Hidden Landscapes of the Past: Uncovering the Ancient World through Lidar

Virtual Summer Lecture Series
June 16 to July 28, 2021

Abstracts and Biographies

June 16 **Takeshi Inomata (University of Arizona)**
Olmec and Maya Ceremonial Landscape Revealed through Lidar

The origins of Maya civilization and its relationship with Olmec civilization have long been debated. We began our research in southeastern Mexico in 2017 to examine these questions. We identified the site of Aguada Fénix, with a rectangular artificial plateau measuring 1,400 m in length and dating to 1,050-750 BC. This is the largest and oldest monumental construction in the Maya area. This find encouraged us to expand our study of similar formal ceremonial complexes by analyzing lidar data. By examining low-resolution lidar obtained by the Mexican government, we covered an area of 85,000 km2, including the Olmec region and the western Maya lowlands. The identifications of many complexes, most of which were not known to archaeologists before our research, transform our understanding of the emergence of Mesoamerican civilizations.

Takeshi Inomata is a professor at the School of Anthropology, University of Arizona. He has been examining social changes in the Maya area. He has directed archaeological projects at Aguateca and Ceibal, Guatemala, and has recently started new investigations in Tabasco, Mexico.

June 23 **Roland Fletcher (University of Sydney)**
The Garden City of Greater Angkor: Insights from Remote Sensing

Angkor, the capital of the Khmer Empire from the 9th for half a millennium, was a vast, low-density, dispersed urban complex covering about 1000 sq km, in which rice fields were intermingled with housing, shrines and water tanks from the outer suburbs, all the way into the west entrance of Angkor Wat. The urban area of Greater Angkor was at the same time, rural – a metropolitan landscape of rice fields. Forest had been removed to create engineered, productive fields. Economic trees and bushes spread across the landscape. Houses were surrounded by productive gardens and sheltered by trees. With the demise of Angkor after the 14th century, the forest re-grew concealing much of that garden city, leaving the great temples and reservoirs partially visible as the markers of its grandeur and wealth. More than a century of archaeological research and the accelerating clearance of the forest in the 20th century began to reveal its canals, roads, shrines, house mounds and water tanks again. In the 21st century, remote sensing using radar and lidar has allowed us to see through vegetation and modern rice fields to reveal the entire urban plan of Greater Angkor, and next to Angkor Wat, a great, unknown structure. We can visualize a city of green - water gleaming in great reservoirs, flowing slowly along long, wide canals and gushing through gaps in the rice field bunds. Thousands of buffalo and cattle moving slowly along roads and ditches. Shrine towers and temples visible above the trees.

Roland Fletcher is Professor of Theoretical and World Archaeology at the University of Sydney. He completed his PhD at Cambridge University in 1975 and has worked at the University of Sydney since 1976. In 1995 he published *The Limits of Settlement Growth* with Cambridge University Press. As a result of the study he initiated an interdisciplinary research program, The Greater Angkor Project, to study the form, operation and demise of Angkor, in an international collaboration with the Cambodian agency, APSARA and the *Ecole francaise d'Extreme Orient***.** He is currently an annual residential fellow at the Danish national Urban Networks Centre.

June 30 **Parker VanValkenburgh (Brown University)**

Lasers Below the Clouds: Mapping Kuelap with Drone-mounted and Terrestrial Lidar

This talk will discuss the results of drone lidar and terrestrial lidar survey at the site of Kuelap, in Amazonas, Peru. Unlike traditional airborne remote sensing, drone lidar produces very high-density measurements at a wide range of scan angles by operating at low altitudes and slow flight speeds. These measurements can resolve near vertical surfaces and novel dimensions of variability in architectural datasets. At Kuelap, drone lidar facilitated detailed characterization of the morphology of standing structures and the recognition of substantial patterns of clustering in building morphology across the site, which may correspond to different construction phases. In turn, terrestrial lidar has enabled us to estimate labor investments in the construction of the site's monumental exterior walls, as well as the implications of these figures for understanding Kuelap's place in the political landscapes in Peru's Chachapoyas region.

