



Roadkill Retrospect: Vehicle-Caused Wildlife Mortality Along Highway 10 GIS Lesson in ArcView 3.x

Lesson Difficulty: ADVANCED

Length of Lesson: 1:00 – 1:20

In this lesson students will:

1. Create a map in ArcView 3.x displaying vehicle-caused wildlife mortalities along Highway 10 between 1988 and 1996.
2. Illustrate the relative density of wildlife mortality.
3. Create *Wildlife Mortality Percentages* graph.
4. Create *Vehicle-Caused Wildlife Mortality Along Highway 10* map complete with 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.
- Introduction to Spatial Analyst tools (Distance Tool).
- Proper understanding of map layout and functions in Arc.

Required Data and Software:

- ArcView 3.x (ArcView GIS 3.3)
- ArcView 3.x's Spatial Analyst Extension
- Data layers (enclosed within CD-ROM): *Highways.shp*, *rmnp.shp*, *Manitoba.shp*, and *HighwayWildlifeMortality.shp*.



Teacher Summary

Wildlife mortalities along Highway 10, which links Dauphin to Brandon and runs straight through Riding Mountain National Park (RMNP), have always been problematic. Colliding with wildlife is not only a danger to public safety – drivers can suffer serious injury or death – but also to **ecological integrity** – killing significant amounts of wild animals reduces an ecosystem's overall health.

In 1996, RMNP staff renewed efforts at reducing wildlife mortalities on Highway 10. Using **GIS technology**, they produced a map that highlighted exactly where the highest numbers of wildlife mortalities occurred. Road signs were then installed around these high-risk areas warning drivers of the presence of wildlife and asking them to slow down. Furthermore, the amount of road salt dispersed on the highway was reduced. These measures lead to an important decrease in roadkill.

In this lesson, students will recreate the map produced in 1996 by RMNP staff. Students will experience how GIS technology helps solve real-world challenges as they learn about the importance of public safety and **ecological integrity** in national parks.

It is suggested that students first get some background on the problem of wildlife mortality on Highway 10, and its repercussions on public safety and ecological integrity. 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:

This is Your Mission

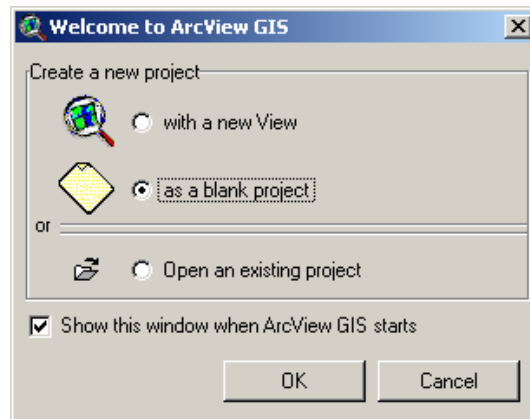
Close your eyes and take a deep breath as we go back in time to 1996... Animal mortalities along Highway 10, the main highway through Riding Mountain National Park (RMNP), have always been a problem. For many years, park staff has been placing signs to warn drivers of the danger, but the effect seems to have been rather limited.

In a new push to reduce animal highway mortalities, park authorities have convened a special committee to analyse wildlife mortality data using GIS. You work as a part-time GIS technician for RMNP and you've been asked to help this committee by following the instructions in this document to complete a map entitled ***Vehicle-Caused Wildlife Mortality along Highway 10.***

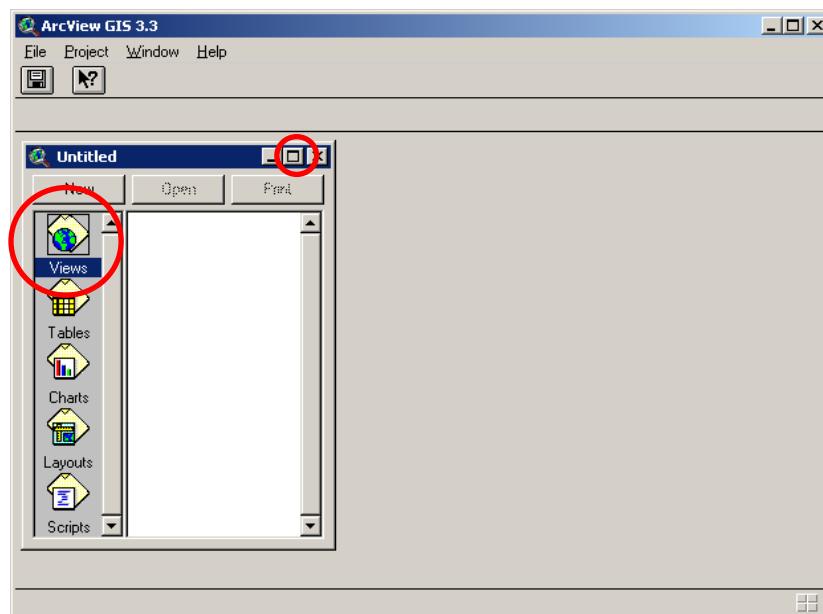
The GIS projection you come up with could help identify better locations to install a new series of signs. It is believed that these signs, an awareness campaign, and with significantly reducing amounts of road salt, will reduce the number of people harmed and animals killed in collisions.

