Weasel Waypoints:
Pine Marten Habitat Ranges in Riding Mountain National Park
GIS Lesson in ArcGIS 9.x

Lesson Difficulty: INTERMEDIATE
Length of Lesson: 1:30 – 1:45

In this lesson students will:
1. Create a map in ArcGIS 9.x displaying pine marten habitat ranges within RMNP.
2. Display pine marten telemetry locations collected from 1992-93.
3. Determine pine marten habitat ranges.
4. Insert and modify 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 attributes table functions and data classification.
- Proper understanding of map layout and functions in ArcGIS.

Required Data and Software:
- ArcGIS 9.x (ArcGIS 9.2 or ArcGIS 9.3)
- Data layers (enclosed within CD-ROM): ***RMNPboundary.shp***, ***mwconifbog*** raster layer, ***MartenTelemetryLocations.shp***, ***waterbodyall.shp***
- Marten Habitat Range Data Sheet (Microsoft Excel file)

Parks Canada   Parcs Canada

Canada

Teacher Summary

This lesson looks at the successful **reintroduction** of the pine marten to Riding Mountain National Park (RMNP). Due mainly to over-trapping, this endearing weasel was **extirpated** from the area in the early part of the 20th century. The marten's prolonged absence led many to believe it would never return to RMNP, but this would not be the case.

In an effort to restore ecological integrity Parks Canada sometimes re-introduces species that were historically part of national park ecosystems and thus, RMNP staff undertook a marten re-introduction program in the early 1990's. This lesson will give students a look at the real-world results of that program and familiarize them with the wider, global issue of **species at risk**.

The GIS lesson can be used on its own, but we suggest that students first learn the basics about ecological integrity, pine marten biology, the re-introduction program and species at risk. Fact Sheets, Web links and various resources have been included to help with this process. Next, students can proceed to the GIS lesson itself. A fictional first-person scenario will help set the scene for the lesson and detailed instructions will guide students and teachers on their way to completing an ArcGIS map entitled *Pine Marten Habitat Ranges in RMNP*. Lastly, consult the resource section and Challenge Options to see how the GIS activity can incorporate outcomes in other subjects and extend the student's learning.

For students:

This is Your Mission

The American Marten was trapped and hunted out of the Riding Mountain National Park (RMNP) area in the early 1900's. Given that it is within RMNP's mandate to reintroduce species that were historically part of the park ecosystem, in the early 1990's, park wardens undertook a marten reintroduction program. Take a deep breath now as we go back in time to that period…

You've been hired as a part-time student to help the wardens monitor pine marten behaviour after the reintroduction. A total of 65 young healthy martens have been released on the east side of RMNP, 8 of which were outfitted with telemetry collars – these emit a radio signal enabling us to track them. <u>The goal is to pinpoint where the martens established themselves and measure their home ranges</u>.

The wardens have handed you GPS data on the 8 martens' locations, recorded from 1992-93. Follow the instructions in this document to complete a map entitled ***Pine Marten Home Ranges in RMNP***.

Part A: Getting Started

- Launch the ArcMap program. If you have a shortcut to ArcMap on your desktop double-click it.
- Otherwise, click **Start > Programs > ArcGIS > ArcMap**
- In the ArcMap startup dialogue box click **A new empty map**
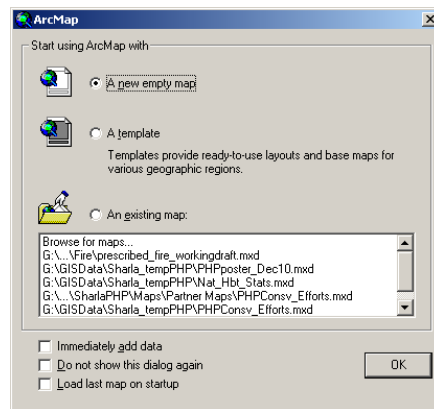
- Click **OK**.

