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

Summer Lecture Series

June 16 to July 28, 2021

Bibliographic Titles

June 16 **Takeshi Inomata (University of Arizona)**

Olmec and Maya Ceremonial Landscape Revealed through Lidar

Inomata, T., Triadan, D., Vazquez Lopez, V. A., Fernandez-Diaz, J. C., Omori, T., Mendez Bauer, M. B., . . . Nasu, H. (2020). Monumental architecture at Aguada Fenix and the rise of Maya civilization. *Nature (London), 582*(7813), 530-533. DOI: https://doi.org/10.1038/s41586-020-2343-4

[The 2020 article is summarized in this open access piece: McAnany, P. A. (2020). Large-scale early Maya sites in Mexico revealed by lidar mapping technology. *Nature (London), 582*(7813), 490-492. https://www.nature.com/articles/d41586-020-01570-8]

Zorich, Z. (2019, October 8). Online Map Leads Archaeologist to Maya Discovery. *New York Times*. https://www.nytimes.com/2019/10/08/science/archaeology-lidar-maya.html

Inomata, T., Triadan, D., Pinzon, F., & Aoyama, K. (2019). Artificial plateau construction during the Preclassic period at the Maya site of Ceibal, Guatemala. PloS One, 14(8), E0221943. DOI: https://doi.org/10.1371/journal.pone.0221943 [Open Access]

Inomata, T., Triadan, D., Pinzón, F., Burham, M., Ranchos, J. L., Aoyama, K., & Haraguchi, T. (2018). Archaeological application of airborne LiDAR to examine social changes in the Ceibal region of the Maya lowlands. *PloS One, 13*(2), E0191619. DOI: https://doi.org/10.1371/journal.pone.0191619 [Open Access]

Inomata, T., Pinzón, F., Ranchos, J. L., Haraguchi, T., Nasu, H., Fernandez-Diaz, J. C., . . . Yonenobu, H. (2017). Archaeological Application of Airborne LiDAR with Object-Based Vegetation Classification and Visualization Techniques at the Lowland Maya Site of Ceibal, Guatemala. *Remote Sensing (Basel, Switzerland), 9*(6), 563. DOI: https://doi.org/10.3390/rs9060563 [Open Access]

Ceibal-Petexbatun Project site: http://www.ceibal-aguateca.org/

June 23 **Roland Fletcher (University of Sydney)**

The Garden City of Greater Angkor: Insights from Remote Sensing

Jean-Baptiste Chevance, "The Phnom Kulen Capital: A Singular and Early Case of Landscape Constructionin Ancient Cambodia," in *Landscapes of Preindustrial Urbanism,* ed. Georges Farhat (Washington, DC: Dumbarton Oaks, 2020), 173–192.

Roland Fletcher, Damian Evans, Christophe Pottier and Chhay Rachna, C. (2015). Angkor Wat: an introduction. *Antiquity*, 89(348), 1388-1401.

Roland Fletcher, Brendan Buckley, Christophe. Pottier and S.-Y. Wang (2017). The case of Angkor and Monsoon Extremes in Mainland Southeast Asia. In Harvey. Weiss, editor, *Megadrought and Collapse: From early agriculture to Angkor*, 276-313. Oxford University Press, New York,

Damian Evans, "Airborne Laser Scanning as a Method for Exploring Long-Term Socio-Ecological Dynamicsin Cambodia," *Journal of Archaeological Science* 74 (October 2016):164–75, http://dx.doi.org/10.1016/j.jas.2016.05.009.

Sarah Klassen and Alison Carter et al 2021. Diachronic modeling of the population within the medieval Greater Angkor Region settlement complex. *Science Advances.* 07 May 2021:Vol. 7, no. 19, eabf8441 DOI: 10.1126/sciadv.abf8441

June 30 **Parker VanValkenburgh (Brown University)**
Lasers Below the Clouds: Mapping Kuelap with Drone-mounted and Terrestrial Lidar

Journal of Field Archaeology Volume 45, 2020 - Issue sup1: Archaeology in the Age of Big Data edited by P. VanValkenburgh and J. A. Dufton, including:

VanValkenburgh, P., Cushman, K. C, Butters, L. et. al. (2020). Lasers Without Lost Cities: Using Drone Lidar to Capture Architectural Complexity at Kuelap, Amazonas, Peru. *Journal of Field Archaeology*, 45 (Sup1), S75-S88. DOI: https://doi.org/10.1080/00934690.2020.1713287 [Open Access]

