The current issue and full text archive of this journal is available on Emerald Insight at: https://www.emerald.com/insight/2044-1266.htm

Capacity building for the documentation and conservation of Latin American cultural heritage: making technology accessible and sustainable

Miquel Reina Ortiz Carleton Immersive Media Studio, Carleton University, Ottawa, Canada Mario Santana Quintero Carleton Immersive Media Studio, Carleton University, Ottawa, Canada and Raymond Lemaire International Centre of Conservation, Katholieke Universiteit Leuven – Campus Arenberg, Heverlee, Belgium Clemencia Vernaza Universidad Externado, Bogota, Colombia Patricia Ramírez and Fernando Montejo Gaitán Instituto Colombiano de Antropología e Historia (ICANH), Bogota, Colombia, and Juana Segura Escobar

Universidad Externado, Bogota, Colombia

Abstract

Purpose – The purpose of this contribution is to demonstrate the importance of interdisciplinary collaboration in integrating advanced and emerging digital techniques in the appropriate and sustainable documentation of heritage sites in Latin America. Existing collaboration between the Universidad del Externado de Colombia, the Colombian Institute of Anthropology and History and the Carleton Immersive Media Studio of Carleton University in Ottawa (Canada) have been sued to demonstrate the importance of this approach. The described collaboration allowed a team of students, researchers, government experts and educators to document selected pilot areas of the remarkable UNESCO World Heritage Sites of National Archeological Park of Tierradentro (UNESCO, 1995) and San Agustín Archaeological Park (UNESCO, 1995). The sophisticated digital recording techniques described, such as 3D scanning, aerial and ground photogrammetry techniques, were used to capture the site's current physical condition, emphasizing the pressing need to conserve the threatened mural paintings (Tierradentro) and carved rock phases (San Agustin). This contribution also underlines the importance of developing the training of emerging professionals from Colombia in adopting these techniques to make their documentation more accurate, reliable and sustainable in the long term. The project's conclusions demonstrate that it is crucial to integrate emerging documentation techniques into the sustainable approach to conservation of these two important UNESCO World Heritage Sites.

Design/methodology/approach – The approach presented in this contribution makes technology more accessible to the conservation specialist in Latin America. It provides a comprehensive capacity building program that involves teaching about theory and practice, using two important UNESCO World Heritage Sites

The authors would like to thank the Site Custodians of the National Archaeological Park of Tierradentro and San Agustín Archaeological Park for providing logistic support to this important project.

Also, to Maria Alvarez Echeverry and Catalina Bateman Vargs of the Programa de Conservación y Restauración de Patrimonio Cultural Mueble, Facultad de Estudios del Patrimonio Cultural at the Universidad Externado for the support provided to conduct the work that are the basis of this paper.

Further, the authors thank other colleagues from the Instituto Colombiano de Antropología e Historia (ICANH) and Carleton Immersive Media Studio (CIMS) who provided support and useful information for this contribution.

Received 15 May 2020 Revised 8 February 2021 Accepted 9 February 2021



Journal of Cultural Heritage Management and Sustainable Development Vol. 11 No. 2, 2021 pp. 155-169 © Emerald Publishing Limited 2044-1266 DOI 10.1108/CHMSD.65-2020.0076

155

Latin American

> cultural heritage

located in Colombia. It is also relevant to the interdisciplinary and institutional collaboration between two universities in the North/South areas of the continent and a government institution that effectively collaborates to provide training to emerging professionals.

Findings – The contribution summarizes the opportunities and limitations of adopting technology to make the documentation process for conservation more sustainable in low-income economies and provides a framework to implement future strategies in South America.

Originality/value – The paper raises a discussion on how the concept of sustainability of adopting new technologies in the context of Latin American countries can assist in optimizing the conservation of decorated surfaces in important UNESCO World Heritage Sites by involving capacity building of emerging professionals. **Keywords** Sustainability Heritage Conservation, Documentation, Colombia, Wall paintings, Decorated

surfaces, UNESCO World Heritage, Recording, Cultural heritage, Best practice, Digital workflows Paper type Research paper

Introduction

This contribution aims to demonstrate the potential of cooperating in the integration of digital documentation techniques in the framework of the conservation of Latin American cultural heritage, making these technologies more sustainable for the region.

