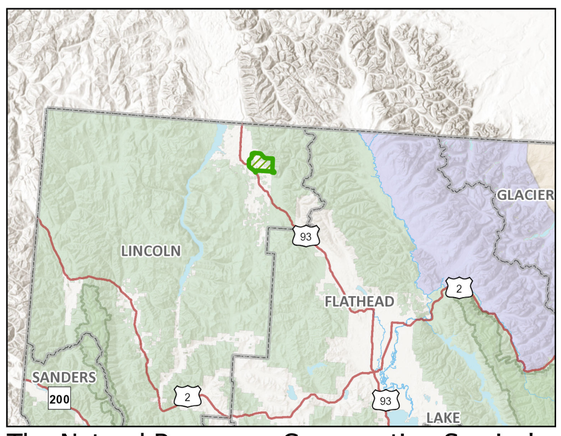
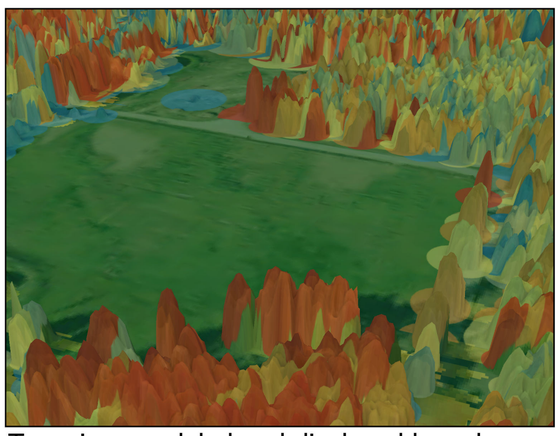
Using Montana's LiDAR Inventory for Wildfire Management

A Case Study on the Glen Lake Fuels Reduction Area in Northern Montana

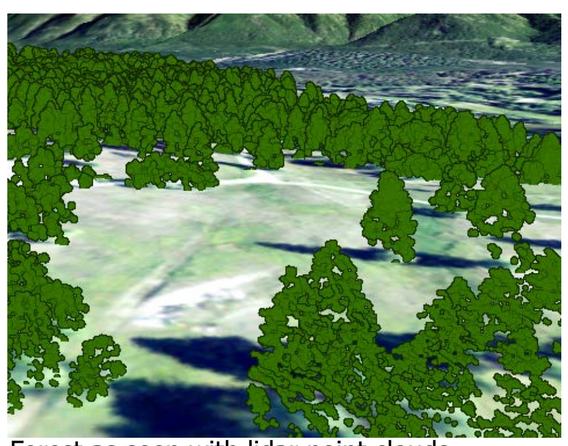
LiDAR or light detection and ranging is not a new technology, however it is new to many of Montana's more remote areas. Since the early 2000s, the Montana Spatial Data Infrastructure has been steadily increasing its LiDAR inventory, opening the door to looking at our state's physical features in new and insightful ways. One of these is looking at vegetation and forest structure.



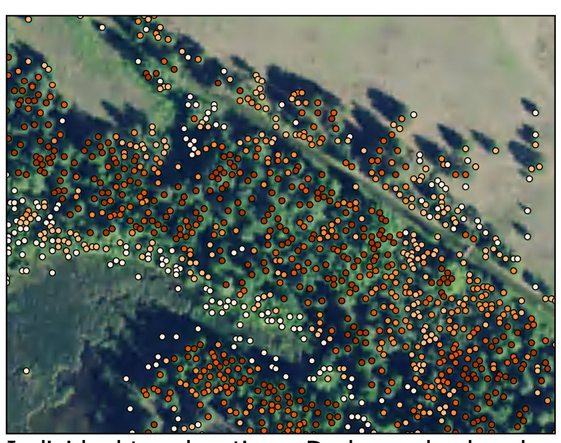
The Natural Resources Conservation Service's Glen Lake Fuels Reduction Area located in Lincoln County, Montana near Eureka.



Tree sizes modeled and displayed by color.



Forest as seen with lidar point clouds.