Part A: Getting Started

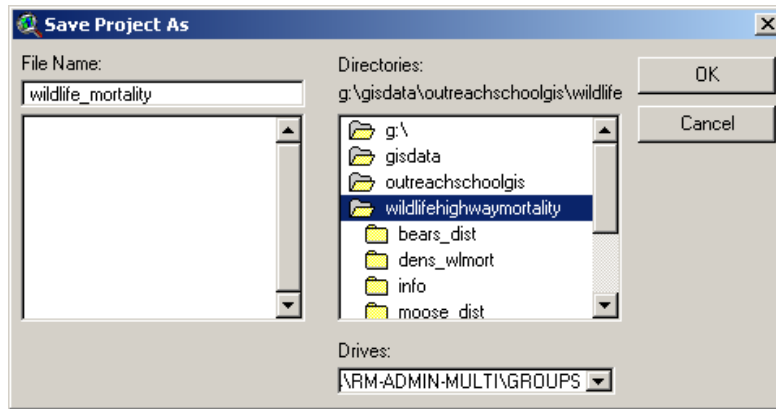
- Launch the **ArcView** program. If you have a shortcut to **ArcView** on your desktop double-click it.
- Otherwise, click **Start > Programs > ESRI > ArcView GIS 3.3**
- In the Welcome to **ArcView GIS** startup dialogue box click **as a blank project** then click ok.



- Expand your screen by clicking on the square at the top right corner.
- Double-click on **Views**.




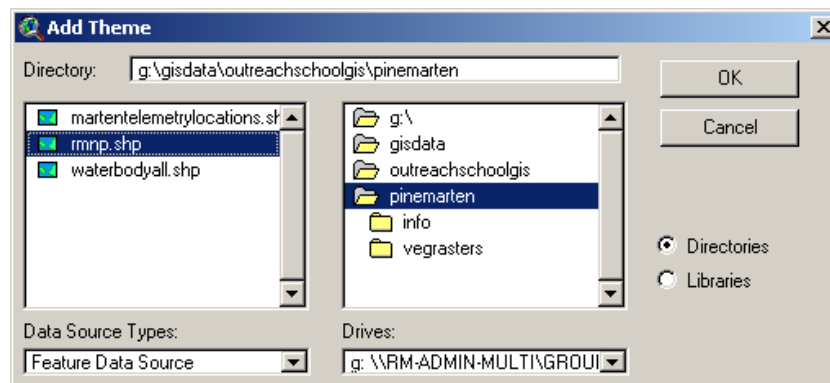
- Click on the **Save Project** button  and save your project as **Wildlife_Mortality.apr** within your working directory. Check with your teacher if you are unsure where to save your project.



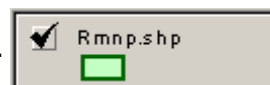
Save your work!

Part B: Adding Data Layers

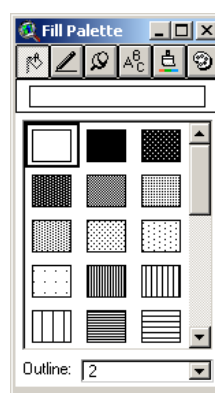
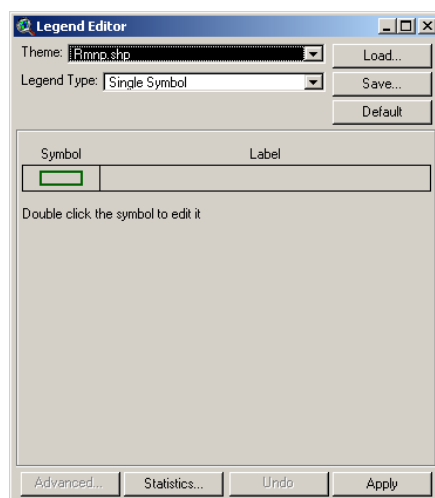
- Click the **Add Theme** button  (located at the top of your screen). This will allow us to add the data layers we wish to work with.
- If you are unsure where the files are located please check with your teacher.
- Make sure your **Data Source Type** is set to **Feature Data Source**.
- Click on **rmnp.shp** and then click **OK**.



