# Characterizing Riparian Vegetation Using the Riparian Classification from LiDAR (RCL) Tool in ArcGIS

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## Abstract

*A vast catalogue of LiDAR point cloud data is available online in government and private databases, and the amount of data available is constantly increasing as new missions are contracted and completed. Aerially-collected LiDAR point clouds are useful for many analytical and visualization purposes, including the delineation and characterization of vegetation. This document details an ArcMap-based, step-by-step process for converting raw point cloud data into a simple vegetation classification raster, as well as an explanation of the model design and limitations.*

## Introduction

Give an overview of LiDAR (how its collected, what each data heading represents, how it applies to veg. characterization). Overview of model (how it was designed, what its input and output is).

## Walkthrough

Generating a landcover raster can be down, in general, by converting a LiDAR point cloud to several raster datasets and then applying a set of filters to the generated rasters. This section will walk through this process.

1. *Obtaining LiDAR data*

LiDAR point clouds can be obtained from numerous sources, including state and federal repositories. One of the most extensive repositories is the National Map (TNMap) Viewer (<https://viewer.nationalmap.gov/basic/>), which hosts LiDAR data for most of the coterminous United States and parts of Alaska and Hawaii. Because LiDAR point clouds covering even a small area often contain millions of points, LiDAR tiles are usually small and so it may be necessary to download multiple tiles. For large study areas with many tiles TNMap can be used with uGET (<https://viewer.nationalmap.gov/uget-instructions/index.html>) to download many tiles at once. Depending on your specific source, the LiDAR data may be delivered uncompressed (.las), compressed (.laz) or in ESRI’s proprietary compressed format (.zlas).

1. *Preprocessing the LiDAR data*

Before generating raster from your LiDAR, you may need to apply some preprocessing functions to your data. These steps are most easily done with the **LAStools** suite (<http://lastools.org/>).

* 1. *Decompressing the LiDAR data (optional)*

If your LiDAR data is uncompressed (.las), you may skip this step. If your data is compressed (.laz) or in ESRI’s proprietary compressed format (.zlas) you will need to decompress your files. If you have .laz files, they can be decompressed with **LASzip**. If you have .zlaz files they can be decompressed with **LASliberator**.

* 1. *Merging the LiDAR data (optional)*

If your study area is sufficiently small, you may be able to merge your LiDAR tiles into a single file which may help with data management. Merging tiles for very large study areas may not be possible due to file size limits; if this is the case you can create several merged files from subsets of your LiDAR tiles. Merging can be done with **LASmerge**.

* 1. *Creating swapped returns (required)*

As of v10.7, ArcMap is unable to natively generate rasters based on LiDAR return number data, so to generate this data we must create a dummy LiDAR file for each tile (or merged .las file) where the elevation column is populated by the return values. This can be done using **las2txt** to generate a text file representing your .las file, and then converting it back to a .las file with swapped headers with **txt2las**. The command line entries to do this are as follows:

las2txt –i your\_file.las -o your\_output.txt -parse xyr

txt2las -i your\_output.txt -o swapped\_file.las -parse xyz

1. *Generating raster data from LiDAR*

Once you have preprocessed your data, you can bring it into ArcMap to view it. In ArcMap, open the Catalogue, and right click on a folder. A menu will pop up; select “Create LAS Dataset”. This will create a .lasd file in that folder. Double click the .lasd file, and under **ADD STEPS TO ADD .LAS FILES TO .LASD AND GENERATE THE REQUIRED ELEVATION/RETURN/SLOPE/ETC PRODUCTS**

1. *Creating the vegetation cover raster*

**TALK ABOUT MOSAICING IF NECESSARY; GIVE RASTER CALCULATOR EXPRESSION. REFERENCE CUSTOM ARCPY DECISION TREE TOOL. CLIPPING RASTER WITH RIPARIAN BUFFER POLYGON**

## Model Details and Limitations

Explanation of how decision tree was generated and how it is interpreted; why we don’t use intensity; how different LiDAR missions may have different return splitting; inability to recognize most impervious surfaces. Explain how this model was trained on extra-riparian vegetation and only in TN, and how this affects model performance. Provide details on model accuracy/precision/recall/etc.

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## References

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