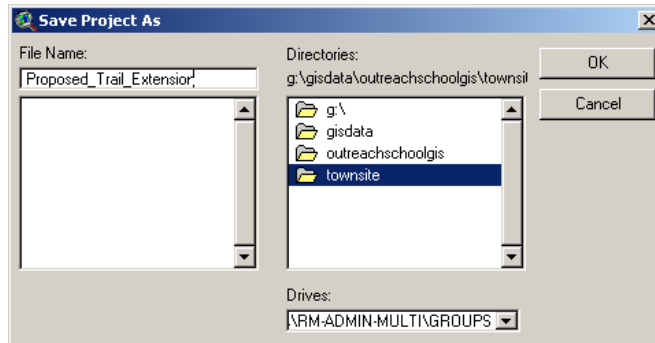


**Trail Sign**
*Photo: Parks Canada*



# Save your work!

## Part B: Adding Data Layers

- We are going to add the **RMNP orthophoto** layer.

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- An **orthophoto** is an aerial photograph that has been geometrically corrected ("orthorectified") so the scale of the photograph is uniform and the photo can be considered equivalent to a map.

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- Select **File > Extensions**.
- Within **Available Extensions** Select **ECW & JPEG 2000 and ER Mapper** so that it now has a check mark located beside it.
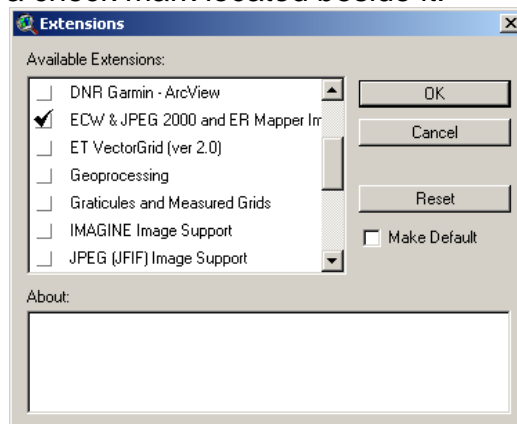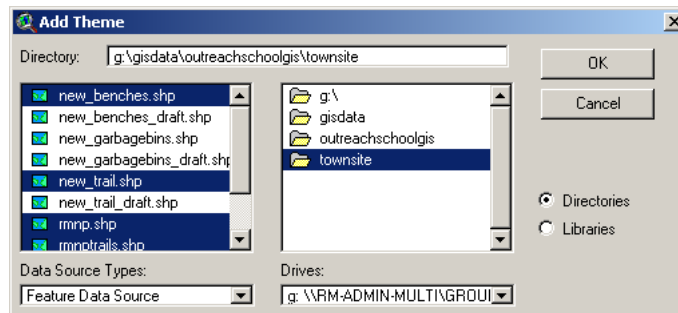


- Click **OK**.

- Click the **Add Theme** button
- Make sure the **Data Source Type** is set to **Image Data Source**.
- Click on *rmnp_0625.ecw* and click **OK**. Check with your teacher if you are unsure where this is located.
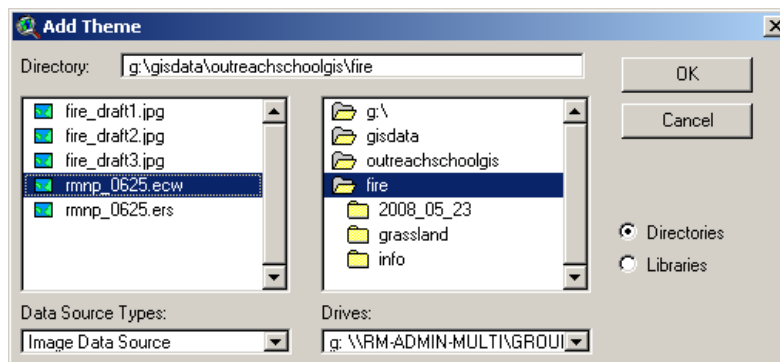


- Click the **Add Theme** button
- Make sure the **Data Source Type** is set to **Feature Data Source**.