Parker VanValkenburgh is an anthropological archaeologist whose research focuses on the history of urbanism, colonialism, environmental change, and Indigenous identity in the Andes. At Brown, he runs the Digital Archaeology Laboratory and teaches courses in Andean Archaeology and Ethnohistory, Geographic Information Systems, Critical Cartography, and Landscape Archaeology. Among other projects, he co-directs the Paisajes Arqueológicos de Chachapoyas project with Carol Rojas Vega and GeoPACHA (the Geospatial Platform for Andean Culture, History and Archaeology), with Steven Wernke. His most recent publication is Alluvium and Empire: The Archaeology of Colonial Resettlement and Indigenous Persistence on Peru's North Coast (University of Arizona Press).

July 7 **José Iriarte (University of Exeter)**
New Light Under the Amazon Forest

In the popular imagination, the Amazon forest is a virgin wilderness nearly empty of people. It has been traditionally conceived as a deceitful Garden of Eden, whose infertile soils and scarce game prevented the development of intensive agriculture leading to complex societies. However, a spate of recent discoveries and technological breakthroughs are overturning these long-held assumptions and creating an entirely new picture of Amazonian human history. Understanding the nature and scale of pre-Columbian human impact and the legacy of past land use is not an easy question to answer. The Amazon is huge, largely unexplored, and has a long history of occupation begging around thirteen thousand years ago. Fortunately, interdisciplinary science and novel approaches are allowing us to reveal the relationship between humans and the rainforest in the past. One new technology that is revolutionizing the archaeology of the rainforests across the Americas is lidar. These 'lasers in the sky' are allowing us to peek through the canopy, revealing new sites. For example, using lidar and remote sensing, we have been able to document that the entire southern rim of the Amazon was populated by complex societies whose population may have reached up to 5 million people. In this presentation, I focus on the findings of our lidar work in the southern rim of the Amazon. More specifically, on two archaeological cultures: the ceremonial landscape of patterned ditched enclosures (so-called 'geoglyphs) and the 'Circular Mound Villages' (so-called 'Suns'). Lidar has allowed us to reveal the complex architectural layout of these sites and expose a regional system of interconnected villages.

Professor Jose Iriarte (University of Exeter, UK) is an archaeologist and archaeobotanist whose research focuses on human-environmental interactions, the development of agricultural economies, and the emergence of complex societies in lowland South and Central America. He has extensive experience in directing and participating in a wide range of international multidisciplinary projects integrating archaeology, archaeobotany, palaeoecology, palaeoclimate, soil science, remote sensing (Lidar), ancient DNA, and modern ecology across Latin America. Notably, the recent work of his research group has chartered unexplored regions of Amazonia documenting earth-building societies along its entire southern rim predicting to have reached 5 million people in pre-Columbian times.

July 14 **Jarrod Burks (Ohio Valley Archaeology)**
Revealing Ohio's Ancient Monuments with LiDAR

It is no exaggeration to say that Ohio is home to some of the largest ancient earthen monuments in the world. These mounds and enclosures were built one basket load at a time by Native Americans some two thousand years ago. They come in a range of shapes and sizes, including circles, squares, super ellipses (bonus points if you already know this shape!), and even massive octagons well over 1000 feet across. Mapping and describing this earthen architecture have been ongoing since the early nineteenth century, and observations of topography feature prominently in most maps. Our efforts to accurately portray these enormous sites took a big leap forward with the introduction of LiDAR (Light Detection and Ranging)—a laser-based mapping technique that has revolutionized archaeological site documentation. In this presentation we explore the utility of LiDAR for imaging Ohio earthwork sites in the context of two hundred years of map making. While LiDAR data are merely topographic data, they allow us to clear away the trees, buildings, and other aboveground features that obscure the hundreds of ancient monuments that punctuate the Middle Ohio Valley landscape. We will also examine cases where LiDAR paired with magnetometry has been able to overcome the flattening effect of generations of agricultural plowing. The amount of earthen mound and embankment building in the region is simply astonishing, and most of it is relatively undocumented. LiDAR represents a fast, accurate technique for continuing the important job of inventorying these ancient monuments.

