

# Ancient history, modern destruction:

Assessing the current status of Syria's World Heritage sites  
using high-resolution satellite imagery

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**Penn Museum**  
UNIVERSITY of PENNSYLVANIA MUSEUM  
of ARCHAEOLOGY and ANTHROPOLOGY



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Visit <http://www.aaas.org/geotech/culturalheritage> for more information about this project.

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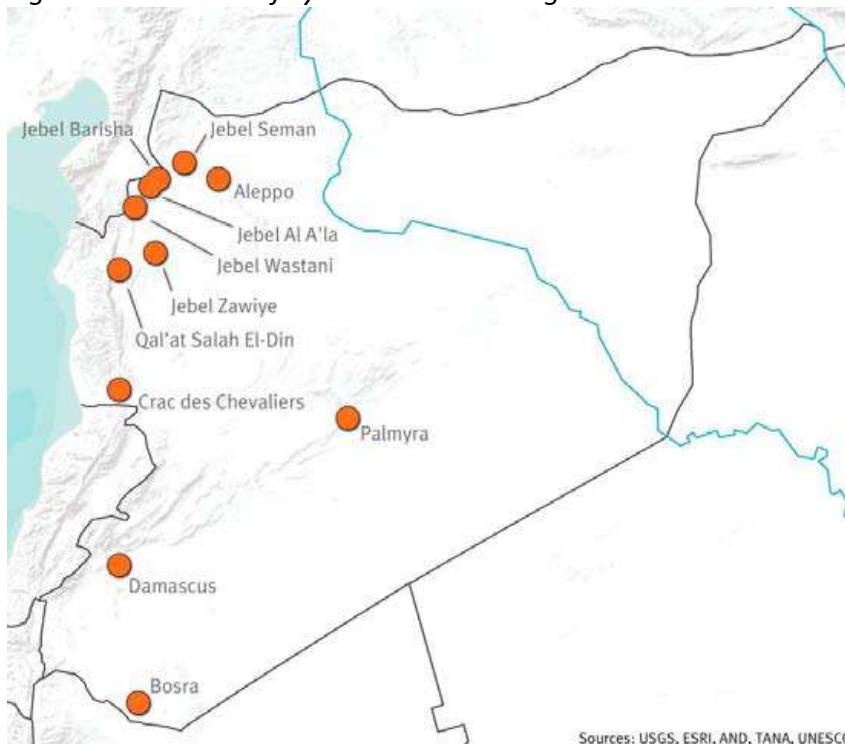
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# Ancient History, Modern Destruction: Assessing the Current Status of Syria's World Heritage Sites Using High-Resolution Satellite Imagery

## Executive Summary

In partnership with the University of Pennsylvania Museum of Archaeology and Anthropology's Penn Cultural Heritage Center (PennCHC) and the Smithsonian Institution, and in cooperation with the Syrian Heritage Task Force, the Geospatial Technologies and Human Rights Project of the American Association for the Advancement of Science (AAAS) undertook an assessment of Syria's World Heritage sites using high-resolution satellite imagery (Figure 1). Syria has six World Heritage sites: the Ancient City of Aleppo, the Ancient City of Bosra, the Ancient City of Damascus, the Ancient Site of Palmyra, the Ancient Cities of Northern Syria, and Crac des Chevaliers and Qal'at Salah El-Din.<sup>1</sup> The purpose of the assessment was to determine the current status of each site. Analysis indicates that five of the six World Heritage sites exhibit significant damage; damage was observed at every site except for the Ancient City of Damascus.

*Figure 1: Overview of Syrian World Heritage sites*



Map: AAAS

## Introduction

<sup>1</sup> <http://whc.unesco.org/en/statesparties/sy>

Damage to Syria's cultural heritage has been widely reported in the news and in social media since the outset of the present civil war in 2011. The potential for harm extends to all six Syrian sites that have been inscribed on the World Heritage list. By their date of inscription, these are: the Ancient City of Damascus (1979), the Ancient City of Bosra (1980), the Site of Palmyra (1980), the Ancient City of Aleppo (1986), the Crac des Chevaliers and Qal'at Salah El-Din (2006), and the Ancient Villages of Northern Syria (2011). In 2013, the World Heritage Committee took the significant step of placing all six of these sites on the "List of World Heritage in Danger" maintained by UNESCO's World Heritage Centre.<sup>2</sup>

A number of reports summarizing damage to Syria's cultural heritage have appeared since the onset of the conflict in Syria in 2011. To date, overviews have been published on World Heritage sites and the destruction of museums, historic structures, and archaeological sites. These include periodic reports by UNESCO,<sup>3</sup> governmental<sup>4</sup> and non-governmental organizations,<sup>5</sup> activist groups,<sup>6</sup> and scholarly articles.<sup>7</sup> AAAS previously released reports on the conflict in Aleppo, which included an analysis of damage to the World Heritage area.<sup>8</sup> However, no work to date has documented the extent of damage to all of Syria's World Heritage sites using recent high-resolution satellite imagery coupled with news media, social media, and verified, on-the-ground information. This report provides an assessment of all six Syrian World Heritage sites by comparing each site prior to the current conflict to their current status, as visible in satellite imagery. Since this is an overview assessment, this report will be followed by future in-depth analysis and time-series reviews of the data available for each individual site in order to construct a site based timeline of damage.