- Hold the **Shift** key to add the following data layers: ***New_Benches.shp,
  New_GarbageBins.shp, New_trail.shp, RMNPtrails.shp,*** and
  ***Roads.shp***



- Click **OK.**

- Under **View1** at the left side of your screen make sure all of the data
  layers you just added are active. If they are not active then click on the
  box located to the left so there is now a checkmark.
- Click and drag the orthophoto (***Rmnp_0625.ecw***) to the bottom.



- Click on the **Window** tab at the top of the screen. Click on **View 1.**
- From the **View** menu select **Properties**.
- Change the **Map Units** to *meters.*
- Change the **Distance Units** to *meters.*
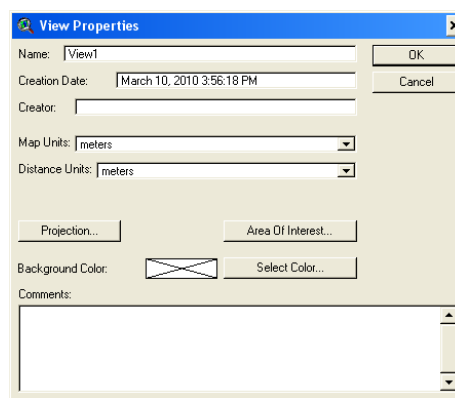


- Click **OK**.

# Save your work!

## Part C: Formatting Data Layers

- We are going to format the roads and trails so they are visible on top of the orthophoto.
- Double-click on the line below *RMNP_trails*.
- Double-click on the **Symbol**.
- Within the **Pen Palette** change the **Size** to **3**.
- Click the **X** to close the **Pen Palette**.
- Click **Apply.**
- Click the **X** to close the **Legend Editor**.
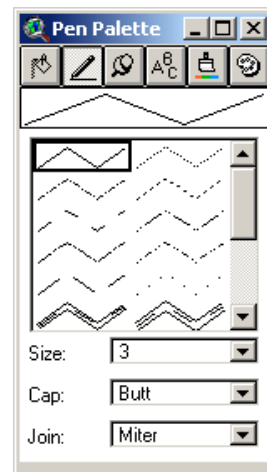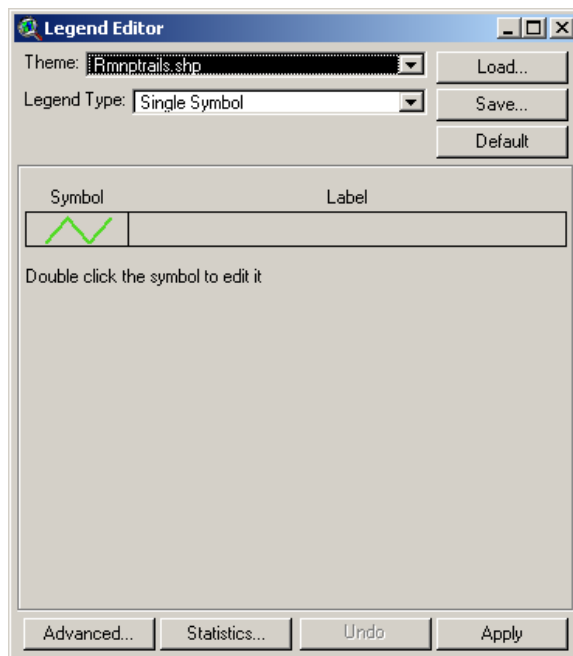


- Double-click on the line below *Roads*.
- Follow the previous steps and change the **Symbol Size** to **3.**

- We are going to extend the **Arrowhead** trail by adding a loop that will connect it to the **Lake Katherine** trail. But first, we must find them on the map.