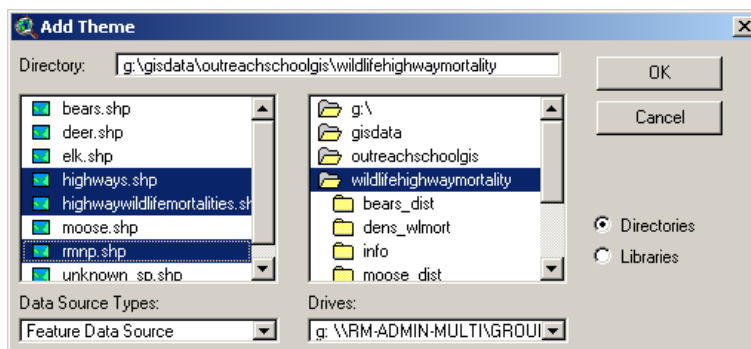
- Make sure the ***rmnp.shp*** layer turned on.



- Double-click on the coloured square located below the layer name. Double-click on the **Symbol**.
- Within the **Legend Editor** double-click the **Symbol** icon and select the hollow square within the **Fill Palette**.
- Click the **X** to close the **Fill Palette**.
- Click **Apply**.
- Click **Apply** within the **Legend Editor** and then close the **Legend Editor**.



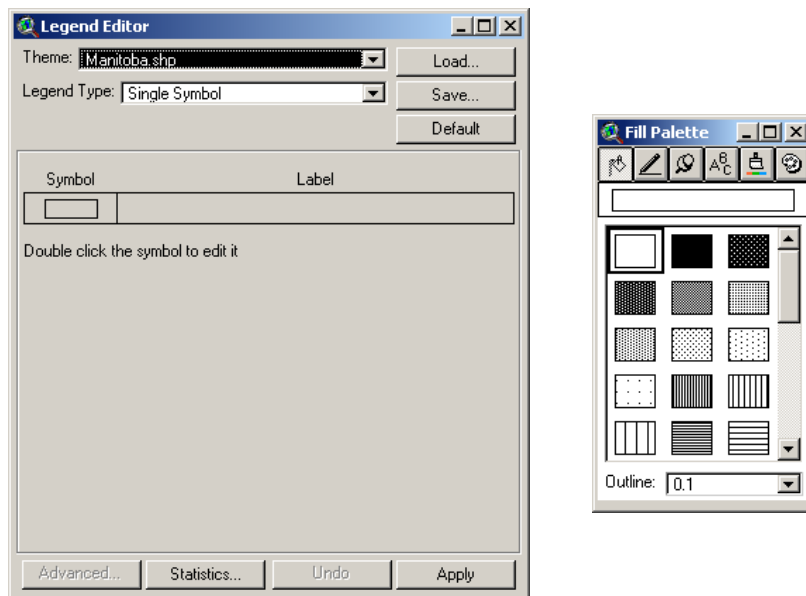
- Click the **Add Theme** button 
- Use the **Shift** key and click on the following data layers: ***Highways.shp***, ***Manitoba.shp***, and ***HighwayWildlifeMortality.shp***.



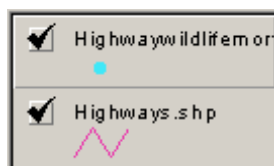
- Make sure ***Manitoba.shp*** is turned on.