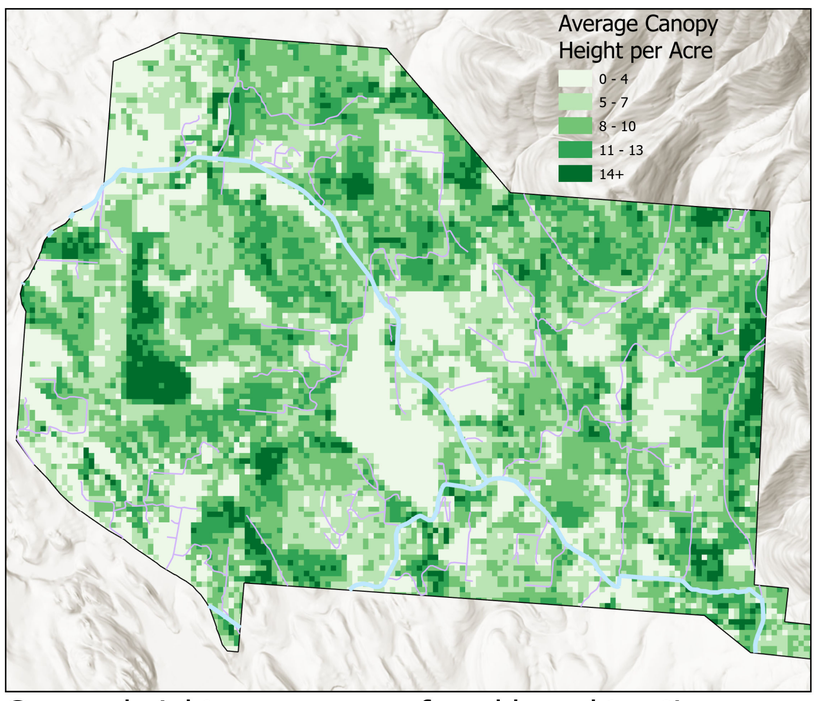


Individual tree locations. Darker red colored points indicate taller individuals

Canopy Height in the Glen Lake Area. Canopy height rasters are a new addition to the state library's inventory for Montana.

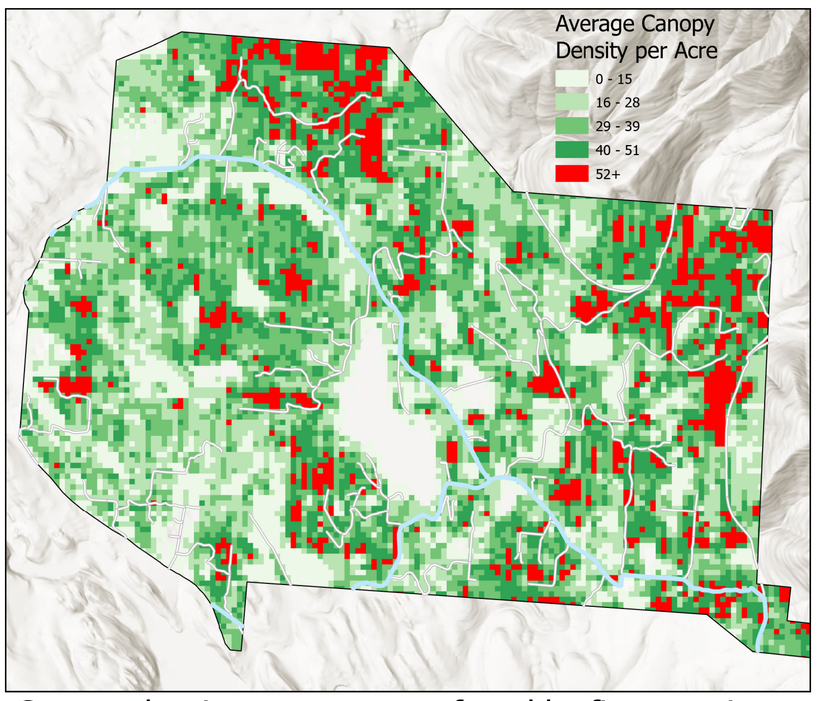
This poster explores three different vegetation metrics as seen with lidar data: canopy height, canopy density (cover), and tree count per acre. These were analyzed specifically for wildfire management around Glen Lake in Lincoln County, Montana.

Canopy Height



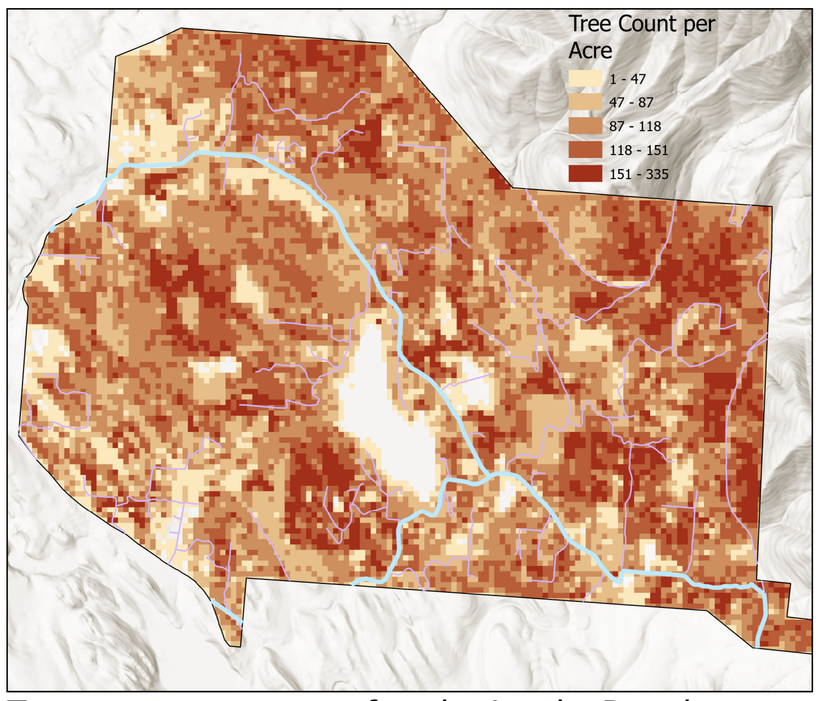
Canopy height per acre was found by subtracting a point cloud derived digital elevation model (the ground) from a digital surface model (the tallest surface points), after filtering out buildings, low lying objects, and outliers.