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<sup>2</sup> <http://whc.unesco.org/en/danger/>

<sup>3</sup> <http://www.unesco.org/new/en/safeguarding-syrian-cultural-heritage/>

<sup>4</sup> <http://whc.unesco.org/en/soc/2914>; <http://whc.unesco.org/en/soc/2912>; <http://whc.unesco.org/en/soc/2911>; <http://whc.unesco.org/en/soc/2915>; <http://whc.unesco.org/en/soc/2913>; <http://whc.unesco.org/en/soc/2916>; [https://hiu.state.gov/.../Syria\\_CulturalSites\\_2013Apr11\\_HIU\\_U771.pdf](https://hiu.state.gov/.../Syria_CulturalSites_2013Apr11_HIU_U771.pdf)

<sup>5</sup> <http://www.asor-syrianheritage.org>; <http://www.heritageforpeace.org>; <http://www.hrw.org/news/2012/03/02/syria-new-satellite-images-show-homs-shelling>; <http://hisd.tors.ku.dk>; E. Cunliffe, (2012) [http://ghn.globalheritagefund.com/uploads/documents/document\\_2107.pdf](http://ghn.globalheritagefund.com/uploads/documents/document_2107.pdf)

<sup>6</sup> <https://www.facebook.com/Archeologie.syrienne>; <https://www.facebook.com/pages/Aleppo-Archaeology>; <http://www.apsa2011.com/index.php/en/>

<sup>7</sup> C. Ali, (2013) Syrian heritage under threat, *Journal of Eastern Mediterranean Archaeology and Heritage Studies*, 1(4), 351-366; S. Al Quntar, (2013) Syrian cultural property in the crossfire: Reality and effectiveness of protection efforts, *Journal of Eastern Mediterranean Archaeology and Heritage Studies*, 1(4), 348-351; J. Casana, (2014) Satellite-based monitoring of looting and damage to archaeological sites in Syria, *Journal of Eastern Mediterranean Archeology and Heritage Studies*; E. Cunliffe, (2013) No longer lost in the wilderness: Cultural property crimes in conflict, *Journal of Eastern Mediterranean Archaeology and Heritage Studies*, 1(4), 343-347; K. Hanson, (in review) Cultural Heritage in Crisis: An Analysis of Archaeological Sites in Syria through Google Earth and Bing Map Satellite Imagery, *Journal of Archaeological Science*.

<sup>8</sup> <http://www.aaas.org/aleppo> ; [http://www.aaas.org/aleppo\\_retrospective](http://www.aaas.org/aleppo_retrospective)

## Data and Methods

AAAS acquired the most recently available high-resolution satellite imagery covering each of Syria's world heritage sites. Imagery was available for all sites, with varying pre-conflict dates. Regardless, an image from prior to the conflict was compared with the most recently acquired image. The imagery used was collected by satellites owned and operated by DigitalGlobe, and the relevant acquisition information is listed in tables in the following subsections.

## World Heritage Site Analysis

### 1. Ancient City of Aleppo

#### *Overview*

As one of the oldest continuously inhabited cities in the world, Aleppo has long been the urban, commercial, and cultural center of northwestern Syria. Aleppo's role as a commercial hub and a trade center that began in the 2<sup>nd</sup> millennium BC and reached its peak during the 16<sup>th</sup>-18<sup>th</sup> centuries AD. In the center of the ancient city, the Aleppo citadel rises 50m above the surrounding area and dates to the 10<sup>th</sup> century BC, or earlier, and stands on the remains of Hittite, Hellenistic, Roman, Byzantine, Seljuk, and Ayyubid period buildings. The surrounding walled city dates to the same periods, with still standing structures and architectural remains. Surviving remains include medieval gates, 6<sup>th</sup> century Christian structures, Roman period street plans, Ayyubid and Mamluk mosques and schools, and many Ottoman period homes and palaces. One of the most well-known cultural sites in Aleppo is the Great Mosque, which was founded in the Umayyad period and rebuilt in the 12<sup>th</sup> century with a Mamluk minaret dated to AD 1090. Next to the Umayyad Mosque is a Byzantine cathedral that later became the al Halawiyah Madrasa—a Koranic school. The Ancient City of Aleppo was inscribed on the World Heritage List in 1986.<sup>9</sup>