- **Zoom In** 🔍 to the area surrounding **Clear Lake**. If you are unsure where to find it, think of the park's shape as the shape of a pistol. Look for Clear Lake in the "trigger" region.



Clear Lake

- To determine the locations of the **Arrowhead** trail and the **Lake Katherine** trail use the **Identify Tool** ⓘ to view the attributes of the trails in RMNP (\***hint** these two trails are located south-east of Clear Lake and the Arrowhead trail is a small loop).



- The **Identify** tool will identify the active layer (the layer with the box around it). If you can't identify the trails, first click on the *RMNP_trails* layer with your pointer and then use the **Identify** tool.
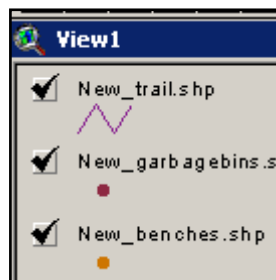
- Once you have determined where these trails are use the **Zoom In** tool 🔍 to look at just these two trails more closely.
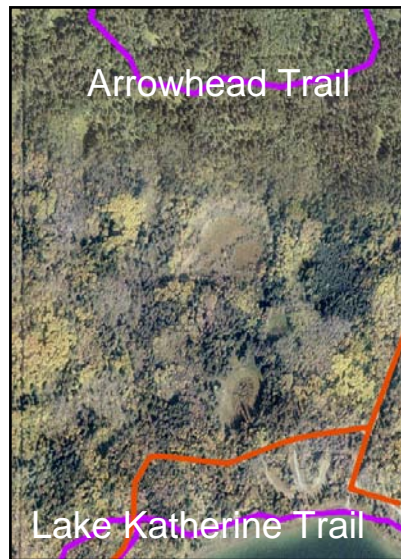


# Save your work!

## Part D: Creating Our New Trail

- Now that we have determined where the **Arrowhead** and **Lake Katherine** trails are we are going to create a trail extension of the **Arrowhead** trail.
- Make sure your '**New**' layers are turned on.

- Click on *New_trail.shp* to make it active.
- Click on **Theme > Start Editing**
- A dashed box should appear around the box next to your layer.
- Click on the **Drawing tools palette** and then select the **Draw line**.
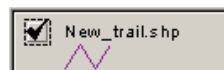
*If the **Draw line** tool is not already active then click and hold the **Drawing tools palette** to see the drop-down menu.

