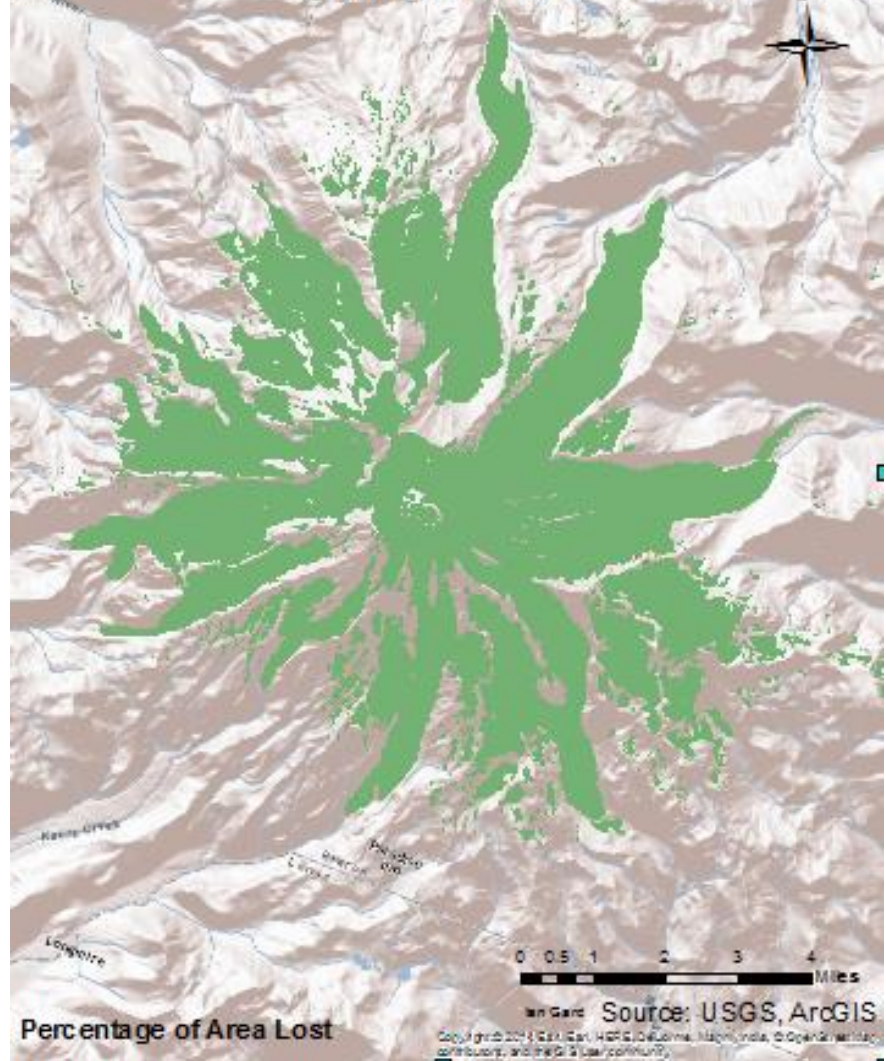An original final project I planned and produced for the course Introduction to GIS. Highlights glacial changes of Mt. Rainier using the software program ArcMap.
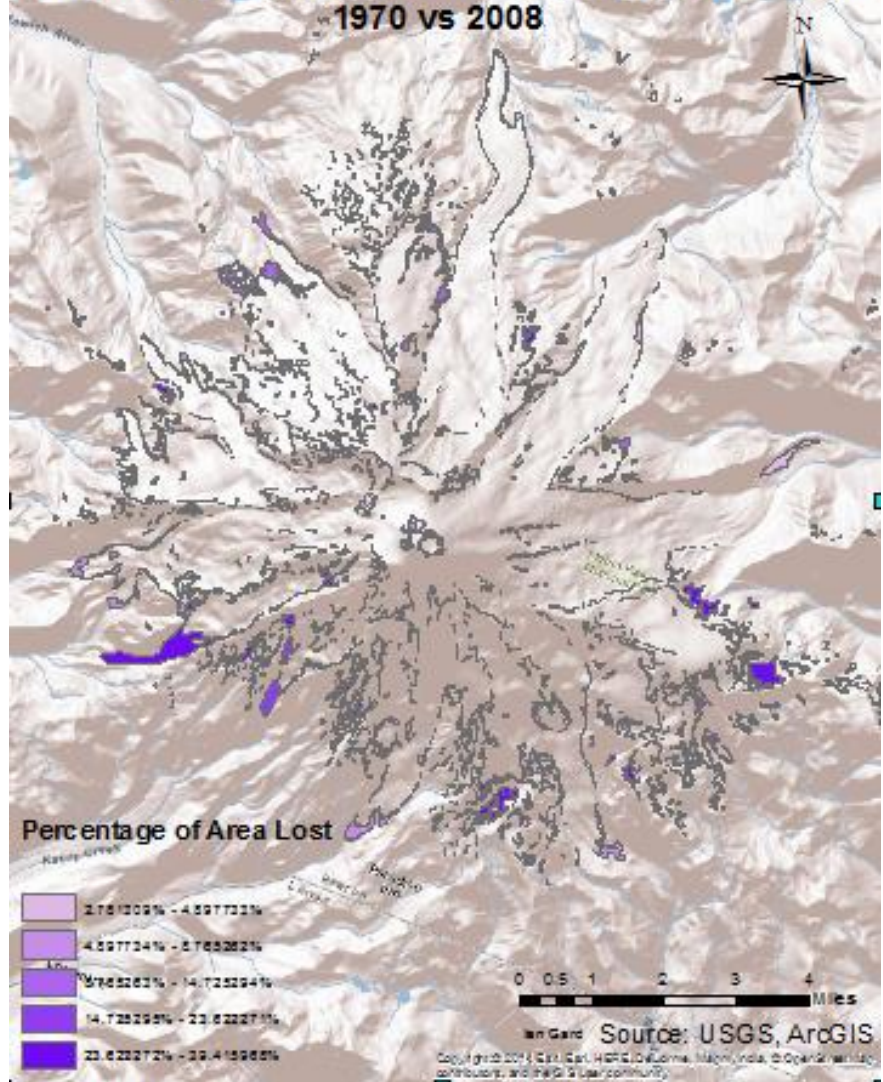
The first map displays the final results of the project, demonstrating the areas of lost glacier between 1970-2008 while also