VanValkenburgh, P. & Dufton, J. A. (2020). Big Archaeology: Horizons and Blindspots. *Journal of Field Archaeology*, vol. 45 (Sup1), pp. S1-S7.
DOI: https://doi.org/10.1080/00934690.2020.1714307 [Open Access]

Zimmerman, P & Webster, C. (2020, July 23). Archaeology and Big Data with Parker VanValkenburgh and Andy Dufton [podcast]. https://www.archaeologypodcastnetwork.com/archaeotech/133

Additional background on Kuélap site: Toyne, J. M., and A. Narváez. 2014. "The Fall of Kuélap: Bioarchaeological Analysis of Death and Destruction on the Eastern Slopes of the Andes." In *Embattled Bodies, Embattled Places*, edited by A. K. Scherer and J. Verano, 341–364. Washington D.C.: Dumbarton Oaks Research Library and Collection.

GeoPACHA: Geospatial Platform for Andean Culture, History, and Archaeology [available only to credentialed researchers]. https://geopacha.org/

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

Iriarte, J., Robinson, M., de Souza, J., Damasceno, A., da Silva, F., Nakahara, F., Ranzi, A. and Aragao, L. (2020). Geometry by Design: Contribution of Lidar to the Understanding of Settlement Patterns of the Mound Villages in SW Amazonia. *Journal of Computer Applications in Archaeology*, 3(1), pp.151–169. DOI: http://doi.org/10.5334/jcaa.45 [Open Access]

de Souza, J.G., Schaan, D.P., Robinson, M. et al. (2018). Pre-Columbian earth-builders settled along the entire southern rim of the Amazon. *Nat Commun* 9, 1125. DOI: https://doi.org/10.1038/s41467-018-03510-7 [Open Access]

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Khan, S, Aragão, L and Iriarte, J. (2017). A UAV–lidar system to map Amazonian rainforest and its ancient landscape transformations. *International Journal of Remote Sensing*, 38(8–10): 2313–2330. DOI: https://doi.org/10.1080/01431161.2017.1295486

July 14 **Jarrod Burks (Ohio Valley Archaeology, Inc.)**

Bathed in Light: Revealing Ohio's Ancient Monuments with LiDAR

Burks, Jarrod (2014). Geophysical Survey at Ohio Earthworks: Updating Nineteenth Century Maps and Filling the "Empty" Spaces. *Archaeological Prospection* 21:5-13.

Burks, Jarrod, edited by D. C. Cowley, R. A. Standring, and M. J. Abicht, (2010). Recording Earthworks in Ohio-Historic Aerial Photography, Old Maps and Magnetic Survey. In *Landscapes through the Lens: Aerial Photographs and the Historic Environment*, edited by pp. 77-87. Oxbow Books, Oxford.

Burks, Jarrod, and Robert A. Cook (2011). Beyond Squier and Davis: Rediscovering Ohio's Earthworks Using Geophysical Remote Sensing. *American Antiquity* 76(4):667-689.

Davis, Jamie, and Jarrod Burks (2019). Indiana Earthwork Sites: New Insights from LiDAR DEMs and Aerial Photographs. In *Encountering Hopewell in the Twenty-first Century, Ohio and Beyond,* edited by Brian G. Redmond, Bret J. Ruby, and Jarrod Burks, pp. 1-25. University of Akron Press, Akron, Ohio.

Davis, Jamie L., Jarrod Burks, and Elliot M. Abrams (2019). Labor Recruitment among Tribal Societies: An Architectural Energetic Analysis of Serpent Mound, Ohio. In *Architectural Energetics in Archaeology: Analytical Expansions and Global Explorations*, edited by Leah McCurdy and Elliot M. Abrams, pp. 138-160. Routledge, New York.

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Romain, William F., and Jarrod Burks (2008b) LiDAR Assessment of the Newark Earthworks. Current Research in Ohio Archaeology 2008, http://www.ohioarchaeology.org, accessed March 25, 2008.

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Redmond, B., Ruby, B., & Burks, J. (2019). Encountering Hopewell in the twenty-first century, Ohio and beyond (First ed., Ohio history and culture). Akron, Ohio: The University of Akron Press.