Canopy Density/Cover



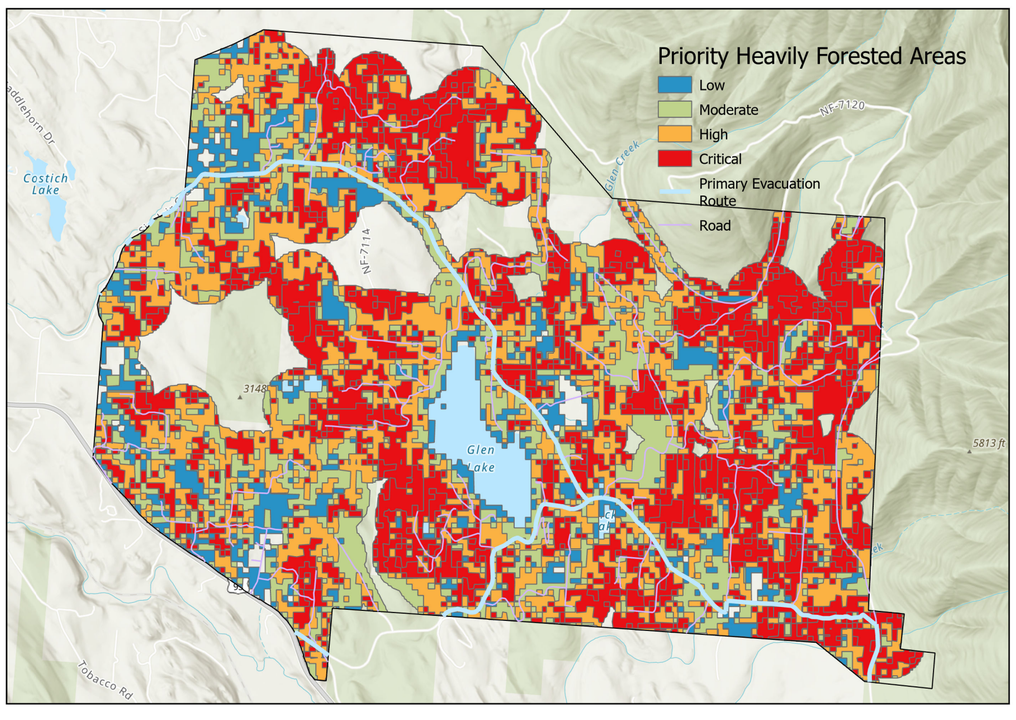
Canopy density per acre, was found by first creating a gridded net of squares over the area of interest. The percentage of point cloud data points classified as vegetation were then averaged in each square grid.

Tree Count



Tree count per acre was found using the R package Forest Tools. This tool finds the highest point in the area of interest, then outlines a canopy crown around that point. It then moves on to the next highest point outside of that crown and does the same until it has mapped all the theoretical tree tops and respective crowns in the area.

When collected in the field, these metrics can be time intensive and expensive to find. While looking at them with lidar helps alleviate that, there can be issues with the accuracy. Canopy height is straightforward and in general should be accurate to less than 0.5 of a meter. Canopy density can depend heavily on the classification of vegetation points, and thus special attention needs to be paid to that process. Tree counts were somewhat accurate, but often detected trees that were not there, which could be seen when compared to satellite imagery. These accuracy concerns were accounted for by averaging the measurements by acre. While coarser, this allowed for a more accurate and still useful visualization of areas of forest that could be classified as priority acres in terms of forest thinning and wildfire management. To the right is a map of a weighted overlay of the 3 metrics showing heavily forested areas that are within a quarter mile of a structure or primary road. Further analysis would include ground validation of the project area, as well as snag detection.



Map Projection: Montana State Plane NAD 83 (2011)
Map Base Layers: Montana Spatial Data Infrastructure & Esri Community Map Contributors
https://msl.mt.gov/GIS/msdi

MONTANA STATE LIBRARY

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