Analysis of Damage to Ukrainian Cultural Heritage Sites: A Case Study as of 08 June 2022

Virginia Museum of Natural History, Cultural Heritage Monitoring Lab (CHML); University of Maryland, Center for International Development & Conflict Management (CIDCM); and Smithsonian Institution, Smithsonian Cultural Rescue Initiative (SCRI)

EXECUTIVE SUMMARY: In a previous report produced under the umbrella of the Conflict Observatory (Bassett et al. 2022a), collaborative research by the Cultural Heritage Monitoring Lab (CHML) and Smithsonian Cultural Rescue Initiative (SCRI) identified over 458 potential impacts to cultural heritage sites across Ukraine following the Russian invasion of February 2022. For the purposes of this report, cultural heritage includes archaeological sites, arts centers, monuments, memorials, museums, places of worship, libraries, and archives. Damage to 104 sites has since been confirmed through analysis of high-resolution satellite imagery and a review of open-source news and social media. With additional contributions from the University of Maryland's Center for International Development & Conflict Management (CIDCM), this report presents satellite imagery of 10 sites with recent damage that cannot be explained by proximity to potential military targets.

INTRODUCTION: The principal treaty addressing cultural heritage in war is the 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict, written following World War II. The 1954 Hague Convention obligates State Parties to "respect" and "safeguard" cultural property in the event of armed conflict, and both Russia and Ukraine are Parties to the Convention. Following the 24 February 2022 Russian invasion of Ukraine, considerable international attention has been given to the damage to the country's cultural heritage. By May 2022, the CHML, SCRI, and CIDCM teams confirmed a higher number of sites damaged in or near the cities of Mariupol and Kharkiv, which saw extensive set-piece urban warfare, and at places of worship, museums, and monuments across the country (Bassett et al., 2022b). However, it is difficult to clearly distinguish collateral damage from intentional targeting in this specific conflict for several reasons, including the close-quarter nature of combat and the use of similar munitions and material by both sides. The CHML, SCRI, and CIDCM teams, under the umbrella of the Conflict Observatory, are working to develop a transparent and replicable methodology to differentiate between these types of damage.[1]

FINDINGS: This report seeks to distinguish between collateral damage and other military activity at cultural heritage sites in Ukraine. It proposes that damaged cultural heritage sites distant (>3km) from ongoing conflict activity, Ukrainian bases or stationary military assets, and dual-use transportation infrastructure (e.g., train stations, railways, airfields, and airports) are unlikely to be damaged as a consequence of military activity. Therefore, not all site damage can be explained by collateral damage or proximity to a potential military target. Among the 104 cultural heritage sites with confirmed damage, 21 are situated >3km from a potential military target or reported military activity. This report presents the 10 sites for which high-resolution satellite imagery is available.

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[1] https://conflictobservatory.org

METHODS: This analysis employs a four-step approach, which: (1) identifies potential impacts to cultural heritage sites in Ukraine using remote sensing technologies; (2) confirms whether a potential impact has observable damage using a combination of high-resolution satellite imagery, traditional news sources, and social media; (3) constructs a new dataset to determine the proximity among confirmed damage, ongoing armed conflict, and military targets; and (4) implements a distance threshold based on proximity to fighting and potential military targets. The result is a set of cultural heritage sites where damage cannot be explained by proximity to militarily relevant targets and is therefore the probable result of Russian activity. This method prioritizes systematic assessment, data transparency, and replicability of results. These steps are discussed in detail below.

First, a list of potential impacts to over 28,000 cultural heritage sites in Ukraine is developed using remote sensing technologies. The term "potential impact" is used to designate a cultural heritage site that has a moderate to high probability of having sustained damage as assessed through remote sensing analysis. Potential impacts are identified using multispectral satellite data. A site is categorized as a potential impact when one or more infrared signatures, suggestive of kinetic activity, indicates overlap or close proximity to a cultural heritage site. Potential impacts retain this status until either damage is confirmed or a ground assessment indicates that a property has not sustained damage.

Second, confirmation of potential impacts is completed. Confirmation relies on triangulating output from sources, including on-the-ground assessment, satellite imagery analysis, and verifiable reporting from credible news or social media sources. In this analysis, a social media source is considered credible when multiple posts provide consistent information and when a picture with a clearly identifiable site and damage is available. The research team includes native language speakers who assist in the process of reading local Ukrainian sources.