**Draw line** →
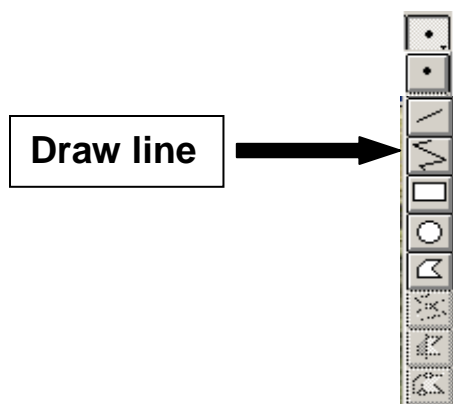


- You will now draw your trail extension onto the map. Your trail should have a natural shape. Be sure to read the **"Successful Trail Design"** fact sheet; this will provide more information on how to design a good trail.
- To begin your editing select any point along the south-western portion of the Arrowhead Trail, and gradually click to add vertices if you want your trail to curve. Continue down towards the **Lake Katherine Trail** and then loop back to the **Arrowhead trail**.
- Double-click once you are finished your proposed loop extension.
- Click on **Theme** > **Save Edits As…**
- Within your working directory (check with your teacher if you are unsure where to save your edits) save your edits. Call your new trail "**Proposed Loop Extension**".
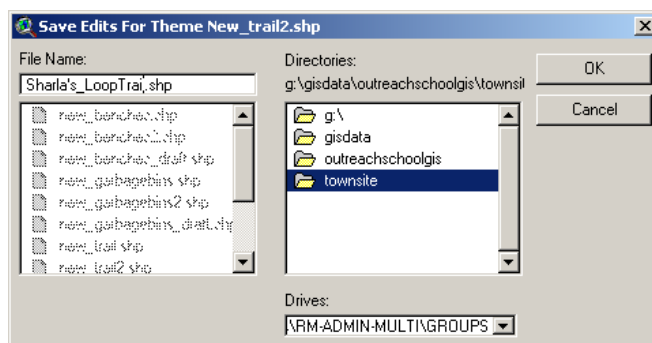
- Double-click on the line located below the new *Proposed Loop Extension* layer.
- Double click on **Symbol**.
- Within the **Pen Palette** change the **Size** to **3**.
- Click the **X** to close the **Pen Palette**.
- You can change the colour of your trail within the **Colour Palette** to make it more visible if it is a dull colour (pick a colour of your choice).
- Click the **X** to close the **Pen Palette**
- Click **Apply.**
- Click the **X** to close the **Legend Editor**.
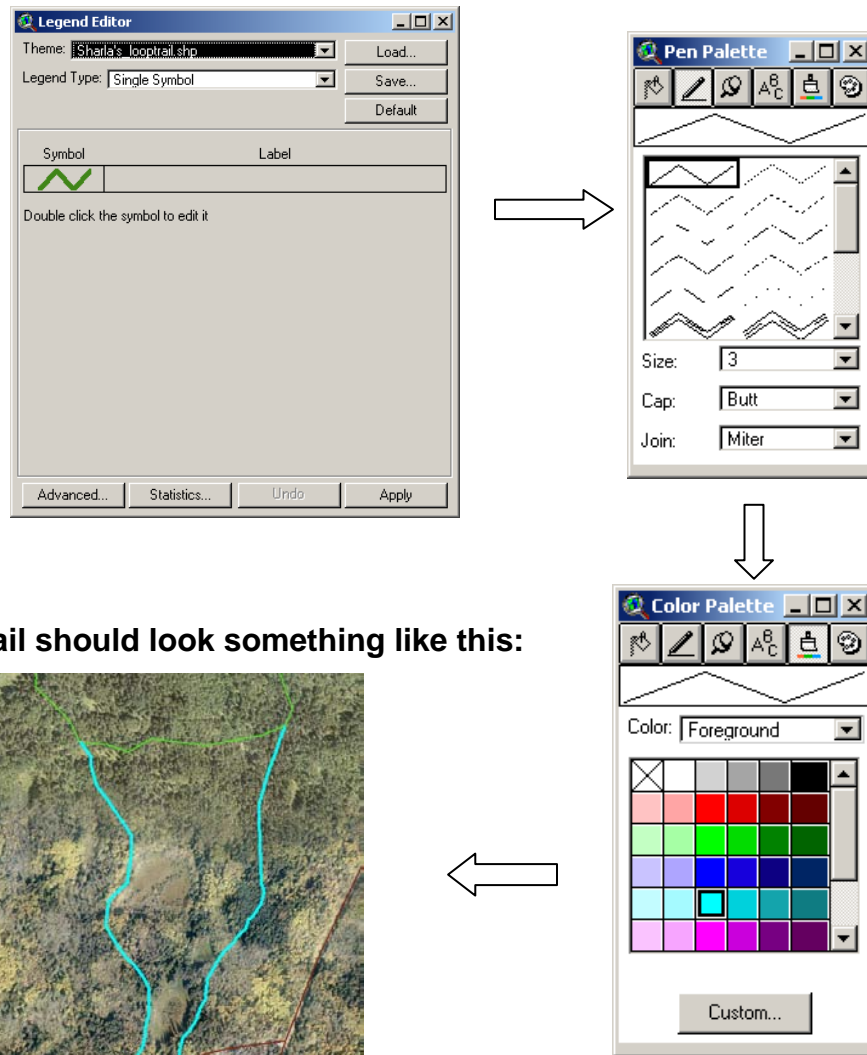
**Your trail should look something like this:**
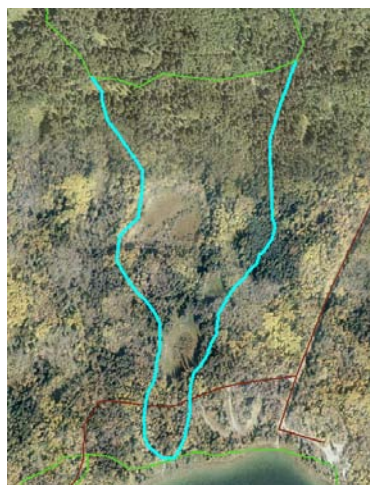
- Measure the length of your trail using the **Measure Tool**.



