

Lidar-derived Tree Canopy Heights using ArcGIS Pro

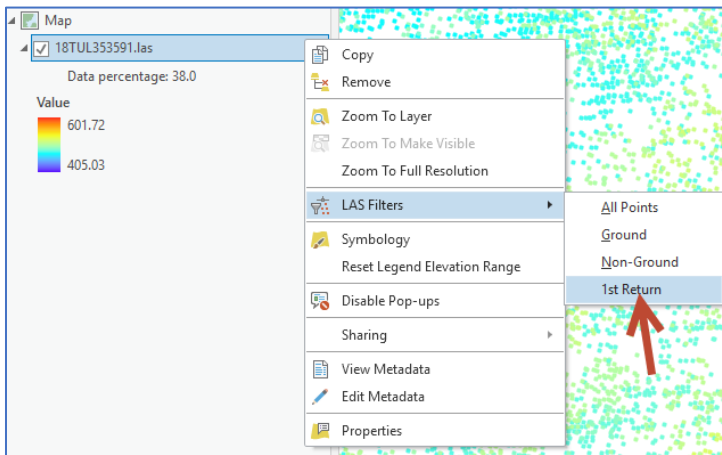
Summary: These instructions demonstrate how to process a raw lidar LAS point cloud to generate an output raster of the tree canopy height. The instructions use 2018 lidar data from the PA Sullivan County Quality Level 1 (QL1) in the Loyalsock State Forest.

System Requirements: ArcGIS Pro 2.4.1 (with Spatial Analyst Extension)

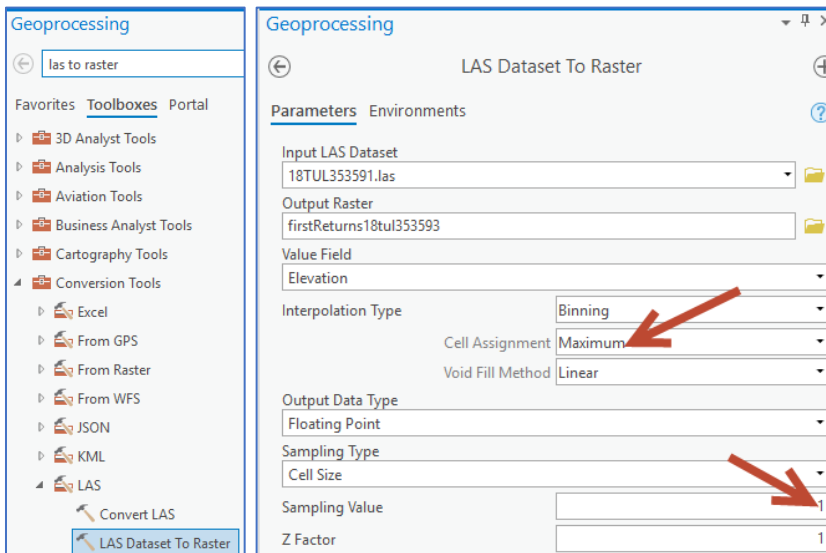
Contact: PA Department of Conservation & Natural Resources, Bureau of Forestry

Disclaimer: Users are advised to use these instructions strictly at their own risk. No warranties are made about the reliability or security of these instructions. No parties shall be held liable for any losses or damages of any kind in connection with the use of these instructions.