- Click on the **Save** button and save your project as *Marten_reintroduction.mxd* within your working directory.
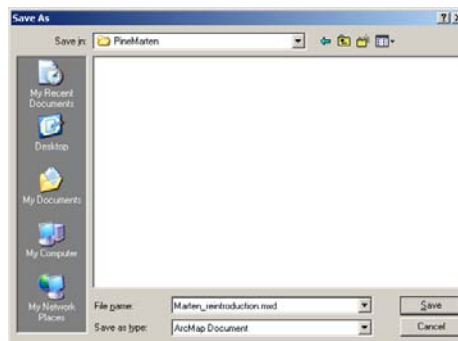
A pine marten climbing a tree
Photo: Parks Canada

- From the **View** menu select the **Data Frame Properties**.
- Click on the tab labelled **Coordinate System**.
- Under **Select a Coordinate System** select:

  Predefined>Projected Coordinate Systems > UTM > NAD 1983 > NAD 1983 UTM Zone 14N
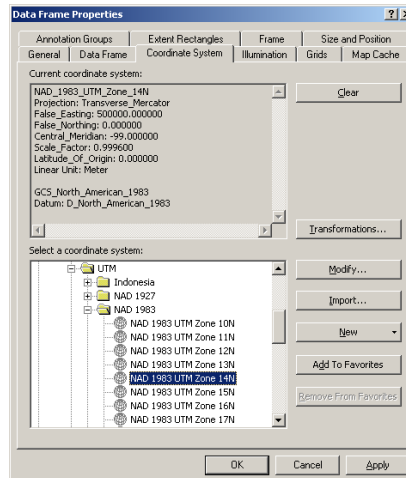
- Click **OK**.

NAD 1983 (North American Datum) 1983 is one of many **geodetic systems** that translate positions indicated on a tool (such as a map, or GPS device) to a real position on earth. NAD 1983 is one of the primary systems of reference for North America, hence **N**orth **A**merican **D**atum. **1983** was the year the system was refined.

UTM (**Universal Transverse Mercator)** is a system of coordinates that divides the Earth into a grid (like when you look on a map to find a town). **UTM Zone 14N** roughly corresponds to the area of Manitoba.

Save your work!

Part B: Adding Data Layers

- Click the **Add Data** 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.
- First we are going to add the data layer *RMNPboundary.shp*
- After locating it (with your teacher's help), click **Add**

- Click on the coloured square located below the layer name in the table of contents on the left side of the screen.
- Within the options box select the drop-down box for **Fill Colour** and select **No Colour**. Change the outline width to **2.00.** Click the drop-down box for **Outline Colour** and select a dark shade of red of your choice.
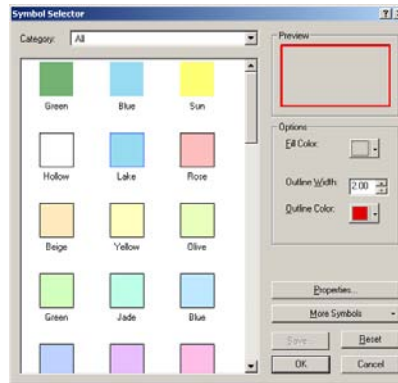
- Click **OK**.

- Click the **Add Data** button ⊕ and within the **VegRaster** folder click on *mwconifbog*.
- Click **Add**.
- There are two coloured squares located below the layer name. Right click on the square labelled **0**. Select **No Colour**. Right click on the square labelled 1, select a **light green** of your choice.
- Click the **Add Data** button ⊕ and click on the lakes shapefile *waterbodyall.shp*.
- Click **Add.**

> You may receive an "**Unknown Spatial Reference**"   warning when you add the *waterbodyall.shp* file. Click OK when you see this.

> A **shapefile** is a format used for storing the geometric location and attribute information of geographic features. Geographic features can be represented by points, lines, or polygons (from ArcGIS Desktop Help).

- Click on the coloured square located below the *waterbodyall* layer name. Within the options box select the drop-down box for **Fill Colour** and select a **light blue**.
- Click **OK**.
- Click the **Add Data** button ⊕ and click on *MartenTelemetryLocations.shp*.
- Click **Add.**

Save your work!

Part C: Separating our Martens

- We are going to classify our telemetry locations to determine the ranges of each Pine Marten.

- Use the **Zoom In** tool to look at the east side of the park more closely.