The contribution provides two case studies of UNESCO Cultural Heritage Places located in Colombia:

- (1) Recording hypogea's mural paintings at the National Archeological Park of Tierradentro and
- (2) Recording the as-found condition of the carved rock phase of the Lavapatas Fountain at the San Agustín Archaeological Park.

The case studies were developed in the framework of the Program for the Conservation and Restoration of Movable Heritage from the University of Externado (Colombia), the Colombian Institute of Anthropology and History (ICANH) and the Carleton Immersive Media Studio (CIMS) at Carleton University (Canada).

The documentation of the physical appearance of heritage places is the basis and cornerstone in the "decision making" for preventive maintenance, monitoring and conservation. The information captured using these digital records and reports contributes to the parameters and elements that owners, site administrators, public officials and conservation specialists can use to decide the best therapies and management of such historically significant sites.

Likewise, the application of a rigorous survey of heritage information can serve a broader purpose. For example, over time, it becomes the primary means by which scientists and the public can consult about a site since the archives' production has changed negatively or disappeared.

In this training initiative, participants have developed skills in digital and visual information in the conservation documentation, with a view to the national and international standards for this type of work.

In practice, they have also evaluated the positive points and limitations of digital surveying techniques when analyzing historical sites.

Furthermore, participants were able to understand the relationship between documentation and its relationship with making appropriate decisions for conservation, including the following aspects:

- (1) Develop an understanding of the role of information in conservation, addressing national and international standards;
- (2) Review the potential limitations of recording and documentation techniques, including simple and advanced tools and financial constraints.

156

(3)	Develop a practical approach using these tools and documentation techniques to
	capture information from cultural heritage resources;
(4)	Include the use of information systems in cultural heritage resources management;

(5) Design reports for presenting information to stakeholders and decision-makers;

Background

A cornerstone of the management and conservation of important heritage sites is recording the physical characteristics. As stated by Demas, when discussing Archeological Site Management, documenting and describing the site is an essential step that allows for delineating the site's components and collecting and synthesizing information and documentation (Demas, 2012).

The information produced by such work assists in the decision-making process for custodians, site managers, public officials, professionals and conservators. Rigorous documentation may also serve a broader purpose: over time, it becomes the primary archival and monitoring records. Both scholars and the public use these records to interpret the site, and they can serve as a posterity record in the event of a catastrophic or gradual loss of the heritage asset.

Furthermore, cultural heritage is a unique and irreplaceable source of information. The process of acquiring heritage information serves to identify heritage places with significance at the local, national and/or international community.

Relevant publications and guidelines developed by the Getty Conservation Institute, the International Council of Monuments (ICOMOS), UNESCO, Historic England, Canada's Standards and Guidelines for the Conservation of Historic Places, Archaeology Data Service Digital Antiquity Guides to Good Practice and the US Park's Historic American Documentation Program have been used to develop the training approach.

In particular, for the project described here and dealing with decorated historic surfaces, the ICOMOS Principles for the Preservation and Conservation/Restoration of Wall Paintings (ICOMOS, 2003) are highly relevant. Article 2 (investigation) underlays the importance of conducting investigations that "find out as much as possible about the fabric of the structure and its superimposed layers with their historical, aesthetic and technical dimensions. This should encompass all material and incorporeal values of the painting, including historic alterations, additions and restorations. This calls for an interdisciplinary approach".

Furthermore, article 3 (Documentation), based on the Charter of Venice approach, explains that "the conservation-restoration of wall paintings must be accompanied by a precise program of documentation in the form of an analytical and critical report, illustrated with drawings, copies, photographs, mapping, etc."