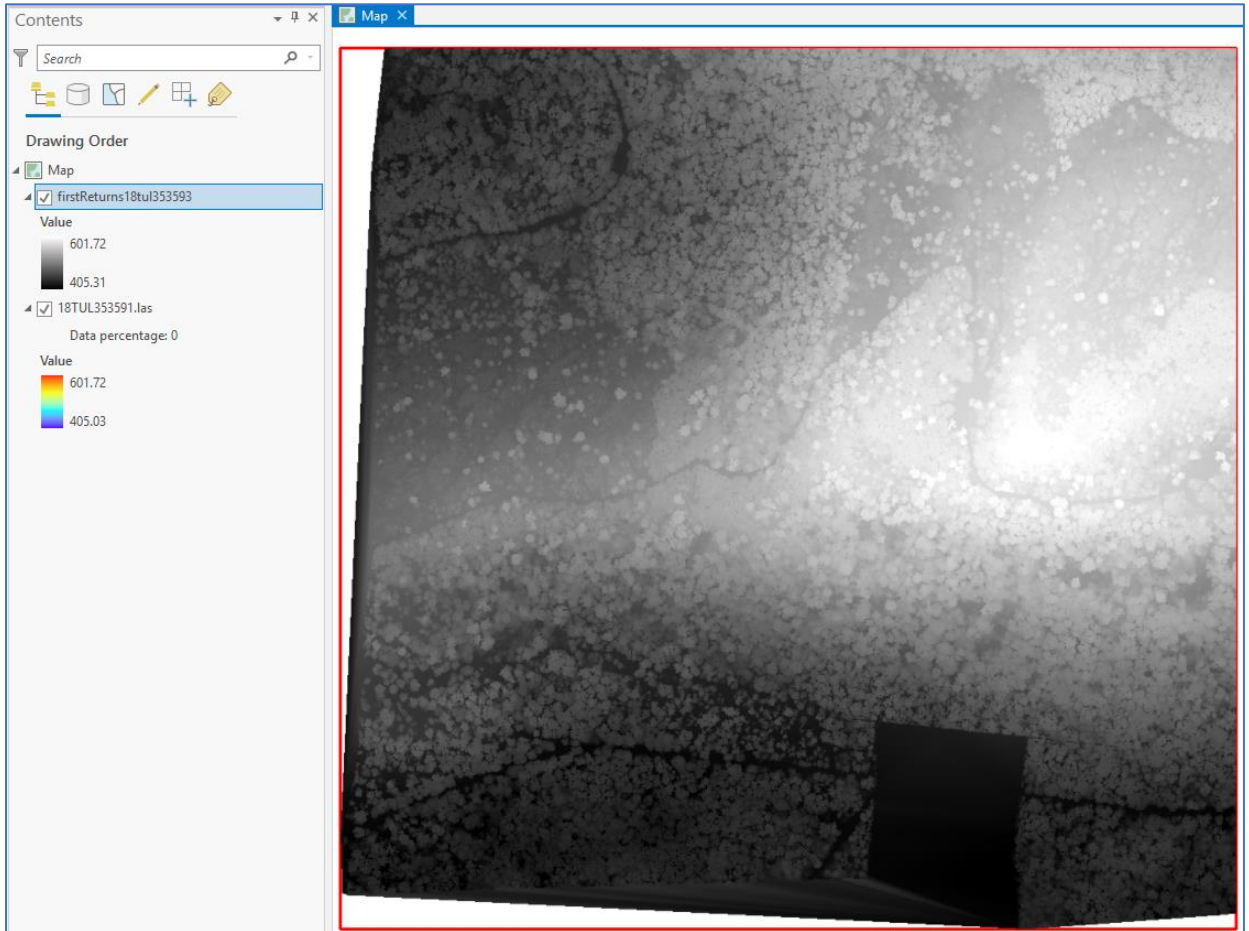
1. Add a *.las file or LAS Dataset (*.lasd) to a map in ArcGIS Pro.
2. Filter the LAS for the FIRST RETURNS only. Right-click on the LAS layer, choose **LAS Filters** → **1st Return**. The first returns are the first objects are encountered...in a forested setting, these would be the top most branches of trees.



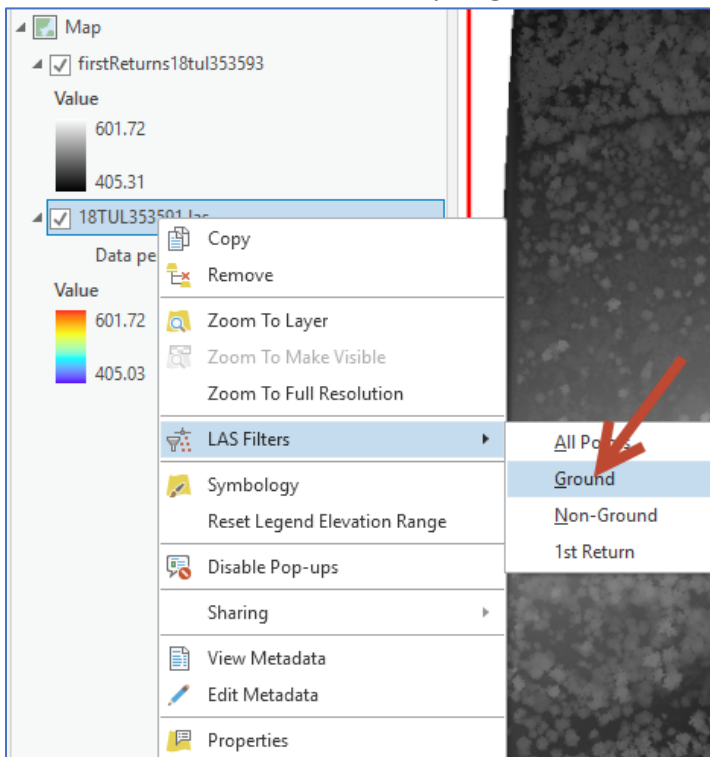
3. Generate a raster of the FIRST RETURNS. Use the **LAS Dataset to Raster** geoprocessing tool. In the Interpolation Type section, set the Type to **Binning**, Cell assignment to **Maximum**, and Void Fill Method to **Linear**. Specify the output raster cell size by setting Sampling Type to **Cell Size** and changing the **Sampling Value**. For this example, the output cell size is 1 meter.