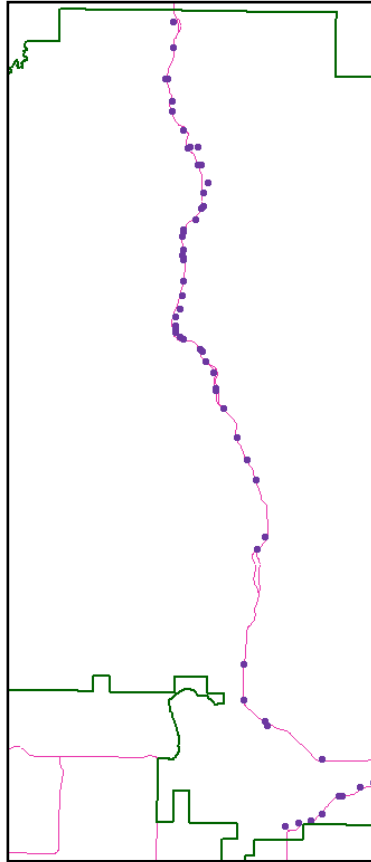
- Double-click on the coloured square located below the layer name. Double-click on the **Symbol**.
- Within the **Legend Editor** double-click the **Symbol** icon and select the hollow square within the **Fill Palette**.
- Click **Apply**.
- Click the **X** to close the **Fill Palette**.
- Click **Apply** within the **Legend Editor** and then close the **Legend Editor**.



- Activate your **Highways.shp** and **HighwayWildlifeMortality.shp** layers by clicking the box to ensure the check-mark is present.



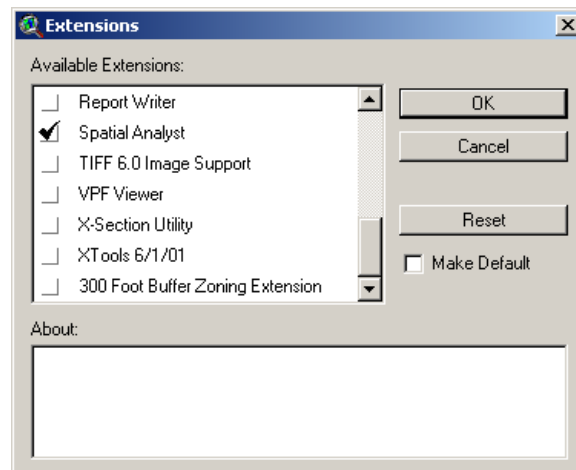
- Use the **Zoom In** tool  to look at only **Highway 10**. Highway 10 runs north-south through the approximate centre of RMNP.



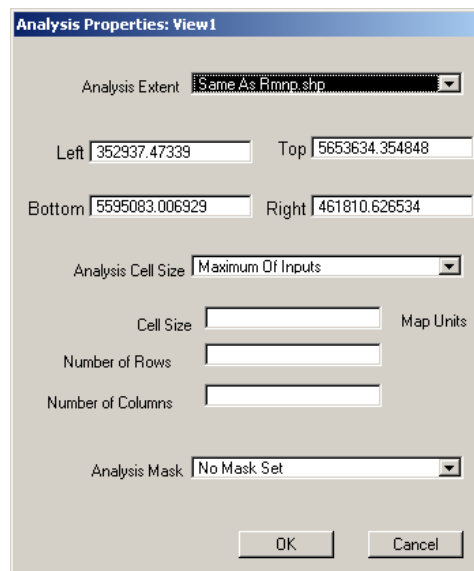
Save your work!

Part C: Working with Spatial Analyst

- We are going to look at the relative density of vehicle-caused wildlife mortality along highway 10. To use the **Distance Tool** we must turn on the **Spatial Analyst** Extension.
- At the top of the screen select **File > Extensions...**
- Within Extensions check the box to the left of the **Spatial Analyst Extension**.

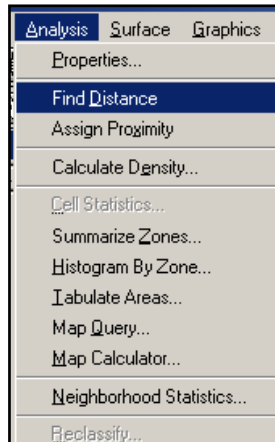
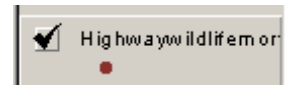


- Click **OK**.
- At the top of the screen click **Analysis > Properties**.
- Change the **Analysis Extent** to **Same as RMNP.shp**
- Set the **Analysis Cell Size** to **Maximum Of Inputs**.
- Leave the **Analysis Mask** as **No Mask Set**.