In terms of the need for capacity building in emerging economies, such as Colombia, UNESCO's Recommendation concerning Education for International Understanding, Co-operation and Peace and Education relating to Human Rights and Fundamental Freedoms (UNESCO, 1974) already identifies in its VI.28 paragraph describes that "In order to develop the study and practice of international co-operation, post-secondary educational establishments should systematically take advantage of the forms of international action inherent in their roles, such as visits from foreign professors and students and professional co-operation between professors and research teams in different countries," this has been a driving principle in developing strategy of this project.

Also, the Sustainable Development Goal (SDG) 4 on education addresses the need to "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all," and in particular 4.7 explains that "appreciation of cultural diversity and culture's contribution to sustainable development." (UN, 2017), both issues are addressed in this project.

157

Latin American cultural heritage

Colombia's UNESCO World Heritage

The Tierradentro Archaeological Park is located in San Andrés de Pisimbalá in the municipality of Inzá. Cauca-Colombia, at a north latitude of 2° 35' and a longitude of 76° 02' west of Greenwich.

The archaeological park consists of collective underground tombs, commonly named hypogea (Plate 1), which seem to reproduce the interior of a house. These constructions are vestiges and unique works in the world; for this reason, the park was included on the World Heritage Site in 1995 by UNESCO under criteria III (UNESCO, 1995a).

Archaeological research in Tierradentro indicates that dispersed agricultural populations initially inhabited this region during the period known as Formative (1000 B.C.–1A.D). These populations shared similarities in pottery, goldsmithing and rock sculptures with San Agustín in Huila. Later during the Classic Regional period (A.D. 1–900 A.D.), human groups increased (Plate 2), integrating residential sites that extend over a vast region, particularly in the Alto de Segovia and the San Andrés Valley, where the hypogea of the archaeological park are found. At the end of this period and the beginning of the Recent period (900 AD–1530 AD), the hypogea were built, an exclusive feature in a broad region in the south of the country. In this period, the population grew, statuary carving was abandoned, and the distribution of settlements increased with people living in a vast region and occupying more new sites. Agricultural practices and burial patterns indicate that these are hierarchical populations known as chiefdom (Langebaek Rueda and Dever, 2009).





Plate 1. 360 panoramic image inside a hypogea (Tierradentro Archaeological Park)

Plate 2. View of the Alto de Segovia component of the property (Tierradentro Archaeological Park) The hypogea were made on the tops of the mountains previously flattened and carved in the rocky mantle made up of volcanic tuffs. The tombs range from 2.50 to 6 m deep, and the most elaborate ones have two central columns, seven niches and polychrome decoration in red, black and white. The hypogea have decorative reliefs of human faces on central columns and pilasters, false beams on the ceiling of the chamber, lintels on the chamber's door frame, and niches or pilasters with horizontal borders. The walls have polychrome decoration with geometric designs, and in some cases, human and animal representations.

They are grouped into four sites: Alto del Aguacate, Alto de San Andrés, Loma de Segovia and Alto del Duende. Carbon analysis shows that the hypogea were used between 1000 BC and 900 AD. C. The exhumed bones of their dead were deposited in ceramic urns.

The climatological and lithological characteristics of the area, together with the stone's porosity, allow the free circulation of water and the presence of moisture leaks. These conditions cause deterioration of the support, such as cracks, fissures, pulverulence and exfoliation, lack of adherence of the plaster and the presence of saline efflorescence and biocolonization.

The deteriorations observed inside the hypogea are of various types. Some of them compromise its structural stability and therefore have to do with the characteristics of the rock in which the hypogeum was carved and how forces work in the current structure. These deteriorations consist of gaps, detachment and fragmentation of the stone support, and cracks, fractures and fissures that occur in the support and wall painting. It is important to note that cracks and fissures favor the conditions for runoff water to leak in rainy seasons, causing a significant zonal deterioration on the polychrome decoration and putting at risk with its mechanical action the values of the hypogea.