Dr. Jarrod Burks specializes in locating the unseen archaeological landscape that surrounds us. He works for Ohio Valley Archaeology, Inc., an archaeology firm in Columbus, Ohio; he also is president of Heartland Earthworks Conservancy, an organization that works to study and save Ohio earthworks. Jarrod fell in love with Ohio's earthworks more than 25 years ago when he moved to Columbus to pursue his doctorate in Hopewell settlement research at The Ohio State University. He now spends time each year surveying earthworks, retracing the footsteps of the 19th century mappers and travelers, as well as discovering previously undocumented sites.

July 21 **Luke Morgan (Monash University)/John Garton (Clark University)**
Visualizing Bomarzo: LiDAR and the Interpretation of an Enigmatic Renaissance Landscape

After several centuries of neglect, the enigmatic Sacro Bosco in Bomarzo (c. 1552-85), with its colossal rock-cut sculptures of monstrous figures, was 'rediscovered' by the Italian critic Mario Praz and the Spanish Surrealist artist Salvador Dali. There are now numerous accounts of the Sacro Bosco, ranging from the biographical to the alchemical, but still no consensus about its purpose and meaning. A significant obstacle to our understanding of the Sacro Bosco is the lack of physical and spatial data about the site. For example, it has never been the subject of a systematic scientific survey. This lecture will introduce our project to undertake a digital topographic survey of the landscape of the Sacro Bosco, LiDAR scanning of individual sculptures, and the reconstruction of the waterworks and related infrastructure. The lecture will also consider the implications of new digital technologies of analysis and representation for the interpretation of historical designed landscapes.

Professor Luke Morgan is Director of Art History & Theory in the Faculty of Art, Design & Architecture at Monash University. He is an elected Fellow of the Australian Academy of the Humanities and an Australian Research Council Future Fellow. His publications include the books *Nature as Model: Salomon de Caus and Early Seventeenth-Century Landscape Design* (2006) and *The Monster in the Garden: The Grotesque and the Gigantic in Renaissance Landscape Design* (2016), both published by The University of Pennsylvania Press.

John Garton is Associate Professor in the faculty of Visual and Performing Arts, Clark University, Worcester, Massachusetts. He is the author of *Grace and Grandeur: The Portraiture of Paolo Veronese* (2008) and editor and co-author of *New Studies on Old Masters: Essays in Renaissance Art in Honour of Colin Eisler* (2011). His research on the Sacro Bosco and other sixteenth-century topics has been published in *Studies in the History of Gardens and Designed Landscapes*, *Arte Veneta* and *Renaissance Quarterly*.

July 28 **Marcello A. Canuto (Middle American Research Institute, Tulane University)**
Taking the High Ground: A Model for Lowland Maya Settlement Patterns as seen from La Corona

Settlement research in the Maya lowlands has struggled to reconcile its ambition to model a tropical forest civilization in ecological terms with the logistical constraints imposed by the forest itself. In this presentation, we argue that the methodological challenges facing settlement research in this tropical lowland setting did more than limit how much researchers knew about ancient Maya settlement: they undermined researchers' confidence in the representativeness of their own best data, shunting the discipline toward smaller scales of analysis and away from quantitative macro-scale settlement pattern research. As a result, many basic facts of human geography have remained unsettled. These challenges can now be overcome thanks to advances in remote sensing. Here, we use lidar-derived settlement and topographic data from the Corona-Achiotal region of northwestern Guatemala to develop a settlement suitability model that reveals patterns in the distribution of archaeological remains vis-à-vis landforms. Applying this model to a much larger published settlement dataset, we demonstrate how it is not only widely applicable in the interior Maya Lowlands, but also capable of identifying historical contingencies in the distribution of settlement, namely the crowding of less-suitable areas of the landscape, linked to urban densification.

Marcello A. Canuto is currently Director of the Middle American Research Institute and Professor of Anthropology at Tulane University. He received his BA from Harvard University in 1991 and his PhD from the University of Pennsylvania in 2002. Before coming to Tulane in 2009, he was an Assistant Professor at Yale University. His research interests include settlement archaeology, household and community dynamics, and the definition of identity through material culture. His past research in Honduras investigated the nature of ethnic diversity at Copan. He now co-directs a project in northwest Peten, Guatemala investigating the construction of political community.