LiDAR Applications for Survey and Mapping at the Ancient Maya Center of El Pilar

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Methods 1:
Comparison revealed the LiDAR base mapping visualization was best for identifying features beneath the tropical canopy (Plenge et al., 2015). Potential features in the images were marked with “GoTo” points in ArcMap and their coordinates downloaded to GPS units. In using base-on-the-ground fieldwork, GPS points guided survey teams to pre-identified “GoTo” points. Almost all cultural features were validated, detailed, and refined with waypoints and digitation. These incoming field data were integrated with the master architecture shapefile created by Wing and drawn documentation and digital waypoints to guide the digitization of cultural features. These data were then sent to MesoLab, cleaned, and analyzed further for presentation, survey management, and other related research projects.

Results:
In the 2017 survey, examination of LiDAR visualizations led to the mapping of Kam and the identification of the new monumental groups Amaal and Onix. In total, 60 of the 694 total pre-identified “GoTo” points were identified as cultural features. Of these, 417 were small architectural and 80 were other features. 105 or 28% of the points identified with the LiDAR were excavated. Approximately 56% of the features currently mapped were not identifiable due to their size and were found and mapped during the field survey.

Abstract:
The El Pilar Archaeological Reserve for Meso Flora and Fauna is a large Classic Maya center straddling the borders of Belize and Guatemala. The acquisition of aerial LiDAR Detection and Ranging (LiDAR) data in 2012 allowed for a boom-on-the-ground settlement survey to be efficiently executed within the 20-kilometer radius of the reserve. Fieldwork from 2014-17 surveys (total of 40% of El Pilar’s area) led to the verification and mapping of 7 major centers and 1 large smaller cultural features. Now that 25% of El Pilar’s area has been surveyed and mapped, it can be confidently said that LiDAR is a highly effective tool in identifying and mapping cultural features under the canopy.

Methods 2:
Field experience shows that 80% of the features mapped will return little or no LiDAR signature. Teams without a low-cost portable LiDAR tool to discern any additional features this movement is recorded in GPS track data. After applying this method to the track data, the LiDAR tool is able to methodically target the underground areas of El Pilar. As seen below, this strategy has been a success in mapping features other than the stated architecture.

Take Home Points:
Data collection and analysis is ongoing, but the 2017 season has reinforced lessons learned from previous work at El Pilar:

1) When systematically integrated with traditional survey protocols, LiDAR is a powerful tool for guiding settlement surveys in the Maya Lowlands with underrepresented locations.

2) Several cultural features have little or no visibility in LiDAR imagery. This is exposed with chalmas (underground imaging pits) where only 1% were discovered with the LiDAR, but the difficulty in recognizing the especially large pre features like plazas (2%) and bennies (7%) is problematic. These features reflect varying construction and landscape modification, possibly for water flow control, and must be recorded to understand and assert human-environment interactions.

3) Not all signatures that appear to be cultural features on the LiDAR are what they appear to be. These were numerous signatures of natural features being identified on the LiDAR, e.g. the massive butresses of the Cobal rock. LiDAR is only effective when used with boots on the ground field validation.

References:

Key:

- Unvisited GoTo Point
- Cultural Features (Architecture)