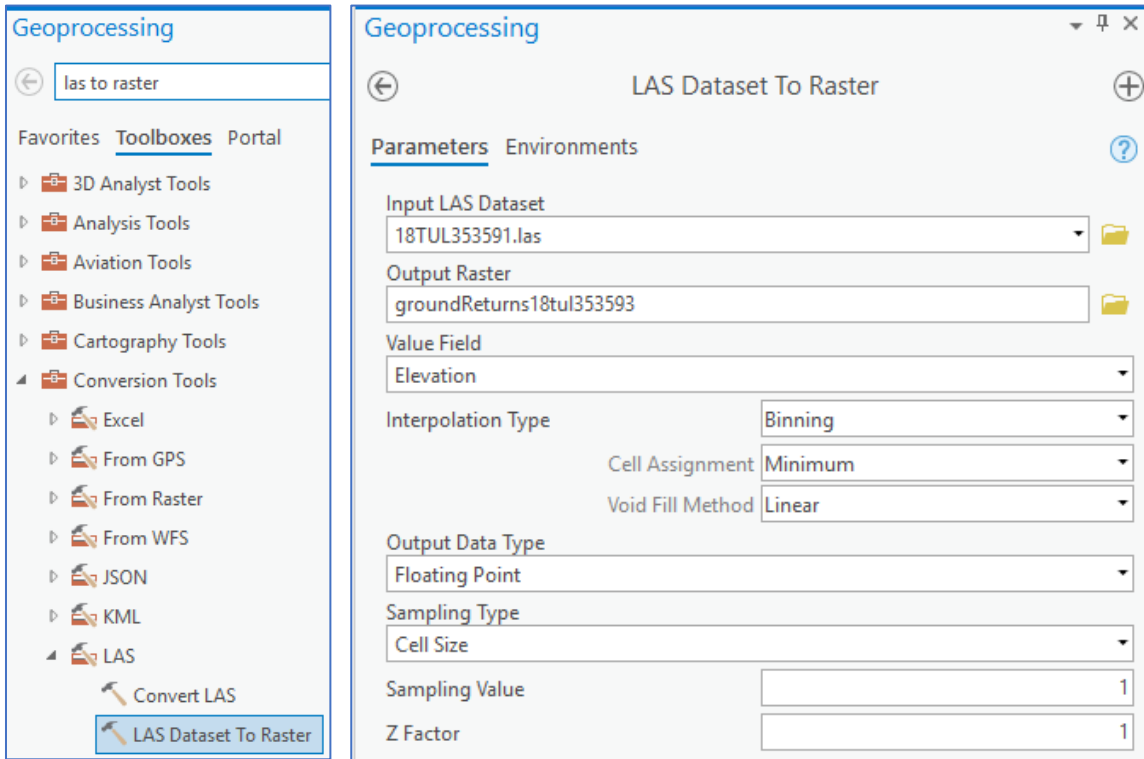
4. You should now have a new raster of FIRST RETURNS:



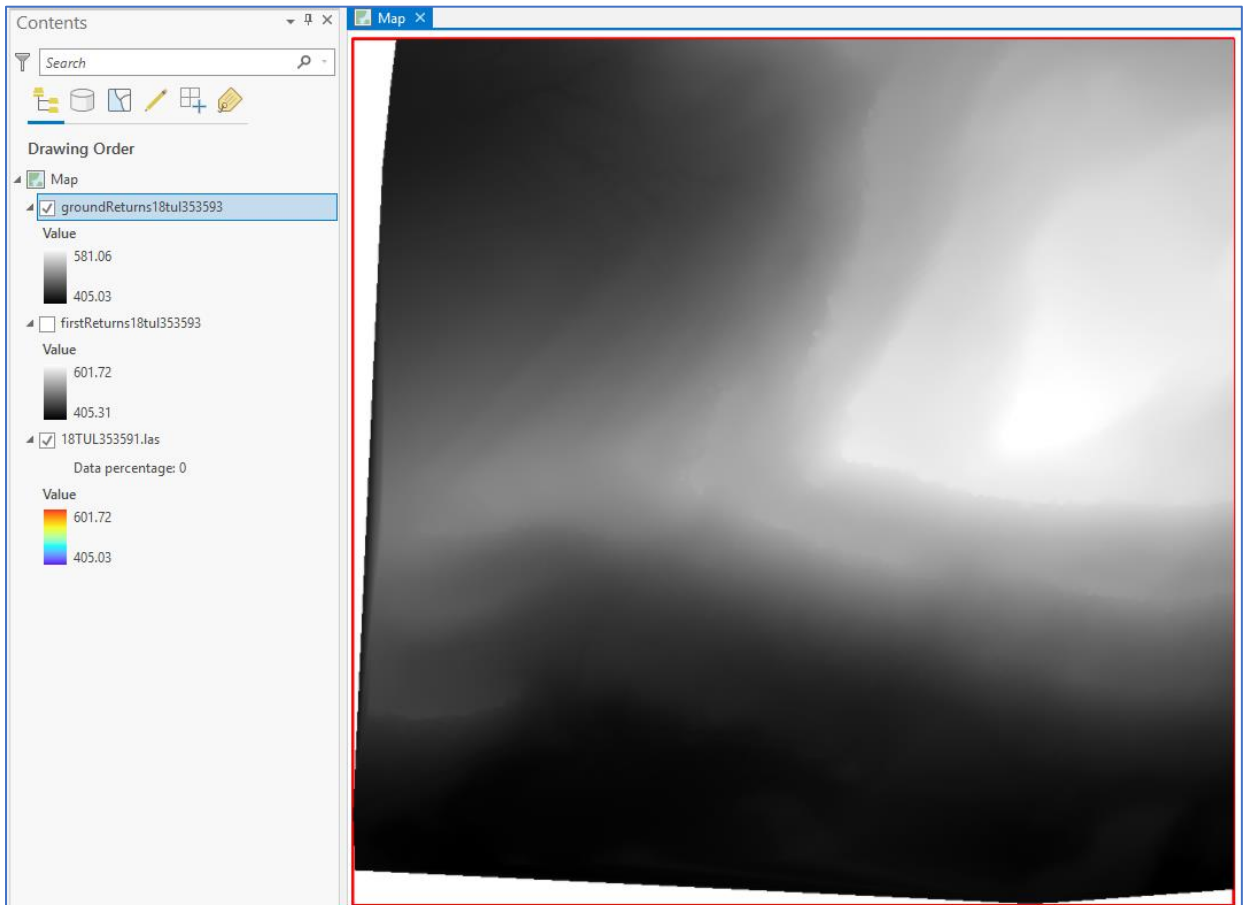
5. Filter the LAS for the GROUND RETURNS only. **Right-click** on the LAS layer, choose **LAS Filters** → **Ground**.



