Lake James Environmental Association

University of North Carolina Asheville

Student Research - Land Cover Mapping and Analysis

Background

The Lake James Environmental Association (LJEA) desired to have an analysis completed identifying the land cover types of the subwatersheds and tributaries making up the Lake James watershed. This analysis would use land cover data from 2001 and 2011 to compare changes to land cover types in the watershed as well as tally acreage for each subwatershed. A student research opportunity was developed and proposed. In November 2017, the University of North Carolina Asheville became involved through Dr. David Gillette. Originally, a UNCA student accepted the project but later had to decline the research. Levi Reece, a second UNCA student already performing benthic macroinvertebrate sampling for LJEA, accepted the research position. In early 2018, the land cover mapping analysis began for LJEA.

Methods

The lakes in the Lake James watershed were obtained through data from the National Hydrography Dataset[1]. The major tributaries of the subwatersheds were calculated by using surrounding elevation data from accessing digital elevation maps from USGS's Earth Explorer[2] . Using the "Fill", "Flow Direction" and "Accumulation" tools in ESRI's ArcMap 10.6, I was able

to predict where the main accumulation and flow direction of water should be. Minor streams and tributaries were removed by isolating the larger water accumulation values using conditional filtering. This identified the primary tributary in each subwatershed. The stream file was then exported as a polyline file. This polyline file was then combined with the Hydrologic Unit Code (HUC) boundaries obtained from the Watershed Boundary Dataset[3] to form cohesive subwatershed boundaries with the primary tributaries overlaying it. Placing HUC subwatershed boundaries around each major tributary allowed for the isolation of a single subwatershed for more refined analysis.

The land cover dataset for the state of North Carolina was retrieved from the 2001 and 2011 National Land Cover Database (NLCD)[4]. It was then imported into ESRI's ArcMap 10.6 computer software. Using the previously mentioned HUC boundaries, the land cover data was then clipped with the "Image Analysis" tool to fit the subwatershed boundary thereby only displaying the wanted land cover. Once each subwatershed's land cover had been clipped from the statewide dataset, the resulting clipped land cover file was exported allowing for the removal of the data for the entire state. At this point, a map outlined in HUC boundaries, a polyline file of streams, a shapefile with lakes, and clipped land cover files remained.

The land cover maps where then broken up into 11 desired subwatershed based on 12-digit HUCs. These subwatersheds included Armstrong Creek, Buck Creek, Catawba River/Lake James, Crooked Creek, Curtis Creek, Headwaters Catawba, Mackey Creek, North Fork Catawba River, Tom's Creek, and Lower and Upper Linville River. Once broken up into each subwatershed, the pixels were recolored and assigned corresponding land cover type values through the "Unique Values" option in the display properties for the datasets, based on the

NLCD Legend[5]. These pixels were then easily summed for each code and color from the dataset's properties option. Each pixel represented 300m^2 of land area. Therefore, by summing the pixels for each land cover type, a total area was determined for each subwatershed.

This process was repeated for each of the 11 subwatersheds with the pixel counts being entered into an online spreadsheet. Additionally, each pixel colors and codes were summed for total m^2 representing each land cover type. This calculation was then converted to acres to provide a more relatable unit of measurement. By adding the totals for all of the pixels, percent for each land cover type was found by dividing that land cover pixel count over the total number of pixels in the watershed. The percent values then easily displayed what percentage of land was covered by what type of land cover for the whole subwatershed. Once the 11 subwatersheds were analyzed from the 2001 NLCD, they were reanalyzed using the 2011 NLCD. By repeating the process with data 10 years older than the original, changes in land cover from 2001 to 2011 were able to be identified. Land cover data tabulation for 2001 and 2011 were placed next to each other in the online spreadsheet to easily view changes, whether positive or negative, in land cover type of the Lake James watershed. Additionally, each subwatershed map was captured for 2001 and 2011 and displayed individually and together for comparison resulting in 33 subwatershed maps for land cover analysis.

Results

The Lake James watershed was determined to cover ~ 247,000 acres. Upon completion of the analysis, it was determined that from 2001 to 2011, the Lake James watershed lost 1,763.6

acres of forested land. Agricultural land increased 1,793.6 acres in the time period and 567.3 acres of new development was completed. This spike in development was partly due to the increased building around Lake James' perimeter. Greater agricultural land cover may be concerning to tributary health with issues of runoff, erosion, and chemical changes. Overall, the land cover state of the watershed does not seem to be declining very rapidly, and it is still largely made up of forested land cover. Further land cover mapping and monitoring using the 2016 NCLD will shed even greater light on the changes taking place in the watershed, and will allow for greater focus on areas of concern.

Summary

Overall, it does not appear that the Lake James watershed is changing too drastically. Only 0.9% of its total forest coverage was converted into agriculture or development. When put into context, the change is very slight. Further monitoring will allow LJEA to continue measuring land cover change, and be able to predict where higher levels of development may occur in the future.

References

[1]https://www.usgs.gov/core-science-systems/ngp/national-hydrography

[2] https://earthexplorer.usgs.gov/

[3]https://viewer.nationalmap.gov/basic/?basemap=b1&category=nhd&title=NHD%20View

[4]https://www.mrlc.gov/nlcd11_data.php

[5]https://www.mrlc.gov/nlcd11_leg.php