Chapter 9
Surveying Ancient Maya Buildings in the Forest

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ABSTRACT
During the last few decades, 3D scanning devices and 3D digital image generating technology has been developed to the point where they significantly reduce errors and time during data collection thus making them highly appropriate tools in the field of archaeology. With regards to surveying, terrestrial laser scanning and digital photogrammetry, they are a viable alternative to traditional methods for measuring. Nevertheless, these technologies are rarely used in projects in the Maya region, even though they offer a wide range of applications, which could be explored and utilised in this subtropical environment. This paper presents the results of digital surveying involving two Maya archaeological sites in Guatemala: La Blanca and Chilonché, as well as demonstrating their effective application for “investigating into the past”.

INTRODUCTION
Urban settlements in the Ancient Maya Lowlands were established in a subtropical rainforest environment where hundreds of archaeological sites are still covered with thick vegetation. These sites include a number of enormous monumental complexes entangled in massive roots of huge trees.

Even in major cities, like the capitals of the powerful Maya kingdoms such as Tikal in the Southern Maya Lowlands (modern-day Petén, Guatemala), which have been explored and investigated ever since the nineteenth century (Vidal & Muñoz, 2012), there are many buildings and other architectural complexes yet to be unearthed due to the complexity of excavating procedures within this heavily forested environment.
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region. This factor explains why it is not always that simple putting together and interpreting the history of these urban centres and their interrelationship.

Generally speaking, Maya archaeologists conduct excavations of large-scale building complexes. The first step is to remove vegetation and structural debris, including the presence of trees often reaching 30m in height. Only then can research work begin on the buildings themselves. Somewhat dangerous at times, this process is labour-intensive and time-consuming, which means that meeting the agreed deadlines is essentially dependent on the technology available.

Traditionally, the techniques employed in recording these excavated monumental complexes include mapping, measured surveying (floor plans, building sections and building elevations) and photography. However, a number of archaeological projects in this field have started experimenting with more sophisticated tools.

BACKGROUND

Over the past two decades, the development and improvement of 3D acquisition through the use of active sensors (in particular those based on laser scanner technology) and more recently the use of passive sensors (Structure from Motion applications) have so far proven to be the best solution for performing rapid surveys of monuments, historical buildings and archaeological remains without actually physically coming into contact with the surfaces.

Pioneering experiments began in the 1990s, including both 3D reconstructions of the archaeological remains (cf. Anfiteatro Flavio 1994–1998) as well as the analysis of architectural façades and the analysis of sculptural complexes (Levoy et al., 2000). Since then, several archaeological sites from around the world have made use of these technologies for different purposes, resulting in a profuse quantity of literature documenting the results of these experiments (Balzani et al., 2004; Lambers et al., 2007; Frischer & Dakouri-Hild, 2008; Reindel & Wagner, 2009; Guidi et al., 2009; Rüther et al., 2009; Benedetti et al., 2010; Stanco et al., 2011; Guidi et al., 2013, 2014).

At Tikal and Chichén Itzá in the Maya region, CyArk developed on-the-ground laser-based scanning (Powell, 2009). Its aim is to produce an open access digital archive of World Heritage sites to be preserved or used for educational purposes. Copan, in Honduras, has also been chosen to test and demonstrate the capabilities of “QueryArch3D”, another tool that enables the web-based visualization of interactive multi-resolution 3D models (Agugiaro et al., 2011; von Schwerin et al. 2013, Auer et al., 2015). However, while both being remarkable propositions, these technologies were not conceived for archaeological analysis nor for other scientific applications during archaeological excavations.

Another pioneering project was developed at Caracol (Belize), using airborne laser scanning technology (lidar). The data revealed the full extent of this archaeological site and demonstrated how it was structured, and how the ancient Maya radically modified their landscape in order to create a sustainable urban environment (Chase et al., 2011). Undoubtedly, this is a very useful tool for the study of Maya landscape and settlement patterns, but the resolution of these aerial lidar images is not sufficient for an accurate study of archaeological buildings and monuments, since this process requires terrestrial data acquisition (Pénard et al., 2005).

Thus, the La Blanca Project (Proyecto La Blanca), which has been conducting archaeological research and promoting cultural heritage in La Blanca and the neighbouring site of Chilonché since 2004, has employed terrestrial laser scanning technology and digital photogrammetry applications with the