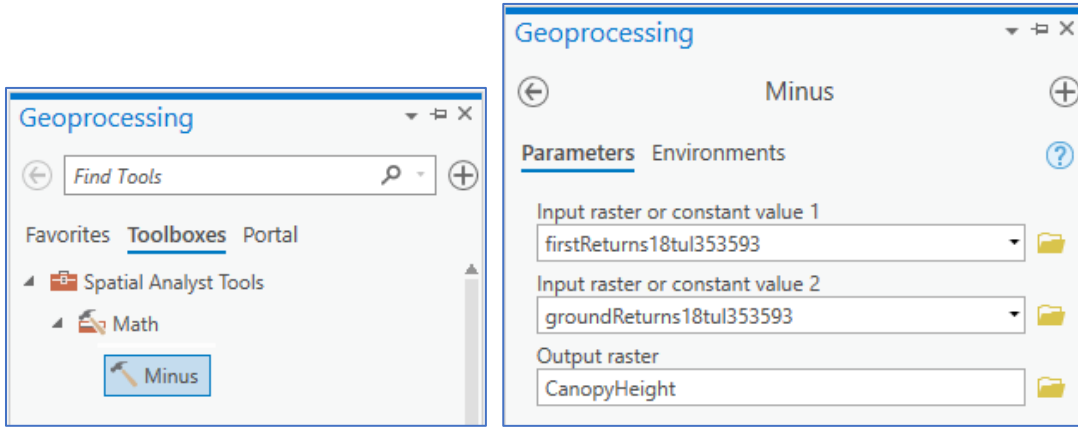
6. Generate a raster of the GROUND RETURNS. Use the **LAS Dataset to Raster** geoprocessing tool. In the Interpolation Type section, set the Type to **Binning**, Cell assignment to **Minimum**, and Void Fill Method to **Linear**. Specify the same output raster cell size (1 meter in this example) as was used to create the raster of first returns setting Sampling Type to **Cell Size** and changing the **Sampling Value**.



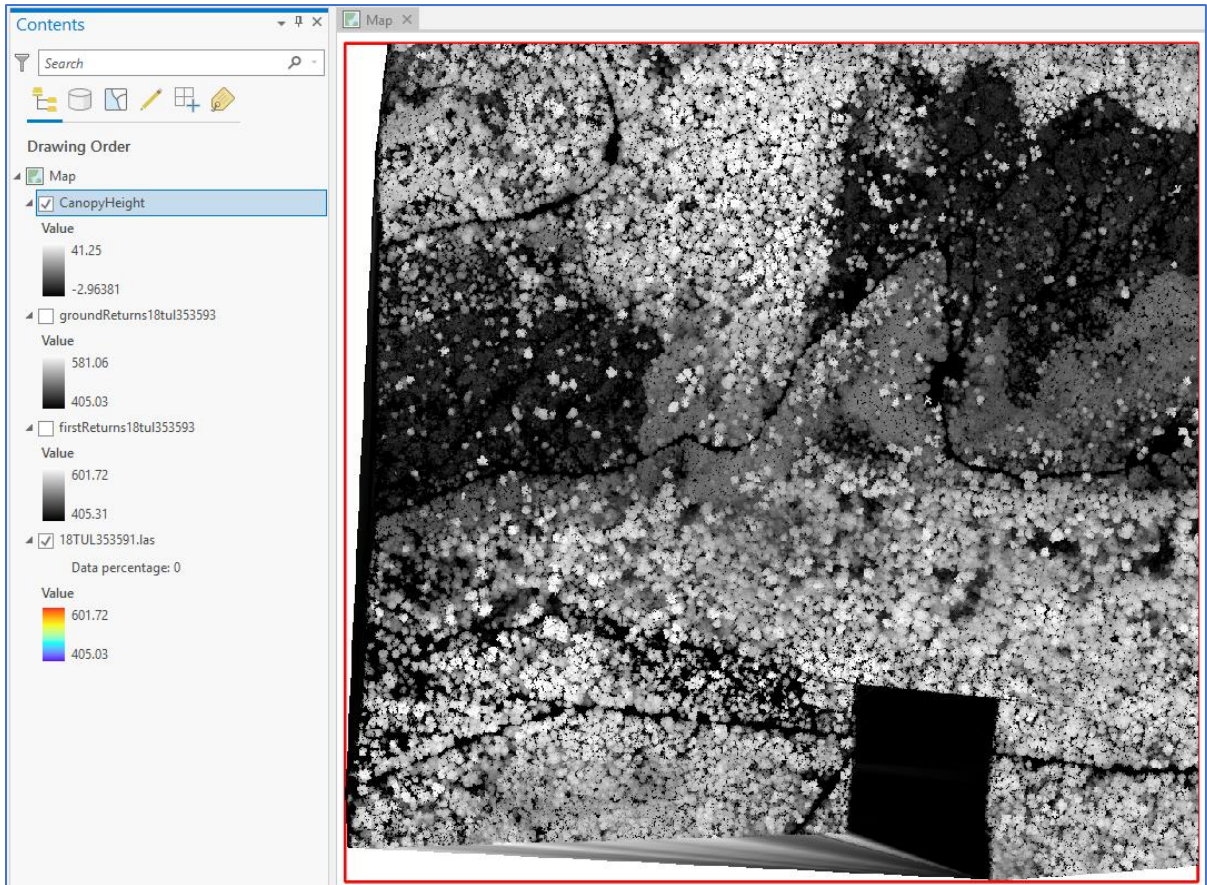
7. You should now have a new raster of GROUND RETURNS:



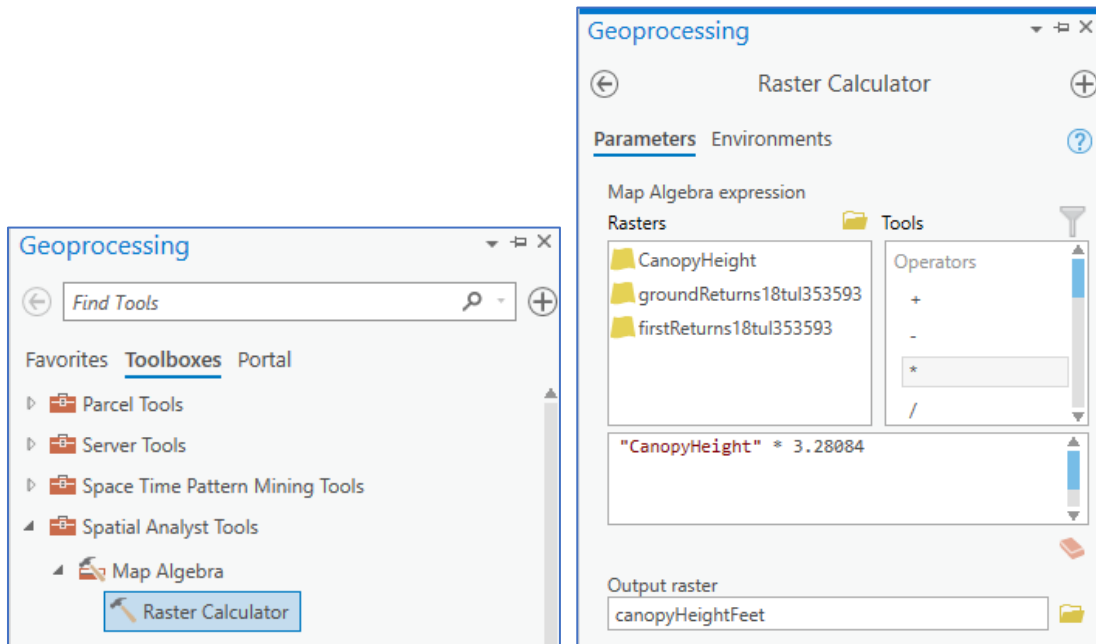
8. Subtract the FIRST RETURN values from the GROUND RETURN values. Use the **Minus** geoprocessing tool in the Spatial Analyst Extension.



