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

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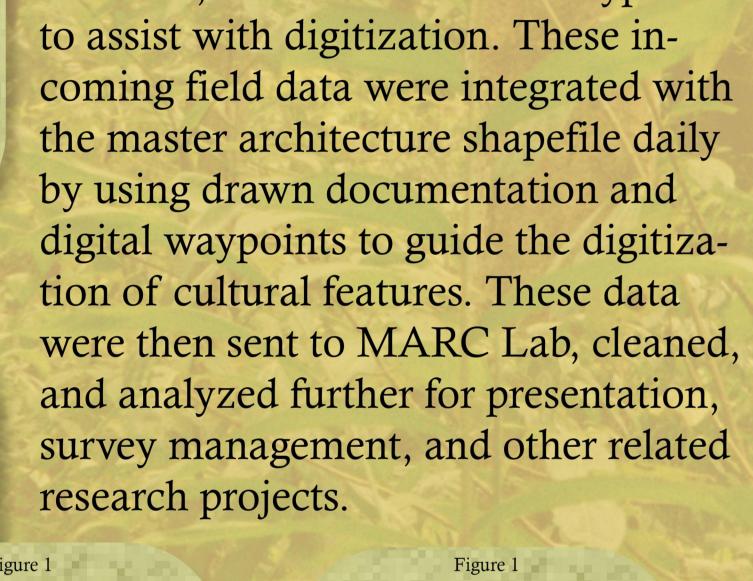
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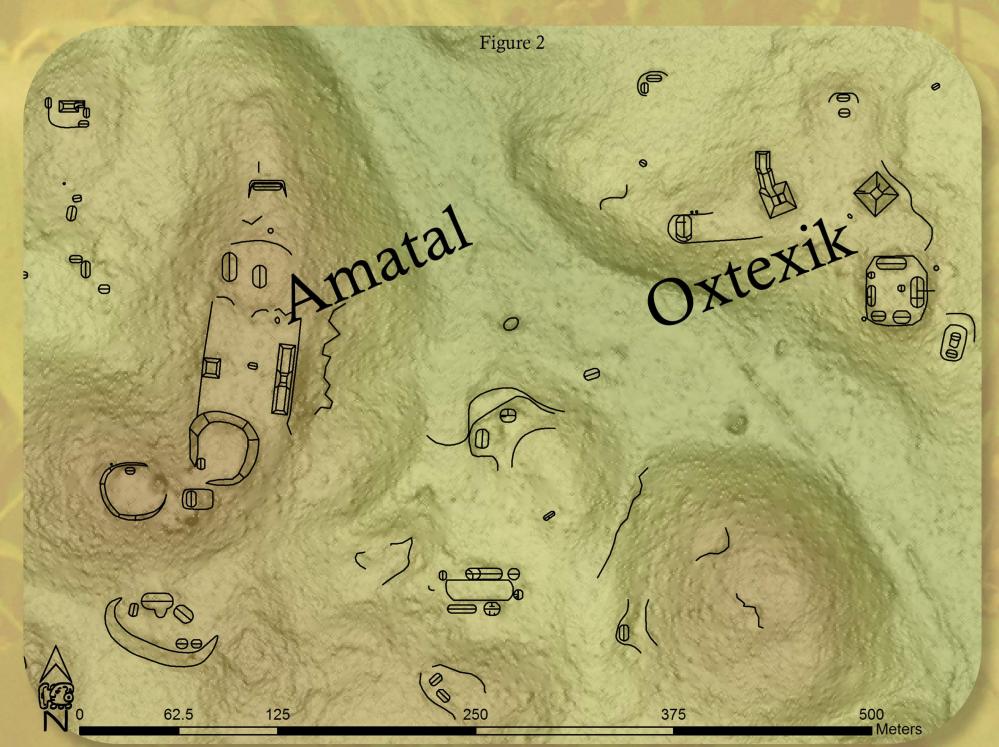
MesoAmerican Research Center

Methods 1:

Comparison revealed the LiDAR bone mapping visualization was best for identifying features beneath the tropical canopy (Pingel et al. 2015). Potential features in the images were marked with "GoTo" points in ArcMap and their coordinates downloaded to GPS units. In using boots-on-the-ground field-work, GPS points guided survey teams to pre-identified GoTo points where cultural features were validated, sketched, and outlined with waypoints to assist with digitization. These in-coming field data were integrated with the master architecture shapefile daily by using drawn documentation and digital waypoints to guide the digitiza-tion of cultural features. These data were then sent to MARC Lab, cleaned, and analyzed further for presentation, survey management, and other related research projects.

Figure 1

Figure 1

Figure 1

Results:

In the 2017 survey, examination of LiDAR visualizations led to the remapping of Kum, and the identification of the new monumental groups Amatal and Oxtexik. In total, 497 of the 690 visited pre-identified GoTo points were identified as cultural features. Of these, 417 were smaller architecture and 80 were other features. 193 or 28% of the points identified with the LiDAR were rejected. Approximately 50% of the features currently mapped were not identifiable due to their size and were found and mapped during the field survey.