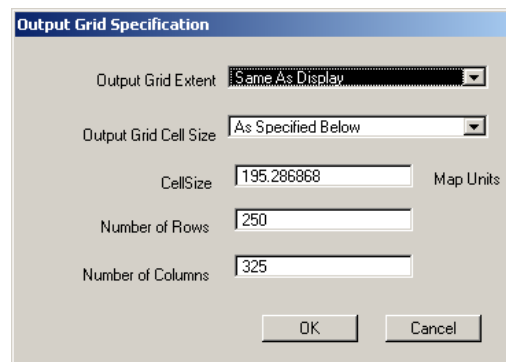


- Click **OK**.

- Make sure your **Highwaywildlifemortality** layer is active.
- At the top of the screen select **Analysis > Find Distance**.

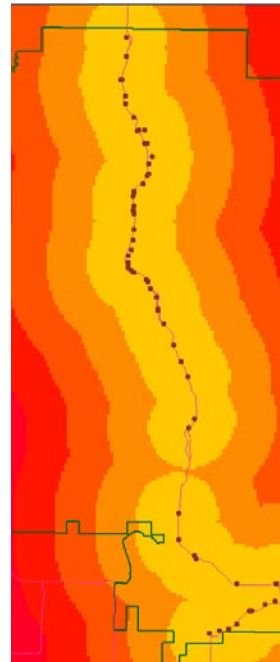
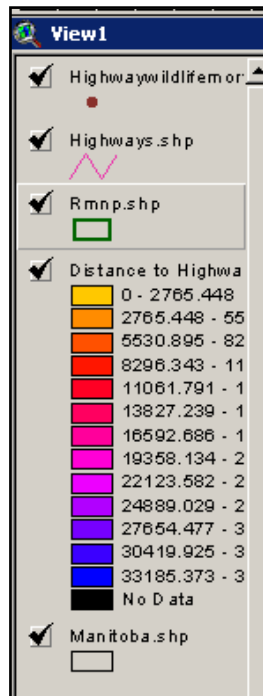


- Set the **Output Grid Extent** to **Same as Display**.

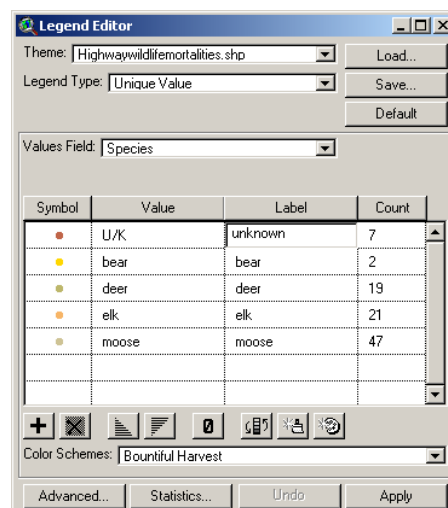


- Click **OK**

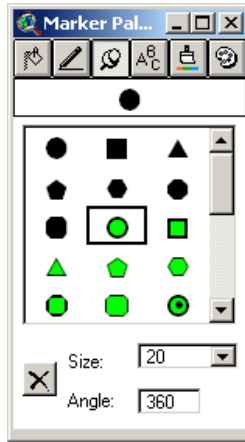
- Under **View1** click and drag your new distance layer so that it is located below your **Highwaywildlifemortalities.shp**, **Highways.shp**, and **Rmnp.shp** layers. If the new **Distance to Highway** layer is at the top then you will not be able to see the other layers.
- Activate your new layer by clicking on the clear box to the left of the layer name. A check-mark will appear.



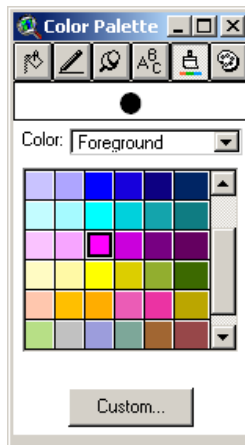
- Under **View1** double-click on the circle located below your **Highwaywildlifemortalities.shp** data layer.
- Within the **Legend Editor** change the **Legend Type** to **Unique Value**.
- Change the **Values Field** to **Species**.
- Click on the label **U/K**. Type in **unknown**.