- If you cannot find the **Zoom** tools at the top of your screen then select **View > Toolbars** and then make sure there is a checkmark beside the **Tools** option.
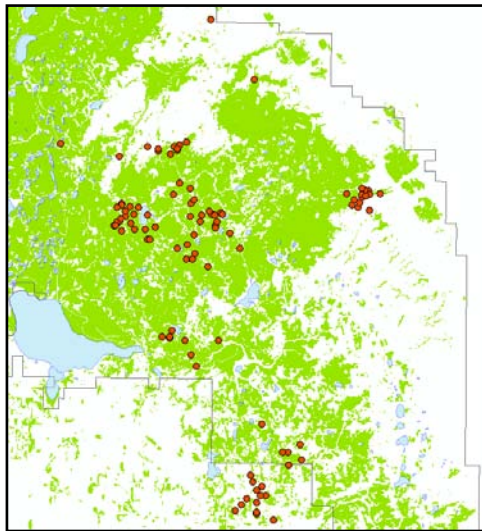
- In the table of contents on the left hand side of your screen right-click on the *MartenTelemetryLocations* layer to open up the **Attribute Table.**

- The **Attribute Table** displays a table containing information on the Marten Telemetry shapefile.
- Within the *MartenTelemetryLocations* Attribute Table there is a column labelled **MARTEN**. The numbers in this column represent individual martens. We are going to display these individual martens.

- **Close** the **Attribute Table** by selecting the **X** in the top right-hand corner.
- Right-click on the *MartenTelemetryLocations* layer then open the **Properties**.
- Within the **Symbology** tab select *Categories > Unique values.*
- Under the **Value Field** select **MARTEN**.
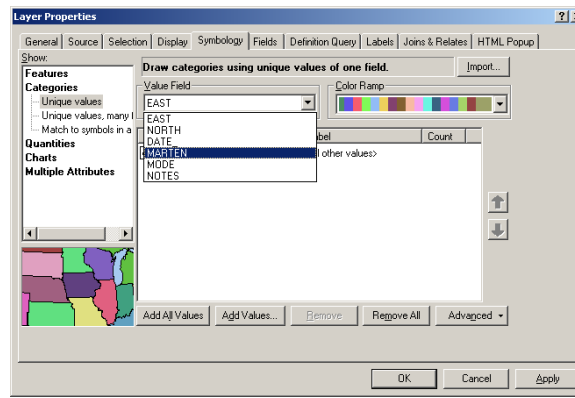
- Select the tab labelled **Add All Values**. This will give you a unique colour for each Marten.
- Select the box ☑ to the left of <all other values> so that the box is no longer selected and is now blank. Select the drop-down arrow below the **Colour Ramp** and select a colour ramp of your choice (remember you want the colours to contrast each other!).
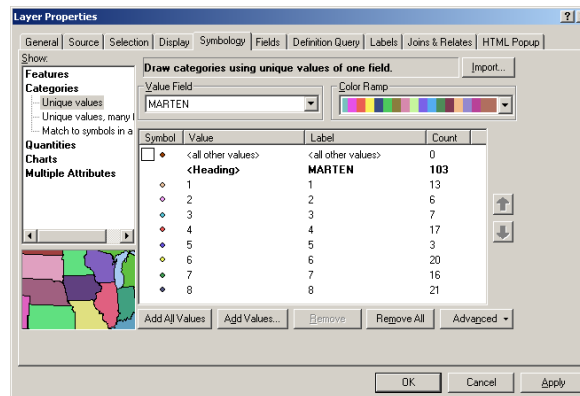

- Select **OK** to close the **Layer Properties**.

- Click on the circle beside the **'1'** beneath your
  MartenTelemetryLocations layer.
- Change the **Size** to a larger number (**5** is good) and if you think the colour
  of the circle is not bright enough you can choose a different bright colour
  under the **Colour** drop-down arrow.
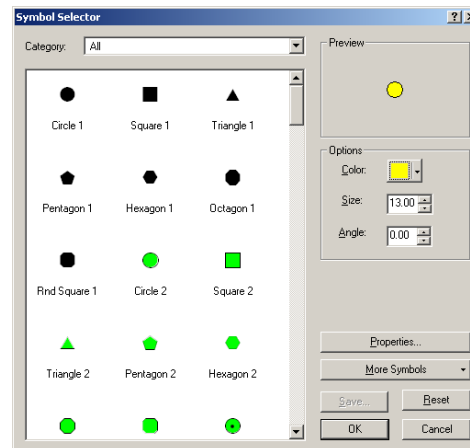
- Click **OK.**

