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H. A. Zurqani
Clemson University

C. J. Post
Clemson University

E. A. Mikhailova
Clemson University

Michael P. Cope
Clemson University

J. S. Allen
Clemson University

See next page for additional authors

Authors
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H.A Zurqani[1,2], C.J Post[1], E.A Mikhailova[1], Michael P. Cope[1], J. S.Allen[3], and B. Lytle[4]

[1]Department of Forestry and Environmental Conservation, Clemson University, SC 29634
[2]Department of Soil and Water, University of Tripoli, Tripoli 13538, Libya
[3]South Carolina Water Resources Center, Clemson University, Pendleton, SC 29670
[4]Clemson Center for Geospatial Technologies, Clemson University, Pendleton, SC 29634

ABSTRACT

Spatial and temporal changes in the land cover affect water quality in the streams and other water bodies. Stream riparian areas are increasingly relevant as the human modification of the landscape continue unabated. The objectives of this study were to: (1) determine the classes and the distribution of land cover in stream riparian areas; (2) examine the accuracy of the existing land cover data National Land Cover Database (NLCD) using high-resolution imagery NAIIP and LiDAR data; and (3) evaluate the integrity of forested riparian buffers areas in the Lower Savannah River basin. The land cover map was produced using a Support Vector Machine (SVM) algorithm supervised classification through the cloud-based Google Earth Engine platform with an overall accuracy assessment of 83.66%. LiDAR data analysis were implemented using ArcGIS 10.6. The result of this study demonstrates that LiDAR data can be used to accurately map the vegetation width, height and canopy cover within the riparian buffer over wide areas to support ecological-based management. It is also highlighted that the open-access imagery and the efficient geospatial analysis GEE provides a reliable methodology to remotely monitor forest cover and land use in the riparian buffer areas.

INTRODUCTION

- Riparian areas have been recognized as important natural features that provide a unique habitat for many wildlife species (Iverson et al., 2001).
- Development of approaches are needed to accurately map the land cover in riparian zones and monitor the changes taking place in order to assess the human modification in the landscape (Zurqani et al., 2018).

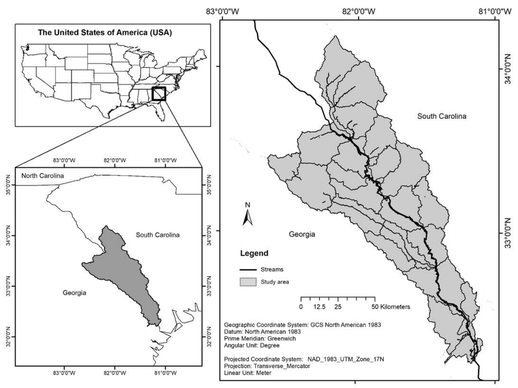

Figure 1. Location of study area in in the Lower Savannah River basin.

OBJECTIVES

- Determine the classes and the distribution of land cover in the stream riparian areas;
- Examine the uncertainty of the existing land cover data National Land Cover Database (NLCD) using high-resolution imagery NAIIP and Lidar data;
- Evaluate the integrity of forested riparian buffers areas in the Lower Savannah River basin.

MATERIALS AND METHODS

Study Site

- The study area is the lower part of the Savannah River basin (Fig. 1). It's coverage is approximately 10704 km^2 in size and spans portions of both states South Carolina and Georgia.
- The average annual temperature for the entire basin is 18 degrees Celsius (Georgia. Environmental Protection Division, 2001). The average annual precipitation ranges between 1m to 2m per year (Georgia. Environmental Protection Division, 2001).
- Zurqani et al (2018) reported that the Savannah River basin has been experiencing a remarkable environmental change caused by anthropocentric activities.

Data Sources and Description

- Data processing (Table 1) used the cloud-computing technology in the Google Earth Engine platform (https://earthengine.google.org/) and (ESRI 2018, ArcGIS 10.6).

Table 1. Data sources and description.

Data Layer	Source	Spatial Resolution (meter)	Date
Watershed Boundary Dataset (WBD), Strems	U.S. Department of the Interior, U.S. Geological Survey	Scale 1:24,000	2016
National Hydrography Dataset Plus (NHDPlus)	U.S. Department of the Interior, U.S. Geological Survey	Scale 1:24,000	2012
The National Agriculture Imagery Program (NAIP)	Google earth engine (GEE) data provided by U.S. Department of Agriculture (USDA) Farm Service Agency	1	2010-2011
Lidar data	National Oceanic and Atmospheric Administration (NOAA)	1	2010-2011
NLCD: USGS National Land Cover Database	Google earth engine (GEE) data provided by U.S. Geological Survey (USGS)	30	2011

Data Processing

- Support Vector Machine (SVM) algorithm was applied in Google earth engine using the (NAIP) data for the year 2011. Python scripts were used to automate LiDAR processing included sub-processing LASTools (Isenburg 2018) and ArcGIS 10.6 software to construct DEM and DTM tiles in a piecewise fashion (Fig. 2). HTCondor software (UW-Madison 2017) was used to distribute jobs across many computers.