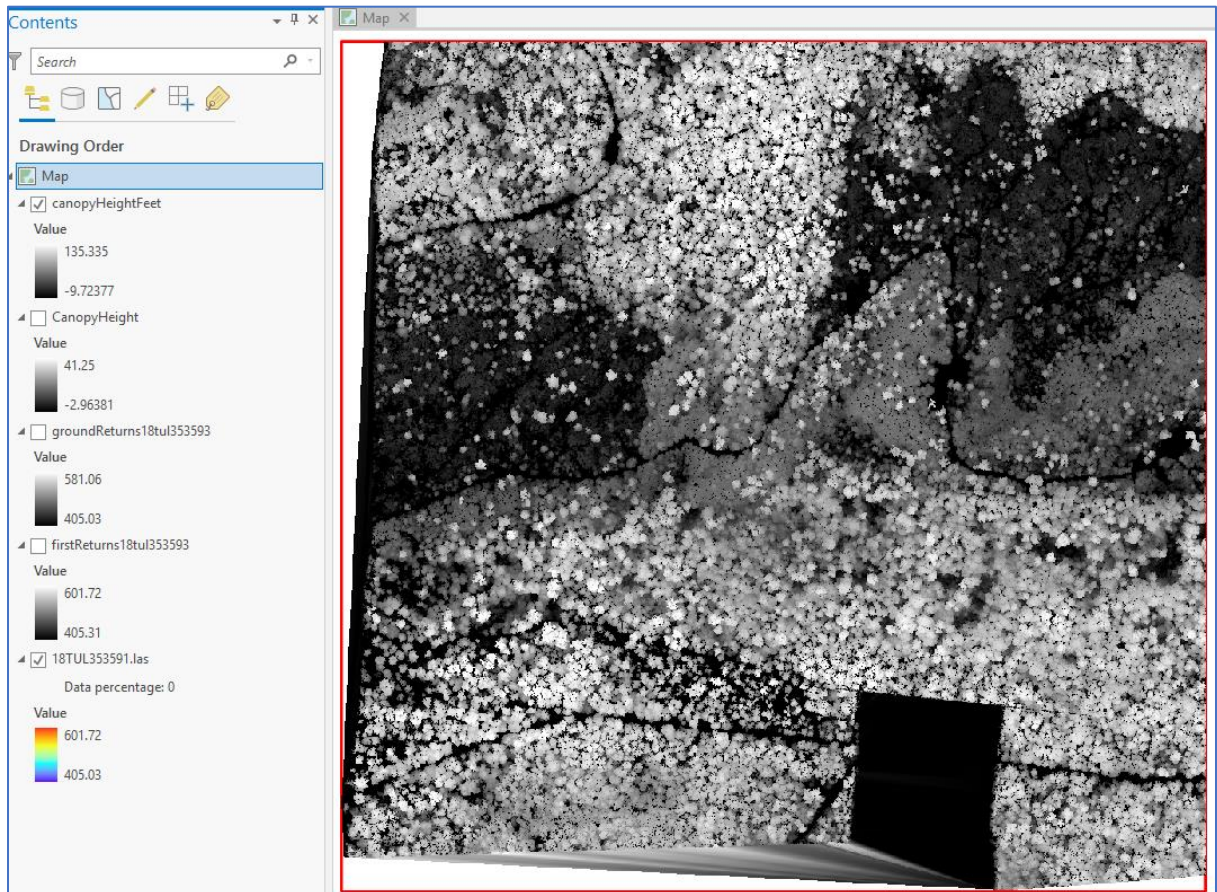
9. You should now have an initial canopy height raster:



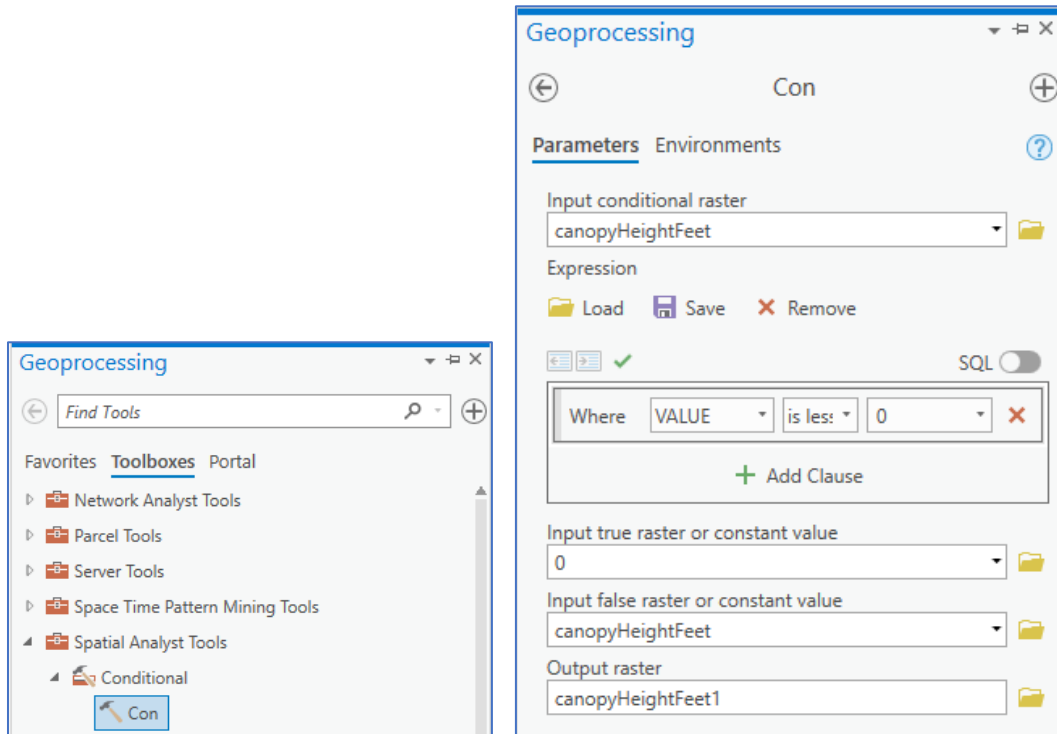
10. Convert height value to feet. If the units defined in the spatial reference of the source dataset are not in feet, you may want to convert the output values to feet. In this example, the output is in meters, so we'll use the **Map Algebra** geoprocessing tool and multiple the canopy height values (in meters) by 3.28084 to convert the values to feet.