During the past two years, Aleppo has been the frontlines in the present conflict. On 15 July 2012, the International Committee of the Red Cross characterized the escalating conflict as a "civil war," a designation that has since entered into common usage in the news media.<sup>10</sup> Since 19 July 2012, reports indicate that government and opposition forces have continued to clash both in and around the city. Accounts of the conflict in Aleppo describe a conflict characterized by heavy fighting, widespread shelling by tanks and artillery, and numerous civilian casualties.<sup>11</sup>

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<sup>9</sup> <http://whc.unesco.org/en/list/21>

<sup>10</sup> <http://www.bbc.co.uk/news/world-middle-east-18849362>

<sup>11</sup> <https://www.icrc.org/eng/resources/documents/news-release/2014/04-22-syria-damascus-aleppo-violence-civilians.htm>; <http://www.aljazeera.com/news/middleeast/2012/09/20129915724124835.html>

## Data

*Table 1: Aleppo imagery acquired*

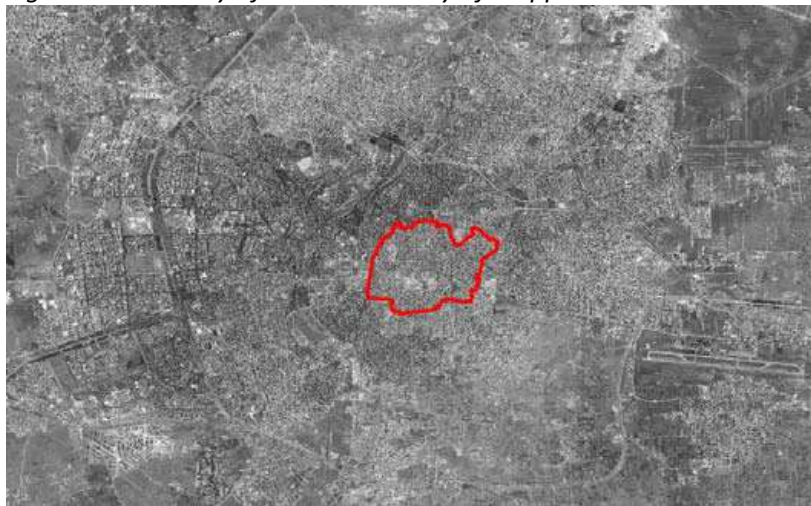
Date	Sensor	Image ID
6 December 2011	WorldView-2	103001000FA1E900
14 July 2014	WorldView-2	1030010035820900
10 August 2014	WorldView-1	1020010033724F00

*All imagery acquired via DigitalGlobe, NextView license*

Three images (Table 1) of Aleppo were acquired and analyzed to assess damage to the Ancient City (Figure 2). An image captured on 6 December 2011 was used to assess the ancient city prior to the start of the current conflict. An image from 14 July 2014 was the most recent multi-spectral image available at the time of analysis. An additional image, captured on 10 August 2014, was acquired to supplement the 14 July 2014 image. This image revealed considerable damage to the old city between 14 July and 10 August 2014.

## Analysis

*Figure 2: Boundary of the Ancient City of Aleppo*



*Image ©2014, DigitalGlobe, NextView License | Analysis AAAS.*

The city of Aleppo has experienced some of the heaviest fighting of the Syrian civil war. A report, published by AAAS in August 2013 and titled *Conflict in Aleppo, Syria: A Retrospective Analysis*, documented the effect of the war on the city as of 26 May 2013. Considerable damage was seen within the old city, including damage to the Great Mosque of Aleppo and the ancient Suq al-Madina covered market. Since that time, the fighting in Aleppo has intensified, which has led to damage to multiple important historical sites throughout the Ancient City.