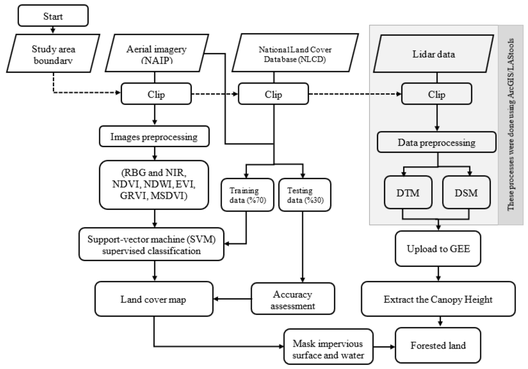

Figure 2. A flow diagram for data processing and the analysis steps.

RESULTS AND DISCUSSION

The distribution of the land cover and forest coverage in the streams riparian areas

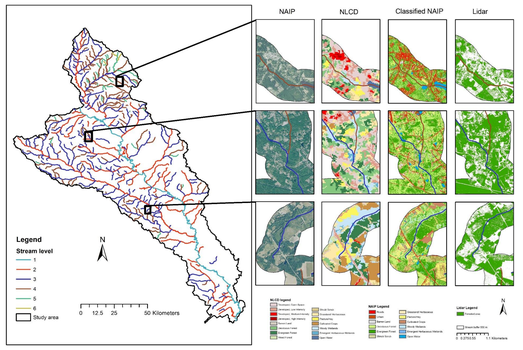

Figure 3. The distribution of the land cover and forest coverage in the streams riparian areas.

Comparing the classes and the distribution of land cover in the streams riparian areas using the NAIP classified imagery and NLCD data (Fig. 4, 5).

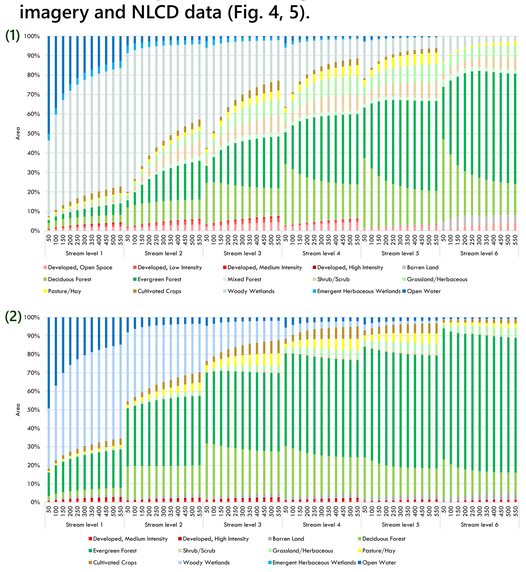

Figure 4. The classes and the distribution of land cover in the streams riparian areas from (1) NAIP classified imagery and (2) NLCD data.

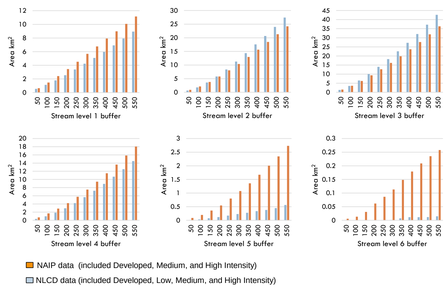

Figure 5. Impervious surfaces within buffers areas using Classified NAIP, and NLCD data.

RESULTS AND DISCUSSION

Evaluating the integrity of forested riparian buffers areas

Evaluating the integrity of forested riparian buffers areas and using the Classified NAIP, NLCD and LiDAR (Fig. 6).

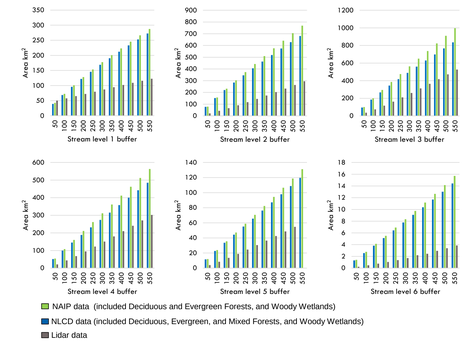

Figure 6. Forested riparian buffers areas using Classified NAIP, NLCD and LiDAR data.

CONLCUSIONS

- The NAIP classified image provided more accurately result in identifying the urban areas than the NLCD data.
- Both NAIP and NLCD data were overestimating the forest cover compared with the Lidar result.
- The result of this study demonstrates that LiDAR data can be used to accurately map the vegetation width, height and canopy cover within the riparian buffer over wide areas to support ecological-based management.
- It is also highlighted that the open-access imagery and the efficient geospatial analysis GEE provides a reliable methodology to remotely monitor forest cover and land use in the riparian buffer areas.

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