Confirming impacts to cultural heritage sites using satellite imagery requires visual analysis of the extent and visibility of damage. Conflict-related damage to sites range from underlying structural weakening to complete destruction. Some potential impacts are not detectable through overhead sensor or satellite technology and may not be detectable for months or years. On-the-ground site verification and news and social media sources are used to help determine the extent and context of damage and to provide information about damage that is difficult to detect from remote sensing.

Third, a panel dataset of events and targets is developed, which could offer alternative explanations for damage to cultural heritage sites. To develop this dataset, the CHML, SCRI, and CIDCM teams incorporated open-source information on the location and date of conflict activity between Russian and Ukrainian armed forces (Hegre et al. 2020); the location of Ukrainian bases, forts, trenches, and other stationary military assets (OSM 2022); and the location of dual-use transportation infrastructure that may be used by Ukrainian forces, which include train stations, railways, airfield, and airports (OSM 2022).

Finally, the proximity between cultural heritage sites and ongoing armed conflict or plausible military targets is calculated. By excluding damaged cultural heritage sites within 3km of known conflict events, military sites, and other military infrastructure, this analysis results in a conservative estimate that accounts for measurement error in the conflict data. The result is a set of sites that are distinguishable from potential collateral damage and other likely purposive action.

FUTURE WORK: Consistent with efforts in global heritage preservation, the CHML, SCRI, and CIDCM are producing the necessary datasets for large-scale collaborative analyses among cultural heritage researchers. By utilizing advanced statistical methods suitable for observational

data, it is possible to understand how and why cultural heritage is damaged during armed conflict. The CHML, SCRI, and CIDCM teams continue to take steps that increase the transparency and replicability of the methods proposed in this report; incorporate additional contextual and environmental factors in our panel dataset in order to account for alternative explanations for cultural heritage site damage (e.g., civilian locations, roads and bridges, additional conflict data, location of Russian and Ukrainian military positions and activity); and apply these methods to identify and understand damage to cultural heritage sites in this conflict.

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Bassett, H. F., Koropeckyj, D. V., Welsh, W., Averyt, K., Hanson, K., Aronson, J., Cil, D., Wegener, C., and Daniels, B. I. (2022b). Ukrainian Cultural Heritage Potential Impact Summary (09 May 2022). Virginia Museum of Natural History, Cultural Heritage Monitoring Lab; and Smithsonian Institution, Smithsonian Cultural Rescue Initiative.

Daniels, B. I., and Golden, G. (2018). Conflict Culture Research Network: Cultural Heritage Site List Dataset, Codebook 3.0. University of Pennsylvania Museum, Penn Cultural Heritage Center.

Hegre, H., Croicu, M., Eck, K., and Högbladh, S. (2020). Introducing the UCDP Candidate Events Dataset. *Research & Politics* 7(3): 2053168020935257.

OpenStreetMaps [OSM]. (2022). Ukraine. https://www.openstreetmap.org/ (accessed 15 June 2022).

Figures

Figure 1:

Rubizhne City Museum (Рубіжанський міський музей) is a local history museum located in Rubizhne, Luhansk Oblast. The two-story building located adjacent to the Rubizhne City Park exhibits a collection of art and artifacts relevant to Rubizhne history and culture. Image from March 9, 2022 shows no visible damage. Image: © 2022 Maxar, NextView License.
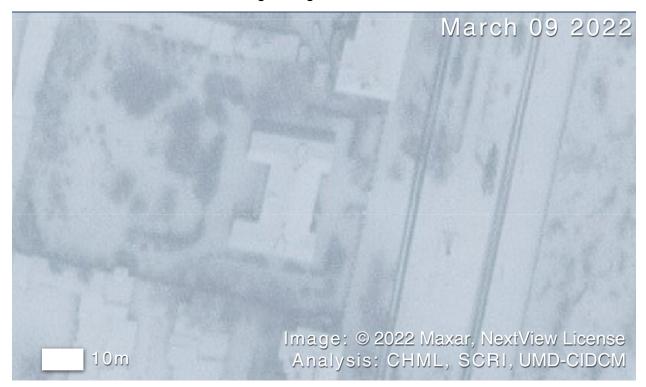
Figure 2:

Rubizhne City Museum (Рубіжанський міський музей) is a local history museum located in Rubizhne, Luhansk Oblast. The two-story building located adjacent to the Rubizhne City Park exhibits a collection of art and artifacts relevant to Rubizhne history and culture. Image from March 29, 2022 shows damage to the roof of the building. Image: © 2022 Maxar, NextView License.