For this reason, ICANH, the governmental entity in charge of the conservation of the site, has centralized the research in the hypogea of Alto de Segovia. From 2017 and during 2018 and 2019, the ICANH, together with teachers from the Externado de Colombia University (Faculty of Cultural Heritage studies), the National University – (Faculty of Geology) and Mexican (INAH, from Mexico) and Canadian (Carleton University) specialists have advanced in the study of its geological characteristics, and the techniques and methodology for its conservation and documentation.

Furthermore, *The San Agustín Archaeological Park* (UNESCO, 1995b) is located in the department of Huila, in the municipality of San Agustín and covers an area of 116 ha.

The main archaeological sites found in the park are located in the site called Mesitas that contain artificial mounds, embankments and funeral constructions; the Fuente de Lavapatas (Plate 3), a monument carved from the stone bed of a creek; the Alto de Lavapatas, an area



Plate 3. Lavapatas Fountain (San Agustín Archaeological Park)

Latin American cultural heritage

with funeral constructions and the Forest of Statues, where different expressions of stone statuary from all over the region were located.

The San Agustín Archaeological Complex has originality in the construction techniques of the tombs, mounds and embankments, as well as versatility in the same context where expressions such as sculpture, petroglyph, painting and carving are combined. These values allow it to be included on the World Heritage List by UNESCO in 1995 under criteria III.

One of the sites that have had the most research within the San Agustin Archaeological Park is the Lavapatas Fountain, considered one of the most significant areas of recognition by inhabitants and visitors. It is an archaeological site that allows identifying the immense knowledge that the Upper Magdalena societies had in rock carving and sculpture. The circulation of water through the Fountain's channels gives higher volume to the sculptures and emphasizes the relationship between stone and water.

These characteristics allow us to state that it is a unique site, and although similar engravings are found in the rest of the region, the complexity of the design, as in the case of frogs, is not found anywhere else in the region or the country.

The main threats affecting the integrity of this statuary, funerary structures and especially the Fuente del Lavapatas are those caused by strong winds, which cause erosion.

Also, increasing rainfall rates throughout the year due to climate change creates instability of the terrain and erosion that endangers the archaeological assets of the site.

The collaboration described in this project has allowed producing an accurate record of the current state of conservation. Furthermore, the advances in research developed in recent years have allowed us to identify the methodology to be implemented in matters of documentation and intervention to mitigate the main alteration factors that put at risk the cultural values of these archaeological remains and their preservation for future generations.

A joint collaboration for documentation

The two archaeological sites described in this project have not been thoroughly studied, currently, they are the primary source of information about the culture or group of people who carved the hypogea of Tierradentro; sculptures and a particular fountain carved directly onto the tuff in San Agustín. Therefore, it was of extreme importance to conduct rigorous documentation of both sites: first, for monitoring the condition of the Lavapatas in order to understand the effect of water running through it and its possible deterioration and need – or not – of a consolidant; and second, for understanding the technology and condition of the hypogea in order to propose a conservation intervention.

The documentation needed to follow standards organized in protocols to guarantee repeatability, quantification and accuracy for achieving this. Students could participate in all these processes of capturing data, processing, organizing and archiving as part of the survey. All this information was used as base maps by the students in second fieldwork to the site of Tierradentro to record original features of the hypogea and their condition based on visual glossaries, which were discussed among them under the guidance of the teachers.

The archaeological sites' documentation was a joint endeavor between CIMS, the ICANH, and teachers and students of the program for the Conservation and Restoration of Movable Heritage from the University of Externado de Colombia.

CIMS's expertise in documentation – mostly related to documenting archaeological sites, decorated surfaces and training postgraduate degrees – together with the specific knowledge of the two local institutions in history, management and wall painting conservation, allowed to form a well-prepared interdisciplinary team to develop the documentation activity. Apart from documenting both Colombian Archaeological Parks of Tierradentro y San Agustín, this process trained local professionals and students to use different documentation techniques as part of the Conservation of Wall Paintings Workshop of the undergraduate program on Conservation of Cultural Heritage offered by the Universidad Externado de Colombia.