representing the full extent of glacier in 1970. The second displays the total extent of glacier in 1970 without comparison for reference. While the bottom map is a clearer view of the areas of lost glacier without being skewed visually by glacial extent from 2008.
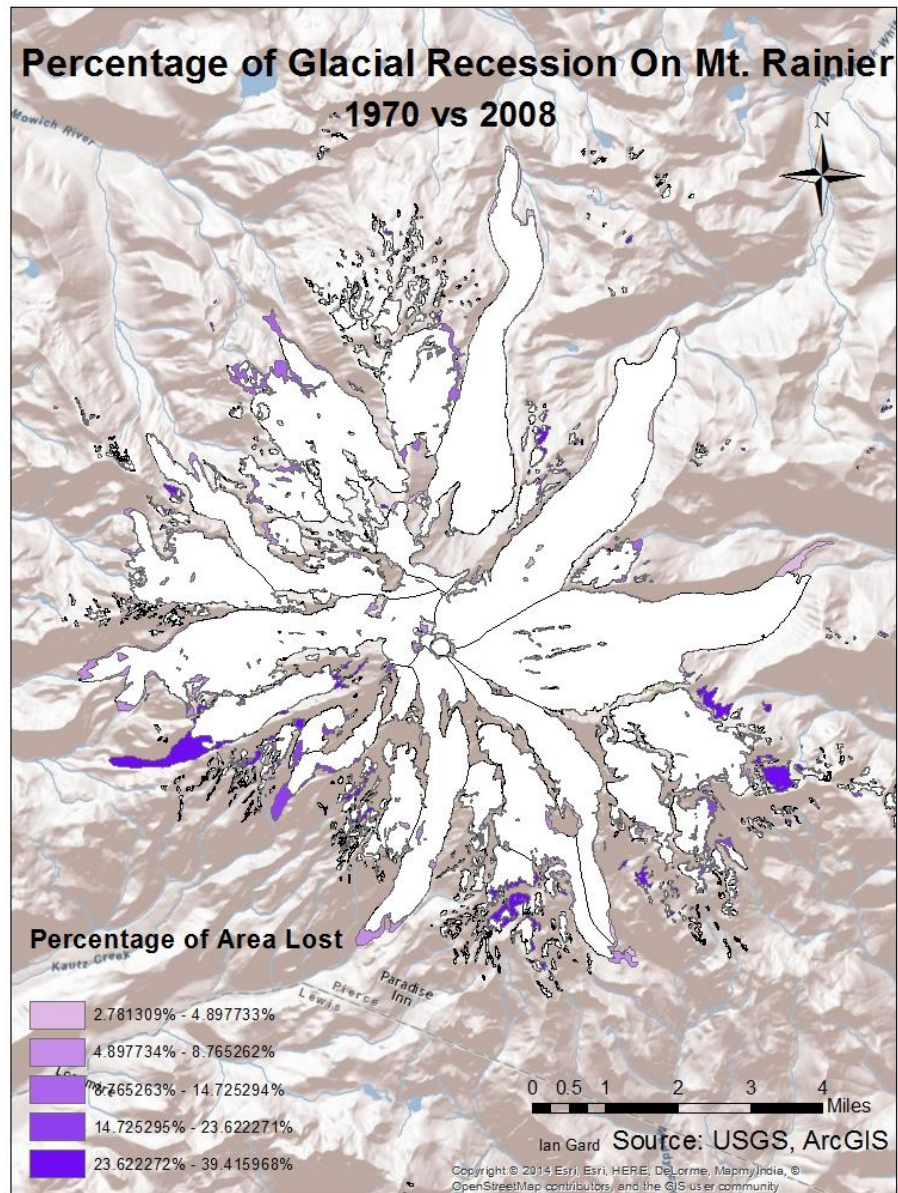
Percentage of Glacial Recession On Mt. Rainier
1970 vs 2008

