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Habitat Fragmenta-on in the Sebago Lake Watershed

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Abstract

The goal of this research was to evaluate the extent of land use change occurring in the Sebago lake watershed of southern Maine. The primary data set used was Landsat 7 Near Infrared satellite imagery of the region which was analyzed with ESRI's ArcGIS software. Data was clipped to the Portland Water District's sub watershed shape file and analyzed with the software's image analysis 'difference' tool which calculates the differences in pixel values between to raster datasets. The 2013 Landsat reclassification was compared to 1987, 1995 and 2009 reclassifications. NOAA's Habitat Priority Planner plugin tool was also utilized in order to create an excel based dataset of sub watersheds most at risk of being degraded. Once all data was compiled, an open access map of the watershed choropleth map of the risk assessment data was uploaded to Carto DB for public access and future reference by Portland Water District.

Introduction & Background

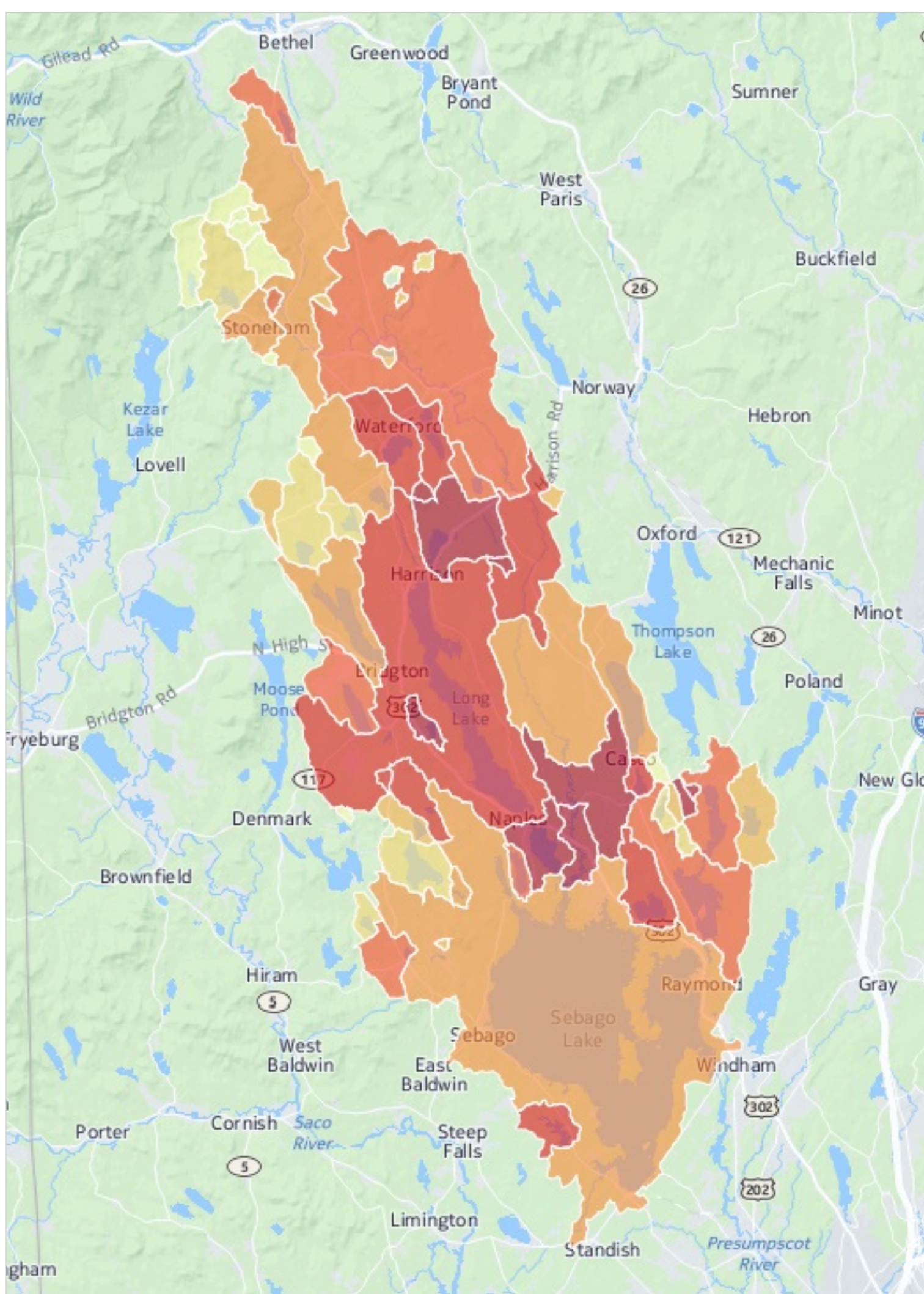
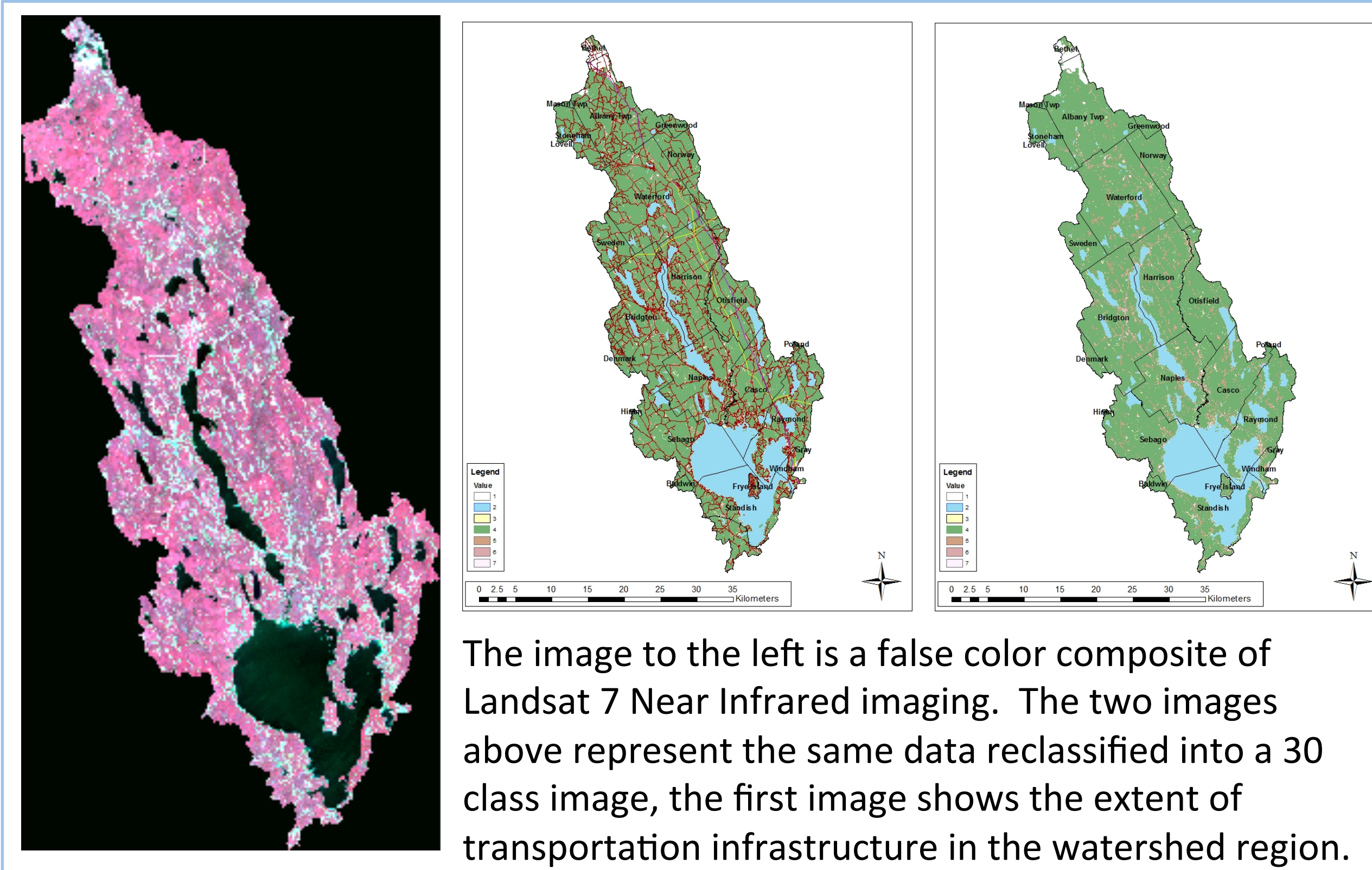
- Sebago lake supplies water to over 200,000 people in the greater Sebago lake region (PWD, 2014)
- Sebago lake has pristine water quality and abundance due to the natural filtration on the forest floor of the incoming water to the lake (PWD, 2014)
- The ecological filtration system and water are at constant threat due to the increasing development of land around the lake, in part caused by the high percent of privately owned land within the region (Bourget, 2012)
- Portland Water District controls the southern 2 miles of shoreline on the lake, 10% of its total area (PWD, 2014)
- The rest of the area is susceptible to private development which is increasingly attractive to landowners due to high property values around the lake (PWD, 2014)
- It is in the interest of Portland Water District to maintain up to date monitoring of development occurring within the watershed to determine the rate of land conversion and severity of the issue so that appropriate preventative measures can be taken