160



Latin American cultural heritage

161

Plate 4. Processing the collected information about the hypogea (Tierradentro Archaeological Park)

Recording approach and techniques

The recording of the two sites involved the use of digital photogrammetry, topographic surveying, terrestrial laser scanning and reflectance transformation imaging (RTI) were taught in workshops and documentation projects to the local professionals. This project took place between April and May 2019. CIMS organized a workshop about the digital documentation of the built heritage and to document these two UNESCO World Heritage Sites.

The workshop, led by Mario Santana Quintero and Miquel Reina Ortiz, was attended by a group of interdisciplinary Colombian professionals (Plate 4). The main goal of the collaboration was to teach different digital recording techniques applied explicitly to wall paintings and carved elements and document both sites. To that end, the course started with a diagram – that includes all the suitable surveying methods considering object size and object complexity – to present comprehensive documentation approach of decorated surfaces approach (Figure 1).

After a two-day theory workshop in Bogotá, Colombia, the group traveled to the municipality of Inzá at the Southwest of Colombia in the Andean's central cordillera, to document the National Archaeological Park of Tierradentro – known for its monumental shaft and chamber tombs – the hypogea. The hypogea are underground burial spaces that served the elite groups from 600 to 900 AD. Excavated usually 5–8 m below the surface, they split into a network of various chambers.



Figure 1. Suitable surveying methods considering object size and object complexity (Boehler and Heinz, 1999) adapted by the author for decorated surfaces documentation

162

This project's goal was to teach different digital recording techniques by documenting four identified spaces of the World Heritage Site. Participants of the workshop learned how to document the hypogea's decorated surfaces – painted and carved with geometric, anthropomorphic and zoomorphic patterns. Participants practiced surveying with a total station, laser scanning, digital photography, condition assessment photography, terrestrial and aerial photogrammetry, and RTI.

The survey was performed using a Reflectorless Electronic Distance Measurement Total Station Leica Geosystems model Viva TS11 to generate a survey network that orient, scale and connect the different generated datasets: 3D laser scanning, aerial and terrestrial photogrammetry. In both historical sites, a set of interior and exterior ground control points was measured. In the interior of the hypogea, different natural features were used as control points to protect the wall painting and to avoid direct contact with the surface (Plate 5).

The 3D Laser Scanning was executed using a highly portable high-resolution phasecomparison scanner Faro Focus 3D CAM2 HDR X 330 with an accuracy of ranges between $\pm 2-7$ mm. It was used for both exterior and interior space of both sites. In addition to the scanning process, different 360° photographs are taken to assign color to the scan points and improve the readability of the Point Cloud (Plate 6).

The photogrammetry, defined as "the art, science, and technology of obtaining reliable information about physical objects and the environment through the processes of recording, measuring, and interpreting photographic images." (Wolf *et al.*, 2014) was used during this process to document two different scales of the project: the site and the decorated surfaces (Plate 7). Aerial photogrammetry was used to generate an ortho-corrected image of both sites



Plate 5. Setting up the total station in a challenging area to connect the inside to the outside (Tierradentro Archaeological Park)



Latin American cultural heritage

163

Plate 6. Laser scanning to record the Lavapatas Fountain (San Agustín Archaeological Park)



Plate 7. Color correction for the photogrammetric survey (Tierradentro Archaeological Park)

while terrestrial photogrammetry captured at a high resolution of the significant decorated surfaces.

Aerial photogrammetry was performed with a remotely-piloted aircraft system (RPAS) or as commonly known as a drone. The selected RPAS model was a DJI Mavic Pro 2. This device is very portable and equipped with a sophisticated Hasselblad camera with high photographic resolution (Plate 8).

The RPAS flight path allows taking overlapping images using a double grid and a flight height of 20 and 35 m. The photographs for the terrestrial – or close-range high definition photogrammetry – were taken with a Nikon 800 with a 20mm lenses. Given the challenging light conditions inside the hypogea, a set of four flashes with umbrellas diffusers per camera mounted on a tripod were used to control lighting and generate a homogeneous exposure on the surface. To achieve a correct color fidelity, a color card (X-Rite Color Passport) was used to control the photograph's white balance and color-correct them.