Figure 3:

Church of St. Theodosius (Церква святителя Феодосія) is a Ukrainian Orthodox Church located in Chernihiv, Chernihiv Oblast. The brick building was consecrated in 1996 and is located in the Yatsevo cemetery (Кладовище "Яцево"). Image from March 10, 2022 shows no visible damage. Image: © 2022 Maxar, NextView License.

Figure 4:

Church of St. Theodosius (Церква святителя Феодосія) is a Ukrainian Orthodox Church in Chernihiv, Chernihiv Oblast. The brick building was consecrated in 1996 and is located in the Yatsevo cemetery (Кладовище "Яцево"). Image from March 18, 2022 shows damage to the building. Image: © 2022 Maxar, NextView License.

Figure 5:

Church of the Holy Prophet Elijah and the Apostle Andrew the First-Called (Храм Святих пророка Іллі та апостола Андрія) is a Ukrainian Orthodox Church located in Hostomel, Kyiv Oblast. The single-story building is located on European road E373. Image from February 28, 2022 shows no visible damage. Image: © 2022 Maxar, NextView License.
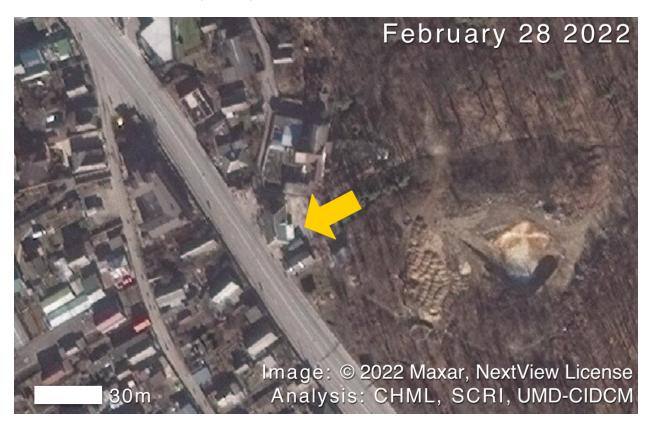
Figure 6:

Church of the Holy Prophet Elijah and the Apostle Andrew the First-Called (Храм Святих пророка Іллі та апостола Андрія) is a Ukrainian Orthodox Church located in Hostomel, Kyiv Oblast. The single-story building is located on European road E373. Image from March 18, 2022 shows damage to the building. Image: © 2022 Maxar, NextView License.
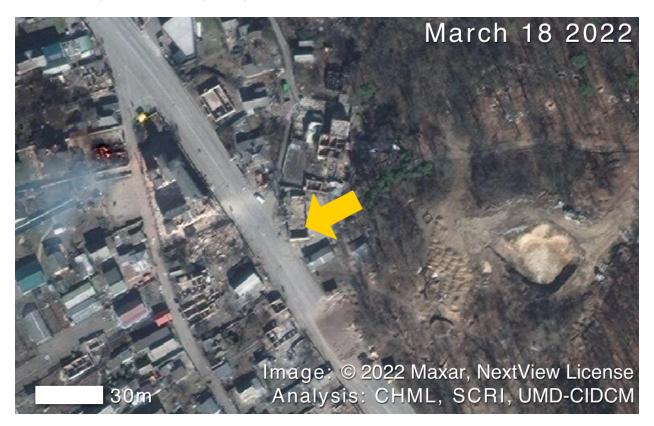
Figure 7:

Ivankiv Historical and Local History Museum (Іванківський Історико-краєзнавчий музей) is a local history museum located in Ivankiv, Kyiv Oblast. The museum was established in 1981 and displays art and artifacts relevant to the history and culture of Ivankiv. At the time of destruction, the museum served as a repository for a collection of paintings by Maria Ovksentiyivna Prymachenko, a Ukrainian painter and former resident of the Ivankiv district. There are conflicting accounts of how many paintings from this collection were present at the time of this damage. Image from February 14, 2022 shows no visible damage. Image: © 2022 Maxar, NextView License.
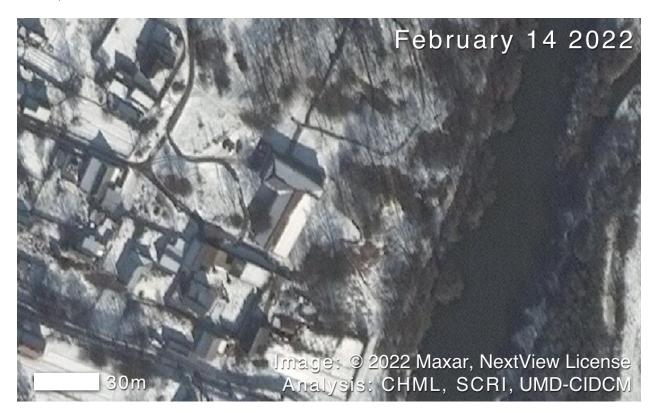
Figure 8:

Ivankiv Historical and Local History Museum (Іванківський Історико-краєзнавчий музей) is a local history museum located in Ivankiv, Kyiv Oblast. The museum was established in 1981 and displays art and artifacts relevant to the history and culture of Ivankiv. At the time of destruction, the museum housed a collection of paintings by Maria Ovksentiyivna Prymachenko, a Ukrainian painter and former resident of the Ivankiv district. Image from February 27, 2022 shows damage to the building. Image: © 2022 Maxar, NextView License.

Figure 9:

Izyum Historical and Local History Museum, named after Mykola Vikentiyovych Sibilov (Ізюмський краєзнавчий музей імені М.В.Сібільова), is a local history museum located in Izyum, Kharkiv Oblast. The museum was established in 1920 and housed a collection of books, paintings, and works of art relevant to the history of the Slobozhanshchyna region. As a rural area, the region around Izyum has limited periodicity of pre-conflict imagery. Image from July 18, 2021 shows no visible damage. Image: © 2022 Maxar, NextView License.

Figure 10:

Izyum Historical and Local History Museum, named after Mykola Vikentiyovych Sibilov (Ізюмський краєзнавчий музей імені М.В.Сібільова), is a local history museum located in Izyum, Kharkiv Oblast. The museum was established in 1920 and housed a collection of books, paintings, and works of art relevant to the history of the Slobozhanshchyna region. Image from March 12, 2022 shows some damage to the building. Image: © 2022 Maxar, NextView License.
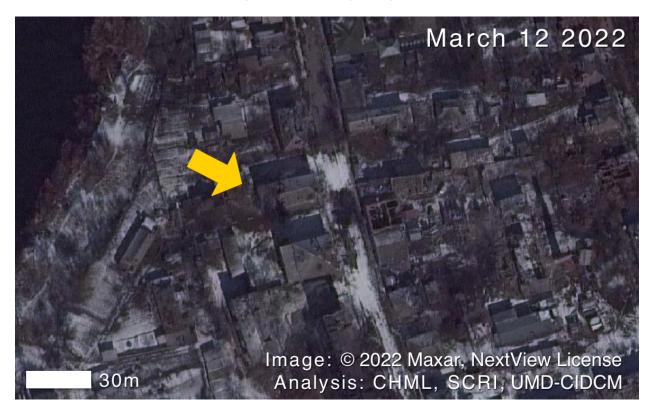
Figure 11:

Izyum Historical and Local History Museum, named after Mykola Vikentiyovych Sibilov (Ізюмський краєзнавчий музей імені М.В.Сібільова), is a local history museum located in Izyum, Kharkiv Oblast. The museum was established in 1920 and housed a collection of books, paintings, and works of art relevant to the history of the Slobozhanshchyna region. Image from March 20, 2022 shows additional damage to the building. Image: © 2022 Maxar, NextView License.

Figure 12:

Church in honor of the Holy Martyrs Faith, Hope, and Love and Their Mother Sophia (Храм на честь святих мучениць Віри, Надії, Любові та матері їх Софії) is a Ukrainian Orthodox Church located in the village of Kamyanka, Kharkiv Oblast. The church is constructed of wood and was consecrated in 2018 as part of the Diocese of Izyum. Image from July 09, 2020 shows no visible damage. Image: © 2022 Maxar, NextView License.