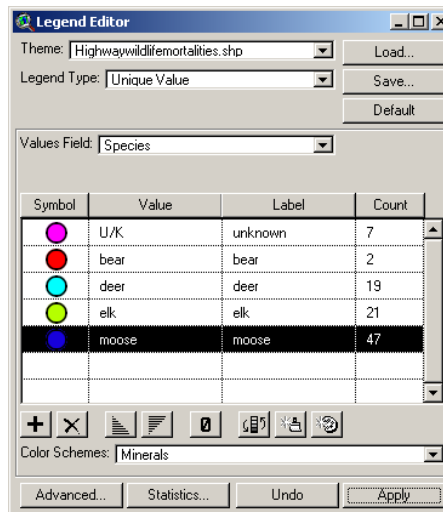
- We will need to change the colours and size of the **Species Symbols**.
- Double-click on the circle beside **U/K**.
- Within the **Marker Palette** change the Size to **12**, change the **Symbol** so it has a black outline.



- Click on the Paintbrush icon to select a colour of your choice within the **Colour Palette**.



- Click the **X** to close the **Colour Palette**.
- Repeat these steps for the **bear, deer, elk, and moose Symbols**. Change the **Symbol size** to **12**. Make sure the colours are distinct from each other and their background.




- Click **Apply** and close the **Legend Editor** by clicking the **X**.


Save your work!

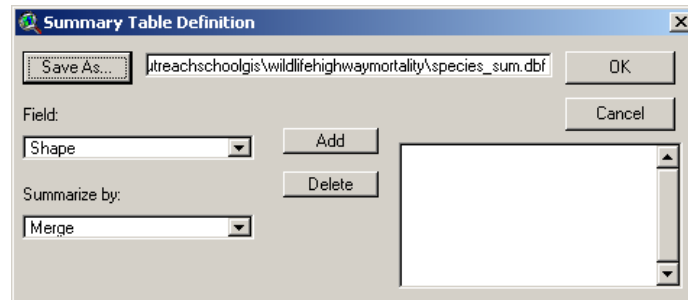
Part D: Displaying our Species

- At the top of the screen click on **Theme > Table**
- Expand the table by clicking on the square at the top right corner.

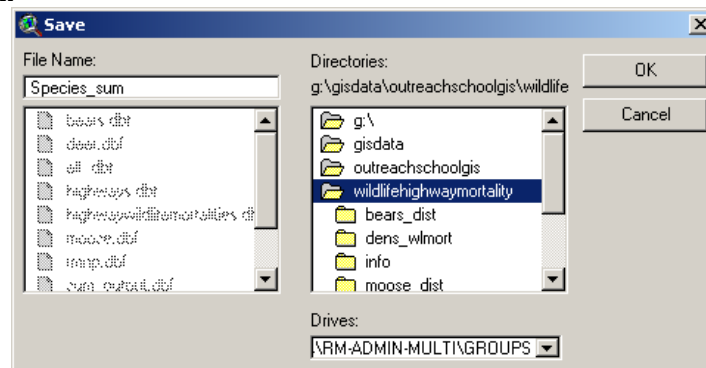
Press the **Clear Selected Features** button  to make sure no unwanted data is selected (at this point, there should be no yellow highlighted areas on your table)

| Shape | X | Y | X83 | Y83 | Species |
|-------|--------|---------|--------|---------|---------|
| Point | 425400 | 5647500 | 425366 | 5647720 | elk |
| Point | 433800 | 5612900 | 433766 | 5613120 | deer |
| Point | 426000 | 5638900 | 425966 | 5639120 | U/K |
| Point | 429621 | 5628874 | 429587 | 5629094 | moose |
| Point | 434900 | 5613400 | 434866 | 5613620 | U/K |
| Point | 435700 | 5614800 | 435666 | 5615020 | moose |
| Point | 429000 | 5617800 | 428966 | 5618020 | moose |
| Point | 425900 | 5641200 | 425866 | 5641420 | moose |
| Point | 426000 | 5640100 | 425966 | 5640320 | moose |
| Point | 428700 | 5631000 | 428666 | 5631220 | U/K |
| Point | 425900 | 5638200 | 425866 | 5638420 | U/K |
| Point | 425900 | 5638200 | 425866 | 5638420 | U/K |

- Click on the **Species** heading.
- Click on the **Summarize icon**. 
- Click **Save As...**
- Save your work as **Species_sum**. Check with your teacher to make sure you save your new table in the correct folder.



