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The Utility and Potential of Remote Sensing for Preservation of Archaeological Earthwork Sites in the Brazilian State of Acre, SW Amazonia

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Abbreviations: LiDAR: Light Detection and Range; SfM: Structure from Motion; IPHAN: National Historic and Artistic Heritage Institute; EMBRAPA: Brazilian Agricultural Research Corporation

Remote sensing forms a fundamental part of archaeological fieldwork today, and is extremely useful not only in the discovery and research, but also in the preservation of archaeological sites. Use of satellite imagery is a common procedure in large-scale archaeological surveys everywhere and low-altitude photography is widely utilized at the scale of excavations [1]. Many remote sensing techniques, such as LiDAR (Light Detection and Range) and different geophysical measurements, still require expensive technologies and/or specialized user supervision. However, low-cost applications and options for data processing which can be free to use are increasingly available. Benefits of low altitude aerial photography with UAVs (drones) and SfM (Structure from Motion) photogrammetry for creating three-dimensional models, provide relatively easy, low-cost, and quick acquisition of data, and enable non-invasive documenting and monitoring of potentially delicate archaeological features [2].

During recent years, archaeologists have found evidence of hundreds of pre-colonial ditched geometric earthworks, labeled the Geoglyphs of Acre, as well as circular village sites dispersed on the interfluvial plateaus of the Purus and Madeira river tributaries in eastern Acre state in southwestern Amazonia [3]. These diverse earthwork complexes are still clearly visible in the contemporary landscape, even centuries after their abandonment. The Acre Geoglyphs consist of continuous ditches ofdifferent geometric shapes and varying sizes, in associationwith exterior embankments. These enclosed spaces, built predominantly for ceremonial purposes, range between 1 and 15 hectares, and some of the ditches are still several meters deep. The circular villages are interconnected by a regional road network and feature artificial earthen mounds arranged around a circular open area with several straight road structures radially entering the circle.

How, then, could remote sensing be applied to the preservation of these archaeological earthwork sites in the Brazilian state of Acre? Given that around 50 percent of the lowland rainforest in eastern Acre is logged and most of the earthworks are found in the deforested areas used for cattle ranching or agriculture, different remote sensing techniques are very useful for archaeological surveys and site monitoring. Actually, since the 90's most earthwork sites in Acre have been identified by aerial photographs and satellite imagery. New sites are constantly being discovered as satellite coverage of the region improves and the size of deforested areas increases. However, only the LiDAR application will adequately resolve the question of the total number and attributes of the region´s archaeological earthworks. The disadvantage of the LiDAR use is that data collection is extremely expensive and a national LiDAR dataset is non-existent in Brazil so far. Therefore, SfM photogrammetry offers the best possibility of obtaining fast, accurate, and low-cost 3D data, at least at the deforested areas.

Increasing economic and political interests in the Amazonian rainforest are causing irreversible changes and even destruction, not solely in the natural

environment but also in the social and cultural spheres. In the worst case, certain cultural phenomena may disappear completely in the not-so-distant future. The most serious threats faced by the earthwork sites are related to logging, agriculture, cattle grazing, and the construction of infrastructure. These wide-ranging mechanized land-use activities not only directly destroy archaeological sites and features but they also often accelerate soil erosion, which in turn will hastily fill up and flatten the earthworks (Figure 1). In some unfortunate cases also the landowners deliberately destroy the earthworks by bulldozing them because they are misinformed and think that discovery of archaeological sites automatically means strict restrictions on private land-use and decrease of property value. This has become more common after the Geoglyphs of Acre were included in the UNESCO World Heritage Tentative List in 2015 and 85 earthwork sites were declared subjects of a national preservation order by IPHAN(National Historic and Artistic Heritage Institute)[4].

To avoid direct intentional destruction of archeological earthworks and to decelerate soil erosion process at the sites would require consistent monitoring through varied remote sensing techniques together with dissemination of correct information and education of local stakeholders in general. This would not require extensive investments since low-cost easy-to-use remote sensing applications suitable for cultural heritage management are nowadays easily available. Also strengthening the collaboration between local authorities would make a big difference for the preservation of archaeological sites. For example, the EMBRAPA (Brazilian Agricultural Research Corporation) of Acre launched a project in 2010 to collect LiDAR data to improve the management and monitoring of the region's forest resources [5]. This kind of intrastate data would be valuable also for the protection of earthwork sites, because eventually only the genuine dedication of the responsible national authorities can ensure the preservation of the unique archaeological heritage in Acre.

Figure1: Aerial remote sensing is a useful method to monitor the degradation of archaeological sites, as well as other changes in the landscape. As an example are the images of the Fazenda Colorada site, photographed first in 2002 and again 9 years later, in 2011. The processes of earthwork decay and erosion are clearly visible.

References

1. Herrmann J, Glissmann B, Sconzo P, Pfälzner P (2018) Unmanned Aerial Vehicle (UAV) Survey with Commercial-Grade Instruments: A Case Study from the Eastern Habur Archaeological Survey. Iraq Journal of Field Archaeology 43(4): 269-283.

2. Nikolakopoulos K, Soura K, Koukouvelas I, Argyropoulos N (2017) UAV vs classical aerial photogrammetry for archaeological studies. Journal of Archaeological Science: Reports 14: 758-773.

3. Sanna S, Pärssinen M, Denise S (2018) Diversity of Pre-colonial Earthworks in the Brazilian state of Acre. Journal of Field Archaeology 43(5): 362–379.

4. UNESCO (2018) World Heritage Centre: Geoglyphs of Acre.

5. Oliveira M (2014) Projetos: Uso do Lidar como ferramenta para monitoramento de florestas nativas na Amazônia: caracterização da biomassa florestal e dos impactos produzidos pelo manejo florestal na Floresta Estadual do Antimary no Estado do Acre. Embrapa Acre.