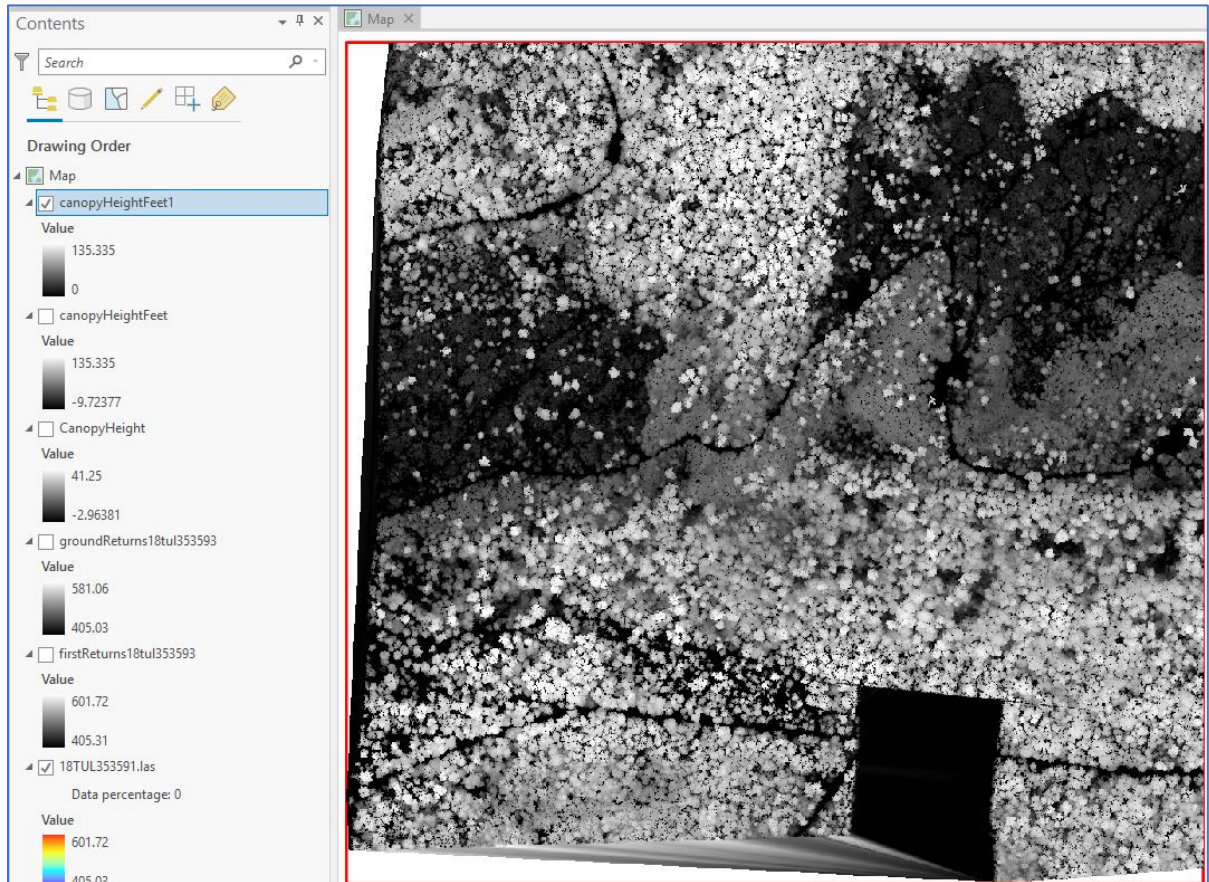
11. You should now have a canopy height raster with units in feet:



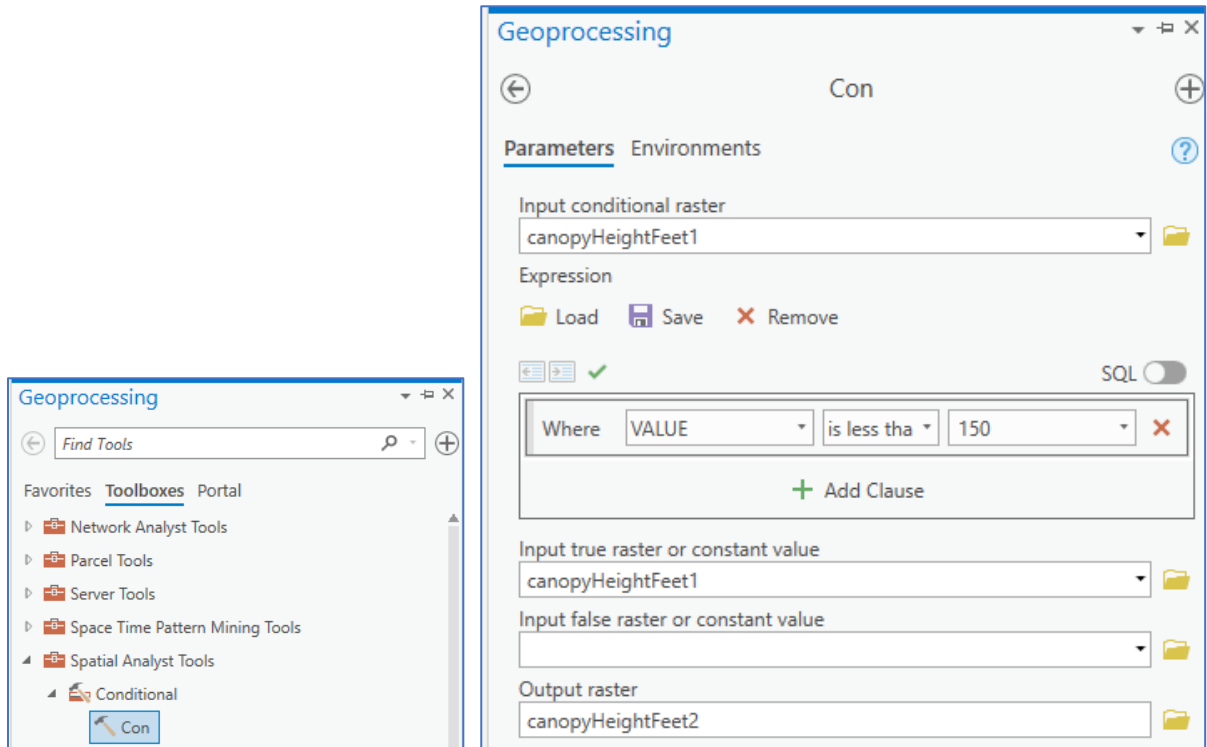
12. Remove any negative values (noise). Use the **Con** geoprocessing tool to recalculate any negative values to a value of zero.