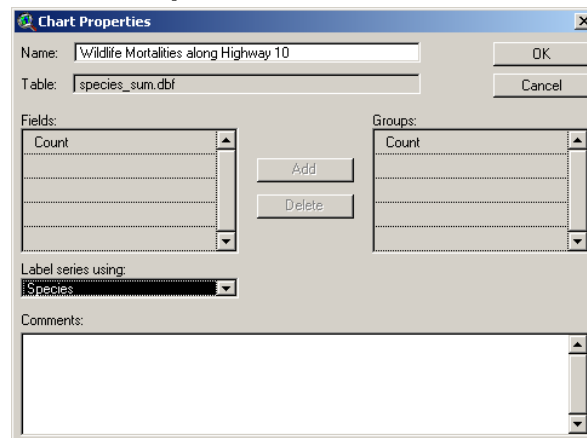
- Click **OK**.



- Click **OK** again.

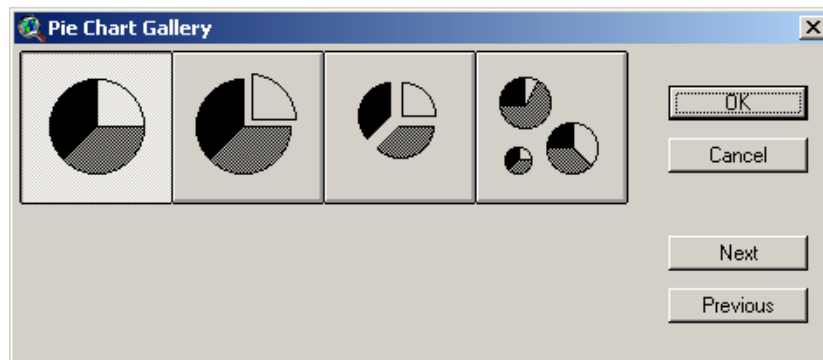
Click on the **Create Chart** icon. 

- Change the title **Name** to **Wildlife Mortalities along Highway 10**.
- Set the **Fields** to **Count**, set the **Groups** to **Count** by clicking the **Add** button.
- Set **Label series** to **Species**.




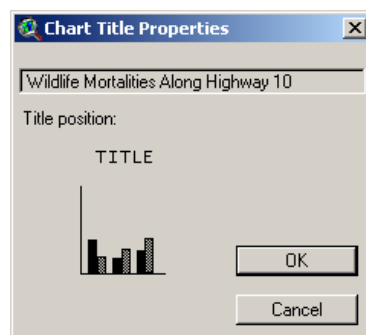
- Click **OK**.

- Click on the **Pie Chart Gallery** icon. 
- Select the first (intact) pie chart.

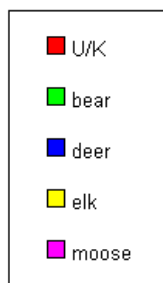


- Click **OK**.

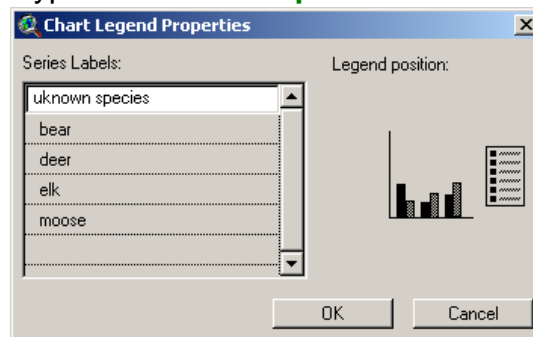
- Click on the **Chart Element Properties** icon. 
- Click on the **Title** above your pie chart.
- Change the title to **Wildlife Mortalities along Highway 10**.



- Click **OK**.
- Click on the **Pie Chart Legend**.

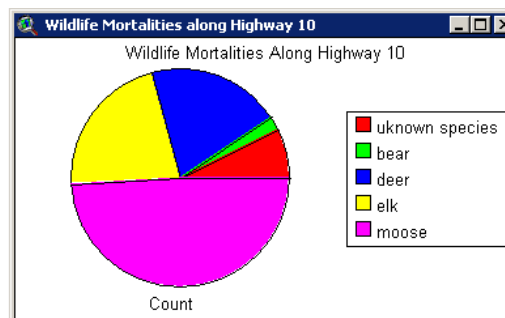



- Click on **U/K**. Type in **unknown species**.



- Click **OK**.

This pie chart represents the type and composition of wildlife mortalities. This chart can be separately printed to include with your final map. Check with your teacher before printing this pie chart.



