Active Intelligence Drone Services

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2021-2022 Snow Brook Drone Report

- **Land Cover Change Analysis:**

Project:

Location: Snow Brook, Sedgwick, Maine

Client: Maine Coast Heritage Trust

Sensors:

- LiDAR unit with integrated camera for colorizing point cloud
- 20MP RGB drone with mechanical shutter for Orthomosiac generation

On July 11th, 2021 @ 1PM and again on July 15th, 2022 @ 1PM Active Intelligence flew drone LiDAR to collect 3D forestry and land cover metrics to try to determine if there were any land cover classification changes one year after the hung culvert was removed.

Using three different point cloud analysis models; Canopy Height Model, Point Cloud Segmentation from Seed Point, and Normalize by Digital Elevation Model to compare Snow Brook's vegetation we were unable to find any statistically significant changes in the land classification profile year to year.

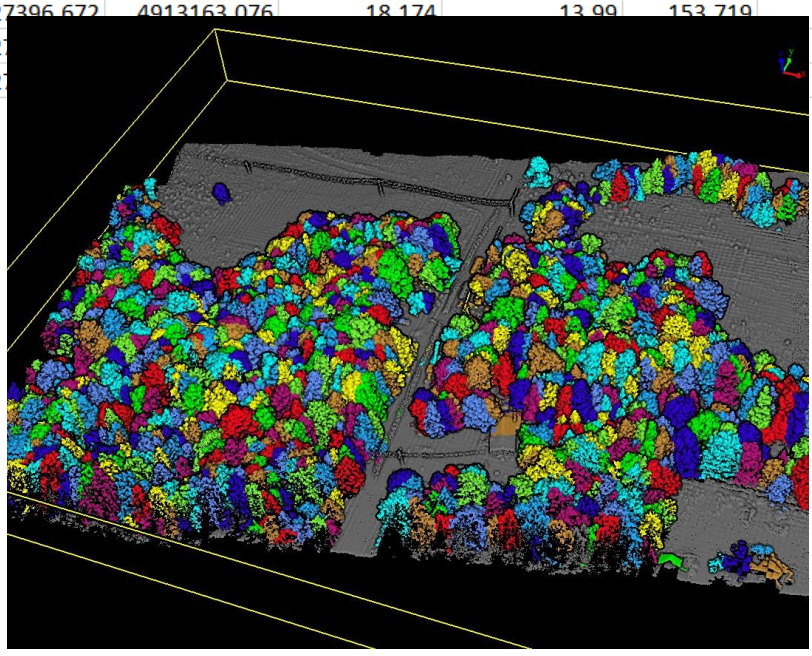
The vegetation that was not disturbed by earthworks remained in its designated land classification. The mixed overstory of deciduous and evergreen trees maintained their shading properties, shrubs and plants below continued to thrive as they were before the culvert removal.

The herbaceous grassland around the adjacent blueberry fields and the little stream crossing the blueberry field's crushed stone access road did not see any changes. There is a little less of a bottleneck from the brook's flow on the topside of the bridge and the edges that were disturbed by earthwork still have wood chips acting as erosion control and mulch one year later.

There is woody wetland approximately 900'ft upstream from the bridge, but with the elevation drop between the two locations the woody wetland was not affected by the culvert removal.

Below is LiDAR segmentation data and an aerial view of the point cloud over Snow Brook on Snow's Cove Rd.

TreeID	TreeLocationX	TreeLocationY	TreeHeight	CrownDiameter	CrownArea	CrownVolume
1	527376.197	4913159.54	15.337	6.726	35.536	237.726
2	527387.867	4913161.917	17.417	7.735	46.985	389.68
3	527379.753	4913164.892	20.417	12.176	116.443	1184.257
4	527415.467	4913151.988	14.004	7.328	42.181	301.924
5	527371.917	4913164.582	17.799	9.022	63.924	510.326
6	527386.389	4913165.171	17.786	5.188	21.141	169.902
7	527392.821	4913165.543	17.167	9.266	67.439	375.05
8	527396.672	4913163.076	18.174	13.99	153.719	1413.206
9	527					541.812
10	527					539.075



In addition to structural data collection from the LiDAR, we also performed red, green, blue spectral data collection to create photographic-based orthomosaics to try to determine if land cover classification changed.

Using Maximum Likelihood Classification training algorithms in ArcGIS Pro we feed spatially-identical orthomosiacs from the inter-tidal zone upstream over Snow's Cove Rd up to a set of rapid's by a four wheeler bridge. We report homeostasis everywhere that was not affected by installing the new bridge, besides grasses reclaiming blueberry field that had wood chips piled before spreading. This was not a change due to the project.

2021 Top: 2022 Bottom

We also ran Maximum Likelihood Classifications of the dogleg at Snow Brook which included the wetlands and woody wetland and again were unable to find any statistical change. Below is a raster colorized by land classification.

Water, developed, barren, deciduous forest, evergreen forest, shrubland, and herbaceous (grassland) classifications are present

Findings:

We wanted to test this LiDAR and RGB drone technology on a project like Snow Brook to see if it could replace some of the manual before and after vegetation change data collection and in this case I do not feel it does a superior job.

Where Snow Brook isn't a marsh or a swamp or expansive wetland that might see a more dramatic visual change from replacing a hung culvert with a free flowing brook, I do not feel manual collection has been replaced by drone data, especially due to the forest canopy.

Although the LiDAR laser data does penetrate the overstory, I think some of the smaller shrub/small riverside plant species that manual collections account for were underrepresented.

With this drone effort being a trial and done at 50% of typical cost, I also don't believe I would recommend the RGB maximum likelihood classification at the vegetation classification level, it is too micro. I find that max likelihood classification excels on macro subjects, roads, buildings, individual standing trees, large homogenous water bodies, etc. A narrow, fast-moving, canopy covered brook would be better analyzed by manual field data collection.

Where LiDAR can be superior to traditional methods is for the planning stages of fish passage development. The ability to map river bank topography through tree cover to gain accurate elevations on a large scale in a very short amount of time is novel.

We recently added a drone flown echo sounder for bathymetric mapping which can get underwater data where it is too challenging for manned boats, remote controlled boats, or because of obstacles.

Final observations after having been to Snow Brook a few more times in person to check, as I went back and forth to projects in the region, is that it is a beautifully restored waterway without any dramatic disruptions upstream or downstream from the new bridge installation. The surrounding land cover classifications have remained as they were and anadromous fish can pass by to spawning grounds, a successful fish passage rehabilitation with stable vegetation.

Thank you, - Tom Massey and Active Intelligence