Objectives

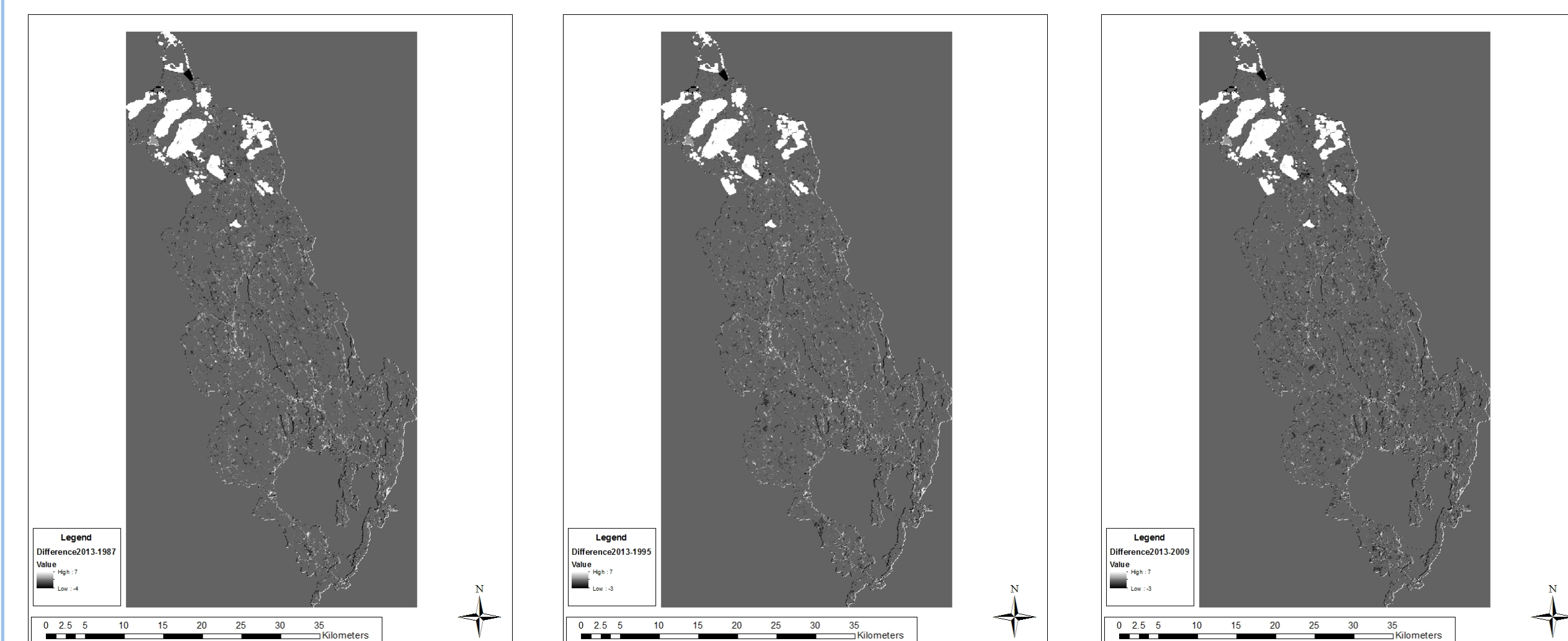
The primary objective of this research project was to identify the extent of land use change that has occurred in the Sebago lake watershed through the use of ArcGIS's image analysis tool on Landsat 7 imagery. Within this primary objective, emphasis was placed on following research parameters that pertained to the interests of Portland Water District in order to create an up to date and applicable database for further investigation. A secondary objective for this research was to assess the ability of the Habitat Priority Planner tool as a viable resource for identifying sub watershed region that are most at risk of total environmental degradation.

Methods

- Data was retrieved from NASA's GLOVIS website and clipped to the appropriate watershed shape file provided by PWD.
- The original multi band image was reclassified using ArcGIS's reclassification tool, 30 original class were created for the unique pixel values, and where then refined down to 7 broader classifications.
- The reclassified image was then compared to prior reclassification's with the difference tool in the image analysis window of ArcGIS. These values were then assessed according to the relevance of pixel value differences in context to their terrain.
- The reclassified image was then analyzed with NOAA's Habitat Priority Planner tool for ArcGIS. The tool produced data on pixel values within the sub watersheds of the region and rated sub watershed's level of risk according to their ratio of developed to forested and water occupied land.
- The HPP data was uploaded to Carto DB's online server and created into a web application map that can be updated and openly accessed by the public.