- You can now close the chart by clicking the **X** or the **Minimize icon**  on the top right corner. Close any other windows that may be open until you get to the **View1** screen (with the table of contents at the left.)
- We are now going to change some of our layer names so that our legend is readable.
- At the table of contents on the left side of the **View1** screen, click on the **Manitoba.shp** layer so that it appears “raised”.
- At the top of the screen, click on **Theme > Properties**
- In the Theme Name field, highlight existing text (“**Manitoba.shp**”)
- Type “**Manitoba Boundary**”
- Repeat these steps for the other layers. Replace

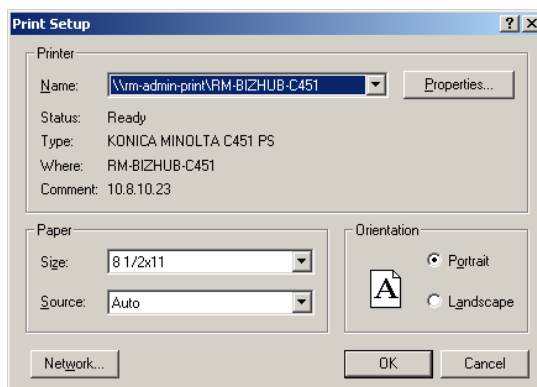
- **Highwaywildlifemortalities.shp** with **Highway Wildlife Mortalities**
- **Highways.shp** with **Highways**
- **Rmnp.shp** with **RMNP Boundary**
- **Distance to Highwaywildlifemortalities.shp** with **Distance to Highway Wildlife Mortalities (m)**

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.

Save your work!

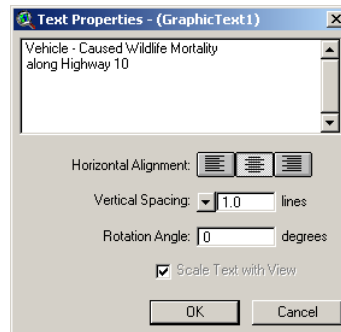
Part D: Final Touches

- 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**.

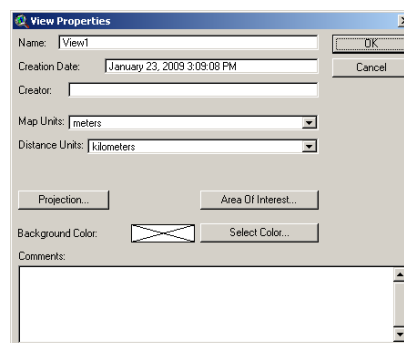


- Click **OK**.
- Lastly we are going to format our **Title**, **North Arrow**, **Legend**, and **Scale Bar** within our map.

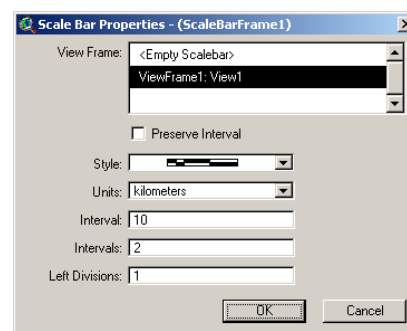
- Double-click **View 1** at the top of the map.
- Type in ***Vehicle-Caused Wildlife Mortality along Highway 10.***







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



- Click **OK**.
- Click on the **Window** tab at the top of the screen. Click on **Layout 1**.
- Double-click on the **Scale bar** located at the bottom of your map.
- Change your **Units** to kilometers.
- Type in **10** for **Interval**.
- Type in **1** for **Left Divisions**.



- Click **OK**.

- Use your **Pointer Tool**  to click and drag your **Scale bar** to a blank space below your map.
- Your **Legend** and **North Arrow** should already be located below your map. If they are not use your **Pointer Tool**  to relocate them to an unoccupied space.
- Click on the **Text icon** 
 - Click along the bottom right side of your screen.
 - Type in your name and today's date. Click **OK**.
- Use your **Pointer Tool**  to relocate your name and date if overlaps 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 Vehicle-Caused Wildlife Mortality within RMNP along Highway 10!

Mission Debriefing

If you are reading this, you have successfully created a map of ***Vehicle-Caused Wildlife Mortality along Highway 10.***

Questions that may arise now are:

1. Using the “*RMNP Map.pdf*” file as a reference, where is the area that a collision with a moose is most likely? Give a landmark as a reference point.
2. Do you think that we need bear crossing signs? Why or why not?
3. Certain sections of highway do NOT have any incidents of vehicle-cause wildlife mortality. Why might that be?

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

Congratulations! The Roads Crew of Riding Mountain National Park now has a better idea of where to place road signs, and what species to indicate on the sign. On to your next mission...