- Repeat these steps with the other Martens (2-8), **remember** to make sure
  that the colours are *__distinct__* from each other and that they stand out
 against the background so you will be able to distinguish them on the
  map.
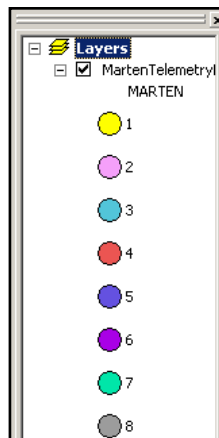
Save your work!

## Part D: Determining the Martens' Habitat Ranges

- **NOTE**: You will need the provided **Marten Habitat Range Data Sheet** to complete this section. Ask your teacher for its location.
- We are going to use the Measure tool to determine each marten's habitat range.

- Habitat range in this context is the total recorded area occupied by a single marten during a designated monitoring period (1992-93).

- Select the **Measure Tool** located along the top left side of your screen.
- If this tool is not located on your screen add it by selecting *View > Toolbars > Tools*
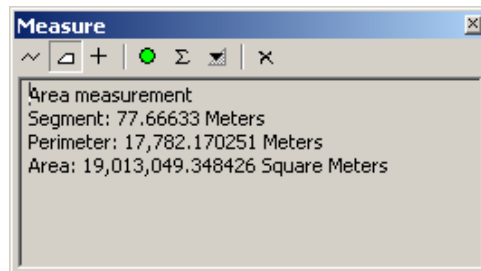
- Click on the **Measure Tool** once and then select the **Measure An Area** tool
- To record individual martens' home ranges, you will draw a square around each marten's cluster of telemetry locations. REMINDER: Each marten is represented by a different colour dot and some have much larger home ranges than others.
- To start, select the habitat range of one of your martens (pick one colour) and, with the **Measure Tool** active, click once at the top left corner of the habitat range and then click at each corner of the range to create a square around the cluster of telemetry locations. **Double click** once your box is complete to measure the area in **square meters**.
- Repeat this process for each marten habitat range.
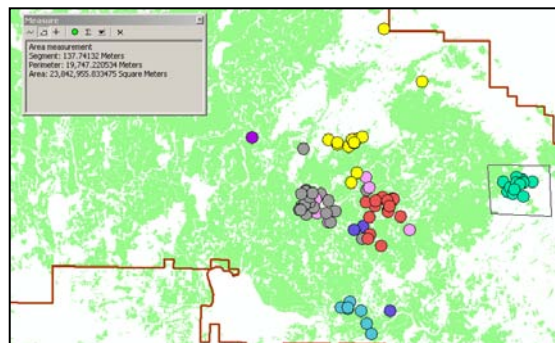
- After recording each marten habitat range determine which martens have the *largest* and the *smallest* home ranges.

- *Hint*** <u>Marten #6</u> has a bigger range than you would first think! What might be the reason for this?
- If your colours are too close together and difficult to differentiate you can also use your **Identify Tool** 🛈 to determine which marten the dot belongs to.

- The **Identify Tool** should be located along the top of your screen as we turned on the <u>Tools</u> toolbar earlier when we used the **Zoom** tool. If you cannot find it there, go to **View > Toolbars > Tools**. This toolbar (like most others) can be "docked" anywhere by clicking on it and dragging to an area of your preference.

- After you have filled out your habitat ranges data sheet make sure you check with your teacher to verify that your results for the smallest and largest habitat ranges are correct.

# Save your work!

Part E: Labelling our Home Ranges

- We are now going to demonstrate which martens have the largest and the smallest habitat ranges and then complete our map.
- First select the **Layout View** 🗋 icon at the bottom of the screen

- If you cannot find this icon you can also select **View** at the top of the screen and then select the **Layout View** 🗋.