Figure 2

Amatal
Oxtexik

Abstract:

The El Pilar Archaeological Reserve for Maya Flora and Fauna is a large Classic Maya center straddling the border of Belize and Guatemala. The acquisition of aerial Light Detection and Ranging (LiDAR) data in 2012 allowed for a boots-on-the-ground settlement survey to be efficiently executed within the 20 km2 of the reserve. Fieldwork from 2014-17 covers 10 km2 or 50% of El Pilar's area and led to the verification and mapping of 7 major centers and ~1,320 smaller cultural features. Now that 50% or 10 Km2 of the study 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.
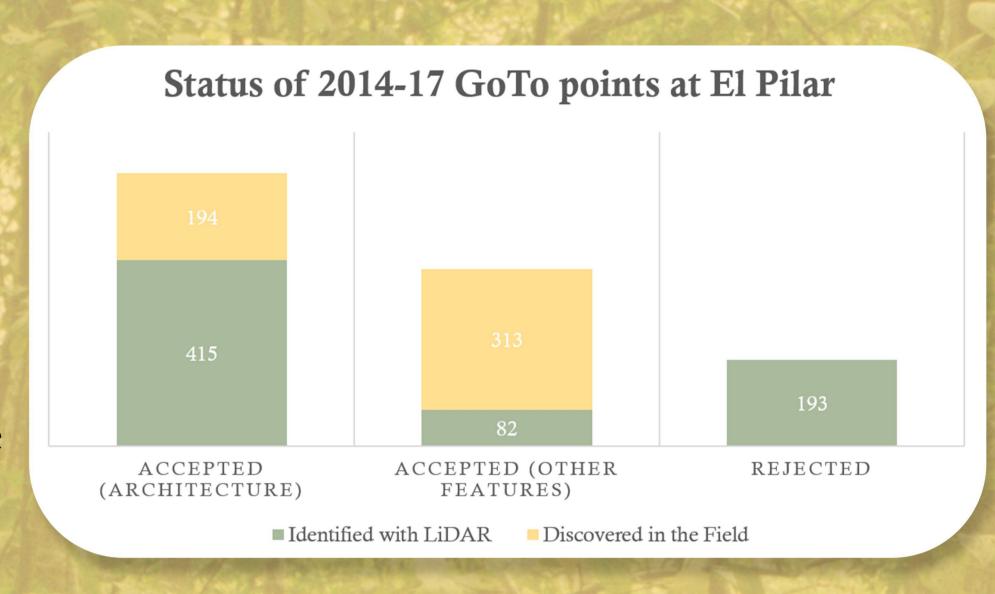
El Pilar

MEXICO · GUATEMALA · BELIZE · HONDURAS · EL SALVADOR

Fig. 1

Fig. 3

Fig. 2

Methods 2:

Field experience shows that around 50% of the features mapped will return little or no LiDAR signature. Teams conduct reconnaissance around GoTo points to discover any additional features; this movement is recorded in GPS track data. After applying 13m buffers to the tracks (the distance that can be seen into the surrounding vegetation) the lab team is able to methodically target the underexplored areas of El Pilar. As seen below, this strategy has been a success in mapping features other than the main architecture.

Status of 2014-17 GoTo points at El Pilar

ACCEPTED (ARCHITECTURE) | ACCEPTED (OTHER FEATURES) | REJECTED

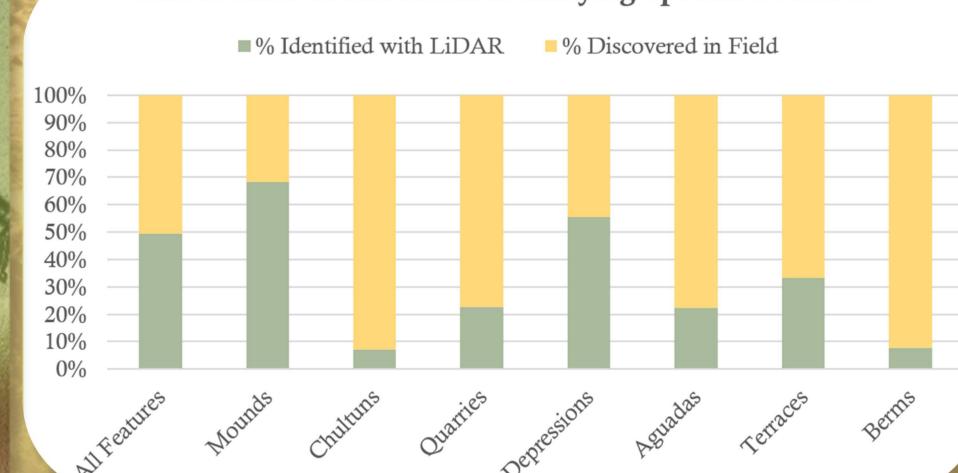■ Identified with LiDAR   ■ Discovered in the Field

Take Home Points:

Data collection and analysis is ongoing, but the 2017 season 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 understood limitations.

2) Several cultural features have little or no visibility in our LiDAR imagery. This is expected with chultuns (underground storage pits) where only 7% were discovered with the LiDAR, but the difficulty in recognizing the expectedly larger other features like quarries (22%) and berms (7%) is problematic. These features reflect resource extraction and landscape modification, possibly for water-flow control, and must be recorded to understand ancient human-environment interactions.

Effectiveness of LiDAR in Identifying Specific Features

■ % Identified with LiDAR   ■ % Discovered in Field

All Features | Mounds | Chultuns | Quarries | Depressions | Aguadas | Terraces | Berms

3) Not all signatures that appear to be cultural features on the LiDAR are what they appear to be. There were numerous instances of natural features being identified on the LiDAR, e.g. the massive buttresses of the Ceiba tree. LiDAR is only effective when used with boots-on-the-ground field validation.

Figure 3

Key:

⬤ - Unvisited GoTo Point

⬡ - Cultural Features (Architecture)

0   0.25 0.5   1   1.5   2
Kilometers

References:

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