- Click at the beginning of your trail and follow along the trail until you reach the end point at the Lake Katherine Trail. Click to create vertices so that you can measure the curves in your trail, double-click at the end to finish measuring.
- The **Length** of your line will be displayed at the bottom left corner of your screen.
- Record the length of your trail. _____**meters**.

## Save your work!

## Part E: Adding Garbage Bins and Benches

- We are going to add in three garbage bins and two benches along our new trail.
- First let's add in our Garbage Bins. We are going to add a **Garbage Bin at the beginning, middle, and end** of our new loop trail.
- Click on *New_garbagebins* to make it active.
- Click on **Theme > Start Editing**
- A dashed box should appear around the box next to your layer.
- Click on the **Drawing tool palette** and then select the **Draw point** tool.

Draw point →
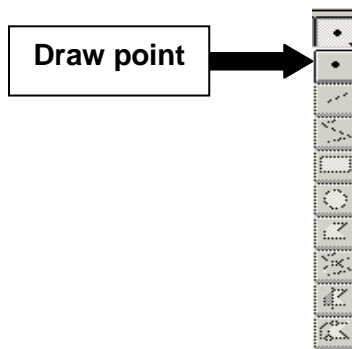


- To begin your editing session use your mouse to click once at the beginning, middle, and end of our new loop trail. On your last click, make sure to **double-click to finish editing**.
- If you are happy with your edits click **Theme > Save Edits As…**

- Within your working directory (check with your teacher if you are unsure where to save your edits) save your edits as **GarbageBins**.
- Under the Theme tab at the top of the page, click **Finish Editing.** Click **OK** if a window appears asking you to save your edits.
- You will repeat these steps and **add two new benches** to your trail loop.
- Use your mouse to click once on each half-way point between the original Arrowhead trail and the Lake Katherine trail.
- Double-click to finish editing.
- If you are happy with your edits click **Theme > Save Edits As…**
- Within your working directory (check with your teacher if you are unsure where to save your edits) save your edits as **Benches**.
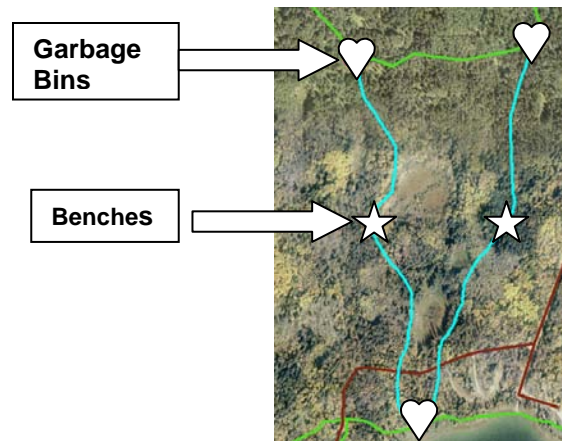


**NOTE**: Hearts and Stars have been added to differentiate garbage bins and benches. Your screen will only show different colour dots.