- Under **File** select the **Page and Print Setup…** Check to make sure the Paper Orientation is in **Portrait**.
- Make sure your paper properties are set to 8 ½ X 11 inches (or **Letter**) so that your map can be printed on one piece of paper.
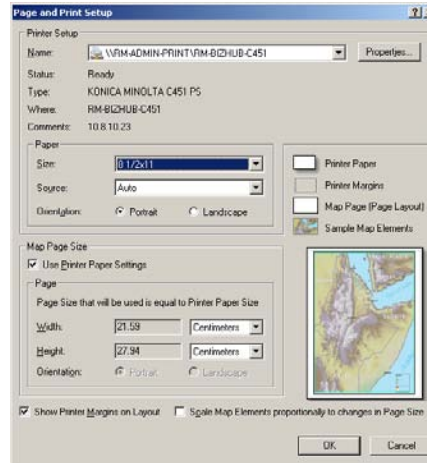
- Click **OK**.

- If your map does not align with your page properties then readjust your RMNP map so that it fits inside the **Layout View**.

- Use the **Zoom In** tool to make sure only the east side of RMNP with the Telemetry locations is visible.

- Select the **New Rectangle** icon from the bottom of the screen to draw a rectangle which will encompass the Telemetry locations of the marten with the *__largest __*home range.
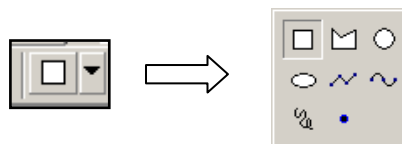
- Right click this rectangle and select **Properties**. Within **Properties** change the **Fill Colour** to No Colour, change the **Outline Colour** to **blue** and change the **Outline Width** to **3.00**.
- Click **OK**.
- Select the **New Circle** icon from the bottom of the screen.
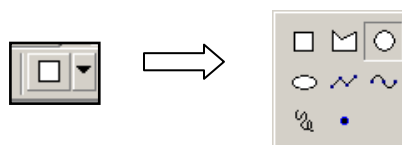
- Use your mouse and selected **New Circle** feature to draw a circle which will encompass the Telemetry locations of the marten with the **_smallest_** home range.
- Right click this circle and select **Properties**. Within **Properties** change the **Fill Colour** to No Colour, change the **Outline Colour** to **red** and change the **Outline Width** to 3.00.
- Click **OK**.
- We are going to label our home ranges. Click the drop-down arrow on the **New Text** icon, select the **Callout** icon.
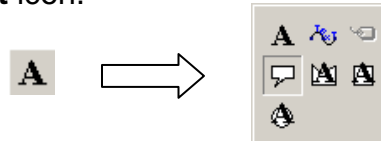
- Click within the middle of the rectangle you just created and drag to outside the rectangle to a white area on the map, away from the marten locations.
- Within the text box type **Largest Habitat Range: Marten 6.**

- Repeat this process with the **Callout** feature to label the circle encompassing the smallest habitat range. Label the circle **Smallest Habitat Range: Marten 7.**
- You can change your text size and colour by right-clicking the text box, within the **Properties** select the **Change Symbol** icon to change the size and colour to your preference.

Did you come up with the same results?
- Does Marten 6 have the largest habitat range? Take a look at how the telemetry locations are spread out, and try to figure out why that might be. *Hint*: **Do you think the martens establish themselves in the exact location in which they are released?**
- Does Marten 7 have the smallest habitat range? Why might that be?

Save your work!