164

Plate 8. RPAS deployed to map the Alto de Segovia (Tierradentro Archaeological Park)



Reflectance transforming imaging (RTI) – a photography-based visualization technique – was used to document small surface variations. This technique involves taking a series of photographs from a still point with varying light positions to digitally re-lit the documented area in real-time. Apart from a DSLR camera and flashes, this process requires a specific toolkit formed by black reflecting spheres, fixing devices and measuring rope (Plate 9).

Finally, record and panoramic photography were executed to document the site. Panoramic photography offers an intuitive and efficient way to show the location, opening up



Plate 9. Utilizing RTI on the Lavapatas Fountain (San Agustın Archaeological Park) the possibility of generating panoramic tours. For this project, the Insta360 One X camera was used, allowing the automatic production of 360° panoramic images.

One of the significant challenges the workshop encountered was with the interior photogrammetric work. The reduced dimensions of the interior space, poor lighting, high humidity and the complex geometry of the decorated surfaces required the acquisition of a high number of photographs. To ensure consistent lighting, participants had to move the flashes and umbrellas around the elliptical space continuously. The participants nicknamed the required movement "el baile de la fotogrametría" or "the photogrammetric dance" due to its complicated series of steps and hand movements.

After an intensive four-day workshop capturing all the data required, the workshop group drove south to the archaeological site of San Agustín to document the ceremonial fountain of Lavapatas. This natural area is placed in the Colombian Massif on the southwest of the Andes in the Huila department, which features the largest complex of pre-Columbian megalithic structures in the region. This second part's objective was to document the Spring of Lavapatas – a natural site used for ancient religious ceremonies and baths. A series of pools and channels are carved into the stone to channel the water with human and animals' motives. During a day and a half – and despite a brief torrential downpour – the group surveyed with a total station, laser scanner and conducted terrestrial and aerial photogrammetry and RTI. With the documentation, an accurate 3D digital reconstruction of the area will be constructed to monitor its rapid degradation level (Plate 10).

Condition assessment: pilot case study with hypogea

The project described in this contribution described the different documentation activities develop in the two important UNESCO World Heritage Properties. However, the condition assessment was focused on understanding the condition of the wall paintings of the selected pre-Columbian monumental shaft tombs with side chambers – known as hypogea in Tierraadentro's Alto de Segovia component.

According to UNESCO's criteria III inscription, the "complex of hypogeal, are a unique testimony to the everyday life, ritual and the singular conception of burial space, of a developed and stable society" (UNESCO, 1995a). The state of the hypogea's conservation is crucial, as the decorated surfaces are an essential part of the site's contribution to the integrity of the outstanding universal value of this property.

The description of the "authenticity" of this property by UNESCO underlays that "the main attributes of Tierradentro hypogea are the tombs' architectural features, including the stairs and chambers, and the internal decoration including carvings and mural paintings. Those features have retained their original characteristics (UNESCO, 1995a)."

Furthermore, "the architecture of the tombs has been preserved in most cases and interventions have been limited to those required for protecting the carvings or paintings from further natural deterioration or in few cases for the reconstruction of structural columns and stairs. Natural erosion and earthquakes have affected several tombs, but human interventions have not caused any significant change in the original layout and features of



Plate 10. Panoramic photograph of Lavapatas Fountain (San Agustín Archaeological Park)

Latin American cultural heritage

the tombs, although authenticity has been modified in some cases by inappropriate earlier interventions" (UNESCO, 1995a).

For these reasons, the Instituto Colombiano de Antropología e Historia (ICANH) and the Universidad del Externado (UC), based on the measured drawings produced in collaboration with the CIMS, developed a condition assessment strategy (Figures 2-7 and Plate 11).