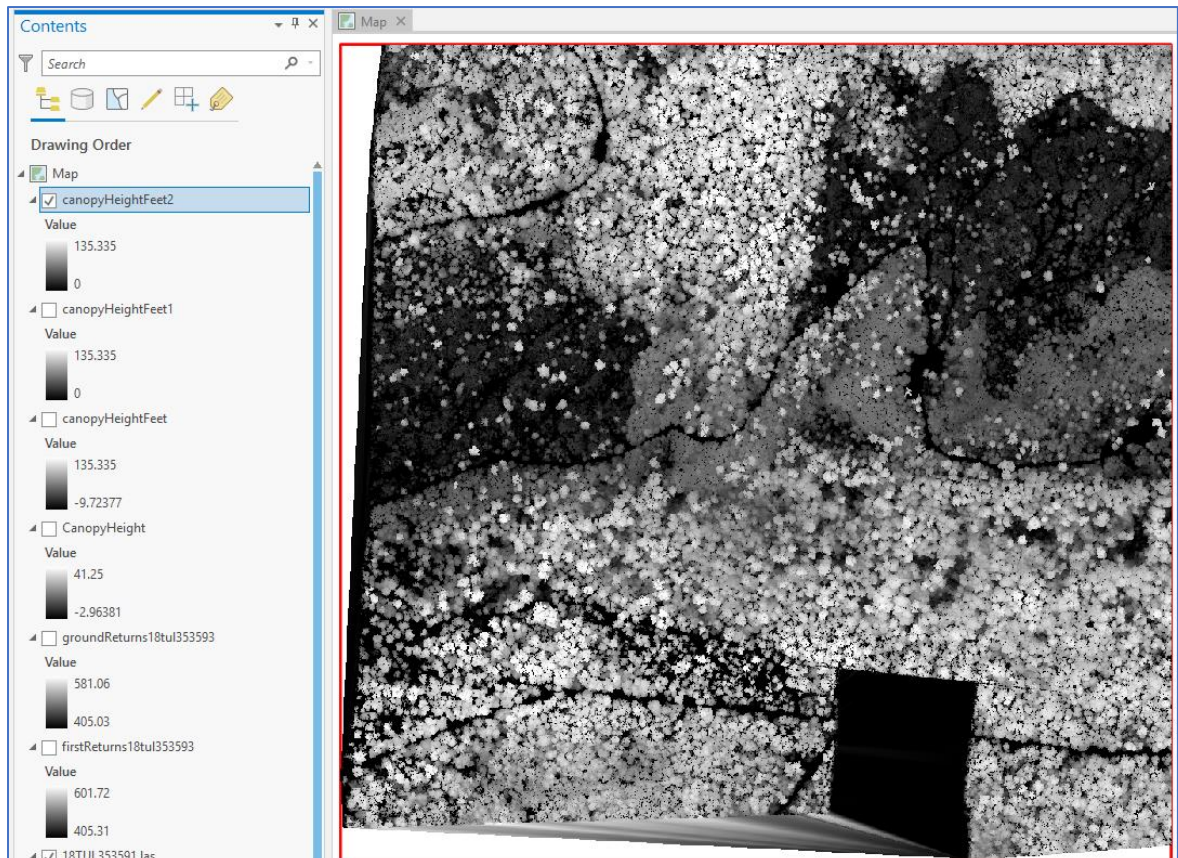
13. You should now have a canopy height raster with units in feet, with no negative values:



14. Remove any abnormally high values (noise). Use the **Con** geoprocessing tool to recalculate any abnormally high values (e.g., > 150 feet).



15. You should now have a canopy height raster with units in feet, with no negative values, and with no heights greater than 150 feet:



16. Your tree canopy height is now complete. Update the symbology to differentiate tall trees from short ones. Optionally, you can further post-process the output data using the **Focal Statistics** geoprocessing tool to further remove any additional noise.