- Double-click on the circle below the **GarbageBins** layer.
- Double-click on the **Symbol** within the **Legend Editor**.
- Within the **Marker Palette** change the **Symbol Size** to **20**.
- Click the **X** to close the **Marker Palette**.
- Click **Apply**.
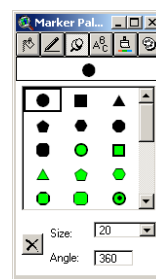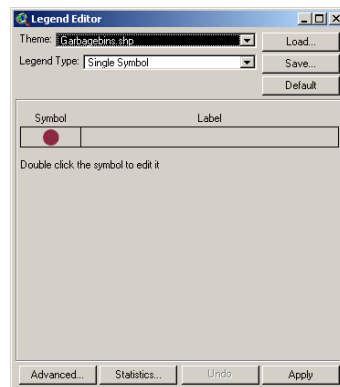


- Click the **X** to close the **Legend Editor**.

- Repeat these steps with the **Benches.**
- Turn off all the data layers we will no longer be using. (To turn off: remove check from the box on left side of layer name.)

- Only the orthophoto (**Rmnp_0625.ecw**), the roads, the trails, and your new benches, garbage bins, and trail should be turned on, with a check on them. All other data layers should not have a checkmark beside them. Click with your mouse to uncheck them.
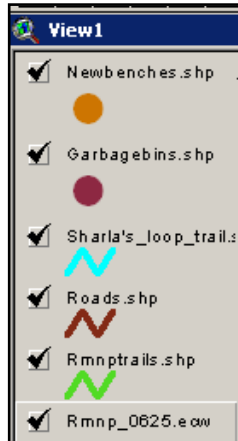


# Save your work!

- We are going to change the names of our layers so that our legend is more readable.
- In the table of contents on the left side of the screen, click on the *Rmnptrails.shp* layer so that it appears "raised".
- At the top of the screen, click **Theme > Properties**
- In the **Theme Name** field of the **Theme Properties** window, highlight *Rmnptrails.shp* with your cursor.
- Type in **Trails**
- Repeat these steps:
    o Replace the for the *Roads.shp* layer with **Roads**

> Sometimes filenames are confusing! Changing the layer names from filenames to "plain English" wording (by inserting spaces, taking out "dots" and underscores, etc) makes for an easy-to-read legend. For example, typing "***RMNP Boundary***" rather than simply "***rmnp***" lets readers know exactly what that shapefile represents.

**Looking at the new trails you have created…**
- Judging by the look of the map do you think that your new trail covers a variety of terrain types (i.e. forest, clearing, wetland, etc.?)
- Considering the terrain and the distance covered, how would you rate this trail: easy, moderate or difficult?

# Save your work!

## Part F: Final Touches

- Select **View > Layout…**
- From the **Template Manager** select **Portrait.**
- Click **OK**.
- A smaller version of the **Layout View** may show up. Expand it by clicking the square at the top right corner.
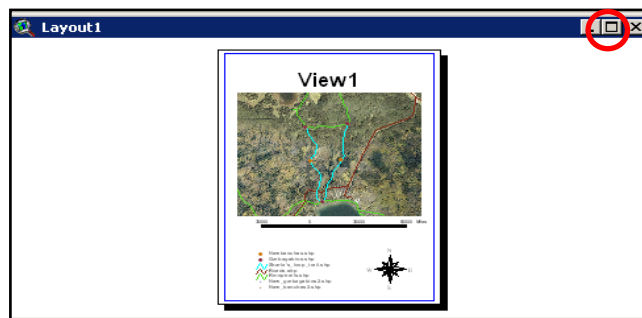