The image to the left is a copy of the open access Carto DB web application map created through with the Habitat Priority Planner data from this research. The map is symbolized according to a scale based on most to least at risk. The red indicates areas with the highest ratio of developed and open land whereas the lighter yellow indicates areas with higher ratios of forested and water occupied land. The map also features all land cover numerical data which is accessible through hover and double click actions by the user, allowing a true visual and numerical associative interpretation to be conducted by the user. The map is also capable of live and push updating.



The images above are difference maps produced by ArcGIS's image analysis function. From left to right, each image represents a comparison of 2013 land use data to 1987, 1995, and 2009. Differences in the images above indicate a change in the assigned value of a pixel according to the classification, therefore lending analysis to the qualitative data produced rather than its quantitative nomenclature. The areas of greatest difference are found in the coastal regions of the watershed, areas along main roadways and urban centers which can be seen in greater detail in the NIR image above.

Results

- Overall increase in the amount of development in the watershed region, primarily around along the main transportation corridors that run throughout the watershed.
- Meandering of the shoreline creates slight variances in the pixel values along the coastline of lakes and pond in the watershed, as well as main rivers and larger, detectable tributaries.
- Habitat Priority Planner was accurate in assessing the 'at risk' value of the watershed's sub watershed regions, and provided information that allowed for the creation of choropleth maps representing the different types of land use per sub watershed region and symbology representative of their ratio compared to their counterparts.
- Carto DB was extremely useful in creating an open access web application map that is capable of being continually updated and kept relevant with minimal alteration. The site also provided a great opportunity to increase public access to the data surrounding the externalities impacting the quality of drinking water.
- Image analysis tool provided an adequate way of analyzing the differences in assigned pixel values between prior research and current research. The Image analysis also provided an effective way to assess the variability in reclassification analysis through the production of qualitative numerical data which was quantifiable.

Discussion/ What's Next

This research provided a great amount of insight into the extent and rate of land use change occurring in the Sebago lake watershed. The study showed that, as anticipated, urbanization and sprawl associated with development occurring along major road ways was the primary cause of change in the watershed, but also revealed the risk of ambiguity in analysis through the image analysis tool and the ability of the tool to produce pure quantitative data. The coastlines of the major lake and banks of rivers indicated meandering and slight alterations in shape suggesting natural and observation induced variance in the data over time. Differences in the shape of urban areas can quite easily be distinguished as development through the nature of the expansion of these areas and the types of conversions occurring. The study also provided valuable data to Portland Water District in regard to risk assessment and the current state of the watersheds sub watershed regions in context to the Habitat Priority Planners risk assessment parameters. What's next for further investigation into the habitat fragmentation can be summated through bullets listed as follows:

- Sociocultural investigation into the economic and social factors influencing the expansion of urban areas and increase of transportation ways throughout the region.
- Investigation into the meandering of coastlines and banks of major rivers and detectable tributaries and the implications of their variability in context to pixel value difference analysis between studies conducted over various increments of time
- Analysis of new 2014 Landsat8 data and its reclassification comparison to the prior Landsat 7 data used in this study
- Continuing updating and refining the open access Carto DB map and data to maintain a sufficient data visualization for inquisition into the watersheds risk assessment state and types of land use.

References

Tony Cole Abraham Dailey and Paul Bourget. "Land Use/Cover Change Across the Sebago Lake Watershed: A Preliminary Analysis" 2009.
Maine Lakes, Rivers and Water Sources. Map. Geology.com. 2014. Viewed 22 Nov. 2014 <http://geology.com/state-map/maps/maine-rivers-map.gif>
Perron, Jeff. Map of Sebago Lake Region. Map. krainin.com. 2004. Viewed 22 Nov. 2014 <http://www.krainin.com/webpix/mappix/slregionmap.jpg>
Portland Water District Lake Map. Digital Map. Pwd.org. 2014. Viewed 22 Nov. 2014. http://www.pwd.org/image/History_Photos/MAP_Only.jpg
PWD. "Sebago Lake History." Portland Water District. Portland Water District, 2014. Web. 22 Nov. 2014.
PWD. "Watershed Protection." Portland Water District - Watershed Protection. Portland Water District, 2014. Web. 22 Nov. 2014.
PWD. "Frequently Asked Questions." Portland Water District-FAQ. Portland Water District, 2014. Web. 22 Nov. 2014.
PWD. "Portland Water District - Comprehensive Water System Strategic Plan." Portland Water District - Comprehensive Water System Strategic Plan. Portland Water District, 2014. Web. 22 Nov. 2014.
PWD. "Policy for Watershed Land Acquisition in Standish." 6.10-00. 22 May 2000. Web. 24 Nov. 2014.
PWD. "Lower Sebago Lake Watershed Land Use Policy." (2008). Portland Water District. 28 Oct. 2008. Web. 26 Nov. 2014.