N

0 0.5 1   2   3   4
                              Miles

Percentage of Area Lost

Source: USGS, ArcGIS

Percentage of Glacial Recession On Mt. Rainier
1970 vs 2008

N

Percentage of Area Lost

2.761208% - 4.597732%

4.597734% - 5.765262%

5.765263% - 14.725294%

14.725295% - 23.622271%

23.622272% - 33.415965%

0   0.5   1   2   3   4
Miles

Ian Gard   Source: USGS, ArcGIS

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contributors, and the GIS user community

This project aimed to explore the spatial areal/snowfield recessional patterns on Mt. Rainier specifically between the dates of 1970 and 2008. Asking the research question, what are the patterns of glacial recession within this time frame? Understanding glacial areal recessional patterns in glacierized areas assists the continued understanding and research of changing climatic conditions and impacts in these, usually hypersensitive areas. Helping to concentrate efforts in area that have been experiencing the most intensive changes in maximum extent.

Polygon extent of glacial maximum from LIDAR imaging from an area survey taken by the National Park Service in during 2007-2008, released publicly by the USGS was used. With these polygons being overlayed on a shaded relief base map provided by ArcGIS.

Once the data was gathered and inserted into ArcMap I overlayed these figures. In order to isolate the individual polygons representing the 1970s-glacial extent from the 2008 extent. In order to perform this operation the overlay Erase tool was used under the Analysis Tools section of ArcToolbox. Then attribute fields of the original area and the new area of the output layer were compared and a new attribute field was created in order to show the total difference in area, which was then converted to percentages, which are represented on the map.

The full range of percentages lost per polygon range from 2.78%-39.41%. The entirety of the original area of the 1970s glacial extent was measured at 93,278,099 square meters, with the total of lost area by 2008 being measured at 9,433,949 square meters. Equating to roughly ten percent of the total glacial/snow extent being lost in the last thirty eight years. The measured polygons with the highest percentage of area lost is as follows; Snowfields-39.41%, Van Trump Glacier- 34.76%, Pyramid Glacier- 33.68%, Paradise Glacier- 32.72%, Williwakas Glacier-31.34%.

The data suggests a higher percentage of recession along the southern part of the mountain and historic glacier extent. Factors such as lower elevation, increased risk of flooding and effect of runoff, rainshadow, decreased albedo, higher relative humidity, and surface temperatures due to anthropogenic influences likely all play factors in the areal concentration of this recession. An interesting aspect of the individual polygon percentage lost is the comparison between snowfields and glaciers. Snowfields lost the largest percentage of area, which is to be expected due to the snows sensitive nature to changes in weather and climate. However, the Van Trump Glacier, the glacier with the largest percent of lost area, was only measured as about attaining about 5% more of its total area. This is an alarmingly low difference when comparing the nature of snow to glaciers, and demonstrating the sensitivity in glaciers to increasing climate variability.

Presenting the areas in percentages versus meters on the map is a superior format for public communication in order to display the urgency of the extent recession. The more public knowledge on the subject can assist in increased funding to the national park system and other environmental conservation agencies.

ArcGIS. 2009. World Shaded Relief.
https://www.arcgis.com/home/item.html?id=9c5370d0b54f4de1b48a3792d7377ff2

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https://www.arcgis.com/home/item.html?id=c61ad8ab017d49e1a82f580ee1298931

https://www.arcgis.com/home/item.html?id=c61ad8ab017d49e1a82f580ee1298931