- Under **File** select the **Print Setup**.
- Make sure your paper is set to 8 ½ X 11 inches (or **Letter**) so that your map can be printed on one piece of paper.
- For **Orientation** select **Portrait**.
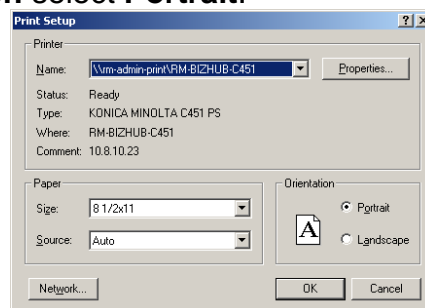


- Click **OK**
- Lastly we are going to format our **Title**, **North Arrow**, **Legend**, and **Scale Bar** within our map.
- Double-click **View 1** at the top of the map.
- Type in *Proposed Loop Extension of the Arrowhead Trail*
- Click **OK.**

- If your title extends beyond your paper then double-click once more on the text. Click half-way through the sentence (after "**of**") to split your title into two lines.
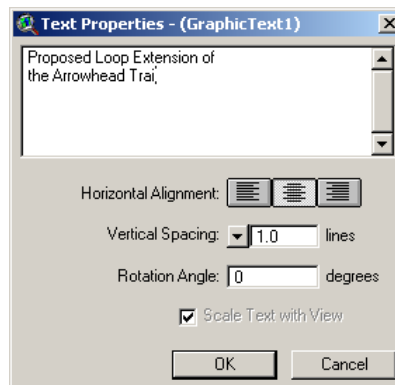


- Click **OK.**

- You can use the **Pointer Tool**  to resize your title.
- We are going to label our trails.
- Click the **Text**  icon and hold to see the drop-down toolbar.

- Select the **Callout** icon. 

- With the **Callout** icon active click on the Arrowhead Trail and drag to an unoccupied area to label the trail **Arrowhead Trail**
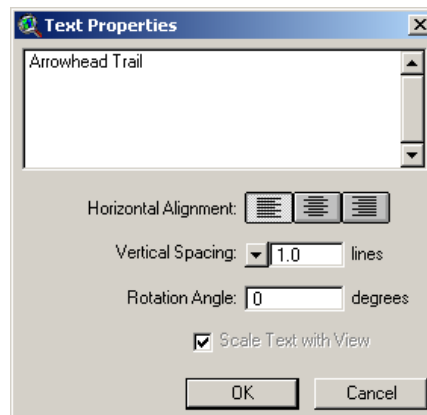


- Click **OK.**
- Repeat this process (with the **Callout** icon) to label the **Lake Katherine Trail** and your new trail, the **Proposed Loop Extension**.
- Click **OK.**

- Use your **Pointer Tool**  to click on the **Scale bar.** On your keyboard hit **Delete** to delete your Scale Bar (because the projection of your map is set to decimal degrees we cannot change the Scale bar from miles to kilometres).

- Your **Legend** and **North Arrow** and **Scale Bar** should already be located along the bottom of your map. If they are not use your **Pointer Tool** to relocate them to a blank space along the bottom of your map.

- Double-click on your **Scale Bar**.  Set the **Units** field to **meters**; set the **Interval** field to **200**.

- Click on the **Text**  icon
- Click along the bottom right side of your screen.
- Type in your name and today's date.

- Use your **Pointer Tool** to relocate your name and date if they overlap anything else on your map.

## Save your work!

## Go Green!

**If you need to print your work, first check for mistakes! That way you will only print one final copy and save paper!**

*Congratulations! You have completed your map of the*
***Proposed Loop Extension of the Arrowhead Trail!***

# Mission Debriefing

If you are reading this, you have successfully completed your map of ***A Proposed Loop Extension of Riding Mountain National Park's Arrowhead Trail***.

Questions that may arise include:

1. Approximately how long is the proposed trail extension?
2. The trail extension appears to cross a road. What type of safety measures should occur at these intersections?

What questions of your own do you have for your classmates?

With this new information, the trail crew of Riding Mountain National Park are better equipped to plan a new and exciting trail extension that will be fully sustainable.

Congratulations! On to your next mission...