Figure 13:

Church in honor of the Holy Martyrs Faith, Hope, and Love and Their Mother Sophia (Храм на честь святих мучениць Віри, Надії, Любові та матері їх Софії) is a Ukrainian Orthodox Church located in the village of Kamyanka, Kharkiv Oblast. The church is constructed of wood and was consecrated in 2018 as part of the Diocese of Izyum. Image from March 23, 2022 shows damage to the building. Image: © 2022 Maxar, NextView License.

Figure 14:

Church in honor of the Holy Martyrs Faith, Hope, and Love and Their Mother Sophia (Храм на честь святих мучениць Віри, Надії, Любові та матері їх Софії) is a Ukrainian Orthodox Church located in the village of Kamyanka, Kharkiv Oblast. The church is constructed of wood and was consecrated in 2018 as part of the Diocese of Izyum. Image from May 13, 2022 shows additional damage to the building. Image: © 2022 Maxar, NextView License.

Figure 15:

St. Elijah's Monastery (Свято-Іллінський чоловічий монастир) is a Ukrainian Orthodox Church located in the village of Varvarivka, Luhansk Oblast. The church is part of the Diocese of Sievierodonetsk. Image from March 29, 2022 shows no visible damage. Image: © 2022 Maxar, NextView License.

Figure 16:

St. Elijah's Monastery (Свято-Іллінський чоловічий монастир) is a Ukrainian Orthodox Church located in the village of Varvarivka, Luhansk Oblast. The church is part of the Diocese of Sievierodonetsk. Image from April 07, 2022 shows damage to the building. Image: © 2022 Maxar, NextView License.

Figure 17:

St. Elijah's Monastery (Свято-Іллінський чоловічий монастир) is a Ukrainian Orthodox Church located in the village of Varvarivka, Luhansk Oblast. The church is part of the Diocese of Sievierodonetsk. Image from April 27, 2022 shows additional damage to the building. Image: © 2022 Maxar, NextView License.

Figure 18:

Hryhorii Skovoroda Literary Memorial (Національний літературно-меморіальний музей Г. С. Сковороди) is a memorial museum located in Skovorodynivka village, Kharkiv Oblast. The museum is located in an 18th-century house and is dedicated to the life and work of Hryhorii Skovoroda, a Ukrainian philosopher. Image from March 26, 2021 shows no visible damage. Image: © 2022 Maxar, NextView License.

Figure 19:

Hryhorii Skovoroda Literary Memorial Museum (Національний літературно-меморіальний музей Г. С. Сковороди) is a memorial museum located in Skovorodynivka village, Kharkiv Oblast. The museum is located in an 18th-century house and is dedicated to the life and work of Hryhorii Skovoroda, a Ukrainian philosopher. Image from June 17, 2022 shows damage to the building. Image: © 2022, Planet Labs Inc., Contract NRO000-22-C-0247.

Figure 20:

The Yatsevo Cemetery (кладовище "Яцево") and Memorial Chapel of the Archangel Michael in honor of soldiers who died for Ukraine (Меморіальна каплиця Архистратига Божого Михаїла в честь воїнів, загиблих за Україну) are two cultural heritage sites located next to each other in the Chernihivs'kyi district of the Chernihiv Oblast. Image from March 10, 2022 shows no visible damage. Image: © 2022 Maxar, NextView License.

Figure 21:

The Yatsevo Cemetery (кладовище "Яцево") and Memorial Chapel of the Archangel Michael in honor of soldiers who died for Ukraine (Меморіальна каплиця Архистратига Божого Михаїла в честь воїнів, загиблих за Україну) are two cultural heritage sites located next to each other in the Chernihivs'kyi district of the Chernihiv Oblast. Image from March 16, 2022 shows damage to both sites visible in the change in shadow of the shrine's profile and the debris field from the shrine impact spilling into the street. Image: © 2022 Maxar, NextView License.

Figure 22:

The Yatsevo Cemetery (кладовище "Яцево") and Memorial Chapel of the Archangel Michael in honor of soldiers who died for Ukraine (Меморіальна каплиця Архистратига Божого Михаїла в честь воїнів, загиблих за Україну) are two cultural heritage sites located next to each other in the Chernihivs'kyi district of the Chernihiv Oblast. Image from April 28, 2022 shows additional damage to both sites. Image: © 2022 Maxar, NextView License.