166







Figure 2. Alto de Segovia with the documented hypogea (S9, S10, S11 and S12) (Tierradentro Archaeolexical Parle) Archaeological Park)

Figure 3.

Site longitudinal of Alto de Segovia with the documented hypogea (S9, S10, S11 and S12) (Tierradentro Archaeological Park)

Figure 4. Reflected ceiling ortho-corrected image of the hypogea S12 (Tierradentro Archaeological Park)

Latin American cultural heritage

167

Figure 5. Longitudinal section ortho-corrected image of the hypogea S12 (Tierradentro Archaeological Park)





Figure 6. Site ortho-image of Lavapatas Fountain (San Agustín Archaeological Park)



Figure 7. Dense point Cloud of Lavapatas Fountain (San Agustín Archaeological Park)

168

Plate 11. Conducts visual condition assessment using the collected data (Tierradentro Archaeological Park)



Conclusions

This project allows evidence of the importance of international collaboration for sustainability, understanding that building capacity and protecting cultural heritage are essential elements contributing to the SDG.

Furthermore, it was an outstanding learning experience for the students to be involved in such a project with international partners. With the information collected by the students, a conservation project was proposed to the ICANH, which will be implemented as soon as possible, as some of the paintings decorating the wall in the hypogea are treated by the effect of climate change and catastrophic events.

What is next

Develop a digital workflow for the systematic recording of wall paintings in Tierradentro and the Lavapatas Fountain that could contribute to creating an adequate maintenance plan that allows conserving the integrity of these two significant properties on the UNESCO World Heritage List.

Further research collaboration is also planned within partners to integrate other educational and government institutions of the region in this type of capacity building programs.

References

- Boehler, W. and Heinz, G., (1999), "Documentation, surveying, photogrammetry", XVII CIPA Symposium. Recife.
- Demas, M. (2012), "Planning for conservation and management of archaeological sites: a values-based approach", in Sullivan, S. and Mackay, R. (Eds), *Archaeological Sites*, Getty Conservation Institute, Los Angeles.
- International Council of Monuments and Sites (ICOMOS) (2003), available at: https://www.icomos.org/ en/what-we-do/focus/179-articles-en-francais/ressources/charters-and-standards/166icomosprinciples-for-the-preservation-and-conservationrestoration-of-wall-paintings (accessed 15 April 2020).
- Langebaek Rueda, C.H and Dever, A. (2009), "Arqueología regional en Tierradentro, Cauca, Colombia", *Revista Colombiana de Antropología*, Vol. 45, pp. 323-367.

United Nations (2017), "Sustainable development goal 4", available at: https://sustainabledevelopment.	Latin
un.org/sdg4 (accessed 15 April 2020).	American
United Nations Educational, Scientific and Cultural Organization (UNESCO) (1974), "Recommendation concerning education for international understanding, co-operation and peace and education relating to human rights and fundamental freedoms", available at: http://portal.unesco.org/en/ev.php-URL_ID=13088&URL_DO=DO_TOPIC&URL_SECTION=201.html (accessed 15 April 2020).	cultural heritage
United Nations Educational, Scientific and Cultural Organization (UNESCO) (1995a), "National archeological park of Tierradentro", available at: http://whc.unesco.org/en/list/743 (accessed 15 April 2020).	169
United Nations Educational, Scientific and Cultural Organization (UNESCO) (1995b), "San Agustín	

- united Nations Educational, Scientific and Cultural Organization (UNESCO) (1995b), San Agustin archaeological park", available at: http://whc.unesco.org/en/list/744 (accessed 15 April 2020).
- Wolf, P.R., Dewitt, B.A. and Wilkinson, B.E. (2014), *Elements of Photogrammetry with Applications in GIS*, McGraw-Hill, New York.

Corresponding author

Miquel Reina Ortiz can be contacted at: miquelreinaortiz@cmail.carleton.ca

For instructions on how to order reprints of this article, please visit our website: www.emeraldgrouppublishing.com/licensing/reprints.htm Or contact us for further details: permissions@emeraldinsight.com