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Henry, ER, Shields, CR and Kidder, TR. 2019. Mapping the Adena-Hopewell Landscape in the Middle OhioValley, USA: Multi-Scalar Approaches to LiDAR-Derived Imagery from Central Kentucky. *Journal of Archaeological Method and Theory*, 26(4): 1513–1555.
DOI: https://doi.org/10.1007/s10816-019-09420-2

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

Jesús García Sánchez, "Archaeological LiDAR in Italy: enhancing research with publicly accessible data," *Antiquity,* vol. 92, issue 364 (August 2018); DOI: https://doi.org/10.15184/aqy.2018.147

Stephen Wass, "Parco di Monstri, Bomarzo: Some preliminary observations on the use of water," *Garden History,* vol. 45, no. 1 (summer 2017), 3–20.

July 28 **Marcello Canuto (Tulane University)**
Taking the High Ground: A Model for Lowland Maya Settlement Patterns as seen through LiDAR

Canuto, MA, Estrada-Belli, F, Garrison, TG, Houston, SD, Acuña, M, Kováč, M, Marken, D, Nondédéo, P, Auld-Thomas, L, Castanet, C, Chatelain, D, Chiriboga, CR, Drápela, T, Lieskovský, T, Tokovinine, A, Velasquez, A, Fernández-Díaz, JC, and Shrestha, R. (2018). Ancient lowland Maya complexity as revealed by airborne laser scanning of northern Guatemala. *Science*, 361(6409): eaau0137. DOI: https://doi.org/10.1126/science.aau0137 [Open Access]

Cascone, S. (2019, August 8). How Lasers are Utterly Transforming Our Understanding of the Ancient Maya, Bringing Their Whole Civilization Back to Light. *ArtNet.* https://news.artnet.com/art-world/technology-transforming-mayan-archaeology-1558456

Clynes, T. (2018, February 1). Exclusive: Laser Scans Reveal Maya "Megapolis" Below Guatemalan Jungle. *National Geographic.* https://www.nationalgeographic.com/history/article/maya-laser-lidar-guatemala-pacunam

Fundación Patrimonio Cultural y Natural Maya: https://pacunam.org/

Related (Uses PACUNAM dataset for a machine learning experiment): Bundzel, Marek, Jascur, Miroslav, Kovac, Milan, Lieskovsky, Tibor, Sincak, Peter, & Tkacik, Tomas. (2020). Semantic Segmentation of Airborne LiDAR Data in Maya Archaeology. *Remote Sensing (Basel, Switzerland), 12*(22), 3685. DOI: https://doi.org/10.3390/rs12223685 [Open Access]

General:

Chase, AF, Chase, DZ, Fisher, CT, Leisz, SJ and Weishampel, JF. 2012. Geospatial revolution and remote sensing LiDAR in Mesoamerican archaeology. *Proceedings of the National Academy of Sciences*, 109(32): 12916–12921. DOI: https://doi.org/10.1073/pnas.1205198109 [Open Access]

Golden, C., T. Murtha, B. Cook, D. S. Shaffer, W. Schroder, E. J. Hermitt, O. Alcover Firpi, and A. K. Scherer. 2016. "Reanalyzing Environmental Lidar Data for Archaeology: Mesoamerican Applications and Implications." *Journal of Archaeological Science: Reports* 9: 293–308. DOI: 10.1016/j.jasrep.2016.07.029

Christoph Siart, Markus Forbriger, and Olaf Bubenzer, eds., *Digital Geoarchaeology: New Techniques for Interdisciplinary Human-Environmental Research* (New York: Springer, 2018)

Georges Farhat, "Bridging Remote Sensing and Worldviews: Urban Landscapes from a Preindustrial Perspective," in *Landscapes of Preindustrial Urbanism,* ed. Georges Farhat (Washington, DC: Dumbarton Oaks, 2020), 1–36

Arlen F. Chase, Diane Z. Chase, and John F. Weishampel, "The Use of LiDAR at the Maya Site of Caracol, Belize," in *Mapping Archaeological Landscapes from Space,* ed. Douglas C. Comer and Michael J. Harrower (New York: Springer, 2013), 187–98

Timothy R. Pauketat, "What Constituted Cahokian Urbanism?" in *Landscapes of Preindustrial Urbanism,* ed. Georges Farhat (Washington, DC: Dumbarton Oaks, 2020), 89–111

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