LiDAR and archaeology: the importance of ground point classification (etc.)

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In most of the Swedish boreal forest, very few ancient remains are known.

Krycklan catchment: remains registered in FMIS, the data base of the Swedish National Heritage Board (RAÄ)

Hunting pits (stone age?)

Tar pits (industrial age?)
In some parts, many ancient remains are known.

Östra Kikkejaur, Arvidsjaur Municipality

The differences are due to the amount of time that has been spent on archaeological surveys.
Field surveys are extremely time consuming and must be selective.

Charcoal kiln
Cairn from land clearing
Stone age graves and settlements
Tar pit
Lill-Skogberget, Sävar parish. Image from FMIS.
Many ancient remains have not been registered. Several unregistered charcoal kilns are visible in the image.
Why is it important to locate ancient remains in the forest?

• Protection: Ancient monuments of a certain age are strictly protected by law. But studies of known remains show that forestry practices causes damages in ca 20% of the cases.

• Science: A more complete picture enables studies of spatial patterns.
LiDAR enables landscape surveys. The data used is usually a DTM.
The DTM (Digital Terrain Model) is prepared from a point cloud.
The point cloud consists of points where laser pulses have been reflected.
However, the point cloud contains little information on the nature of each point.
A classification must be done

- Many different methods
- Different purposes: forest structure, topography, water flows...
- On classification for archaeology: http://lbi-archpro.org/als-filtering/
Lasground_new (LAStools)
Default: only last returns
A number of parameters for further filtering:
• Step – should be as big as the size of the biggest object located on the filtered area. Step = 3 recommended in “wilderness”
• Offset – the distance above the current ground estimate where points get included
• Spike – removes spikes (disturbing needle-shaped formations)

Example of command line:
lasground_new.exe ^
-i tiles_raw\0077.las ^
-o tiles_ground\Kr77moon_step3offset001.las ^
-step 3.0 ^
-offset 0.01 ^
-spike 0.3 ^
Tar pit and hunting pit on clearcut
Classification with lasground_new:
-offset 0.01 -step 3.0 -spike 0.3
Classification with lasground_new:
-offset 0.1 -step 3.0 -spike 0.3
Tar pit in dense vegetation
Classification with lasground_new: 
-offset 0.01  -step 3.0  -spike 0.3
Classification with lasground_new:
- offset 0.1 - step 3.0 - spike 0.3
Less ground points

Tar pit in dense vegetation

More ground points

Tar pit and hunting pit on clearcut
A pit that becomes increasingly difficult to detect, due to vegetation
Classification with lasground_new:
-offset 0.01 -step 3.0 -spike 0.3
Classification with lasground_new:
-offset 0.1 -step 3.0 -spike 0.3
Less ground points  More ground points
Ground point classification is only one of many things to take into account!

- **Scanning season.** The Swedish National Land Survey scans southern Sweden before or after trees have leaves, but northern Sweden during the growing season.

- **DTM interpolation.** Various methods, various parameters...

- **Visualization.** Light/shade is paramount to the detection of anomalies.
The importance of light and shade
Conclusion. When preparing LiDAR data for archaeological purposes, it is important to consider:

• What do we hope to find?

• What is the typical vegetation?

• What parameters can make the things we hope to find show most clearly in this vegetation?
Thank you!

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