Part F: Final Touches

- Lastly we are going to add a **Title**, **North Arrow**, **Legend**, and **Scale Bar** to our map.
- At the top of the screen select **Insert** and select **Title**. Label your title *Pine Marten Home Ranges in Riding Mountain National Park.*
- Click and drag your title to the top of the page.
- Select **Insert** again and choose a **North Arrow** symbol of your choice. Click **OK** to close the **North Arrow Selector box.**
- Click and drag your **North Arrow** to the top right-hand corner of your map.
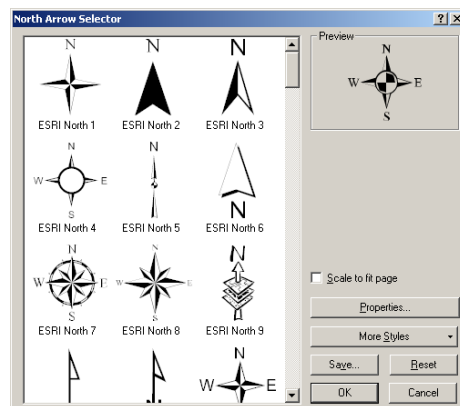
- Select **Insert** and select **Legend**. We only want our *MartenTelemetryLocations* layer to appear on our Legend. If the *RMNP* shapefile, *waterbodyall* shapefile, or *mwconifbog* vegetation raster layer appear within the list of **Legend Items** on the right hand side select them and then click the **<** icon within the middle of the **Legend Wizard**. The number of columns in the Legend should be set at **2**.
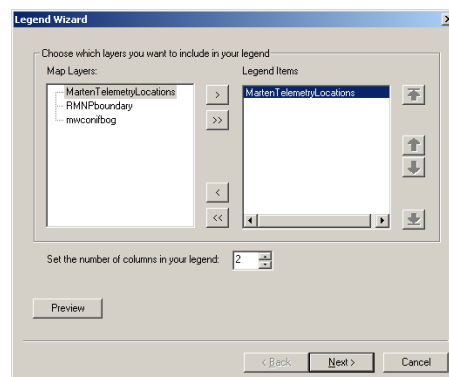
Sometimes filenames are confusing! Changing the layer names from filenames to "plain English" wording (by inserting spaces, taking out "dots" and underscores, etc) makes for an easy-to-read legend. For example, typing "**RMNP Boundary**" rather than simply "**rmnp**" lets readers know exactly what that shapefile represents.

- Click **Next>** and type in **Legend** for the **Legend Title** (this may appear already).
- Click **Next>** and click the drop-down arrow to create a **Border** that is **1.0 Point** width. Click the drop-down arrow to change the **Background** to **white**.
- Click **Next>** two more times and then **Finish** to create your Legend.
- Drag your **Legend** to the bottom left section of your map, it may cover the bottom corner of your map depending on your page settings.

- We are going to change the names of our **MartenTelemetryLocations** layer so that our legend is more readable.
- In the table of contents on the left of the screen, click on **MartenTelemetryLocations** once, wait a second, click again and type in **Marten Telemetry Locations** (*note the spaces between the words!)

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.

- Select **Insert** again and select **Scale Bar**.
- Select a Scale Bar of your choice.
- Select **Properties** and change the **Division Units** to **kilometers**, change the **Label** to **km** (type in **km**).
- Change the number of divisions to **2.**
- Select **OK** and **OK** once more to close the **Scale Bar Selector** dialogue box.
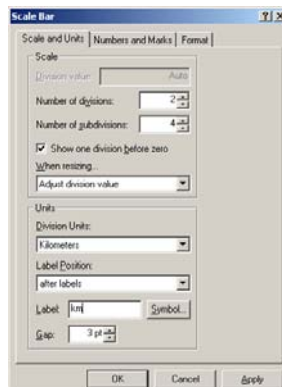
- Place your scale bar in a space near the lower-left of your map, making sure not to cover any existing marten telemetry points.

- Click on the text icon [A▾] located at the bottom left-hand side of your screen to insert text (the **Callout** icon may still be active, select it and then select the text icon)

- Include the name of the author (you!) and today's date along the bottom right-hand corner of the page.
- If you wish to modify the size and appearance of your text, simply right click it and select **Properties**

Save your work!

Looking for a reference point?   Try to locate **Wasagaming** and **/** or **Clear Lake** on your map. Create callouts to label all those points. Now, compare your map with the map of the park in the *Resources* folder (**RMNP Map.pdf**). Were you close? Fix your callouts if you were off the mark!

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
Pine Marten Home Ranges in RMNP!!

Mission Debriefing

If you are reading this, you have completed your map of **Pine Marten Habitat Ranges in Riding Mountain National Park.**

Questions that may arise include:

1. One marten has a very large habitat range. Which one is it? What could be the reason for this?
2. Using the scale on your map to measure, approximately how far from the furthest north-west point did the marten appear to finally establish its home range?
3. Using the file "RMNP Map.pdf" to compare, what is the name of the Warden Station closest to the Home Range of Marten #7?

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

Thanks to your map, park staff are better equipped to monitor future marten movement to keep track of this once-extirpated species.

Congratulations! On to your next mission...