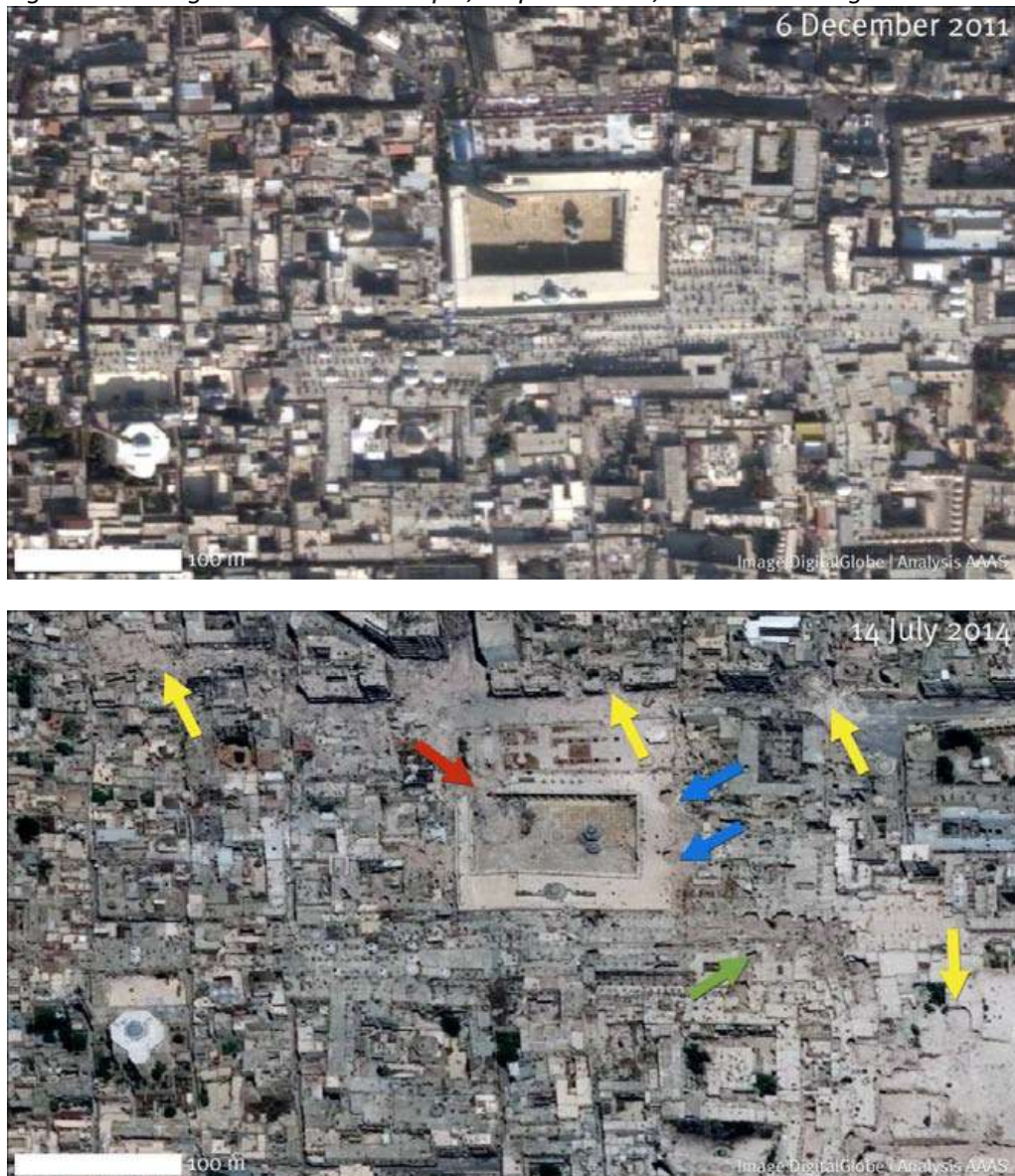
Destruction is visible throughout the site. Debris is present across the area and blocks of structures have been reduced to rubble. Many of these are large and built with durable materials, such as stone, bricks, and mud brick adobe, suggesting intense bombing. The



destroyed structures include historic mosques and madrassas, government buildings, and civilian structures.

In spring 2013, it was reported that the minaret of the Great Mosque of Aleppo had been destroyed during the fighting. AAAS documented this damage in its August 2013 report. Since that time, two additional craters have appeared along the eastern wall of the mosque. The nearby Suq al-Madina was also heavily damaged, as were multiple other structures (Figure 3).

*Figure 3: Damage to the Great Mosque, Suq al-Madina, and surrounding area*



*Between 6 December 2011 (top) and 14 July 2014, the roof of the Suq al-Madina was damaged (green arrow), the minaret of the Great Mosque was destroyed (red arrow) and two craters appear on the eastern wall (blue arrows). In addition, multiple nearby structures were heavily damaged (yellow arrows). Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.19N, 37.15E.*

Much of the heaviest damage was concentrated in the area immediately south of the citadel. This area contains government buildings, such as the Ministry of Justice headquarters, a police headquarters, and the Grand Serail of Aleppo, which was the main government building in the city under the French Mandate. Other historic structures that were damaged and destroyed include the Hammam Yalbougha an-Nasry (late 15<sup>th</sup> century), the Khusruwiye Mosque (mid-16<sup>th</sup> century), and the Carlton Citadel Hotel (19<sup>th</sup> century). By 14 July 2014, the Carlton Citadel Hotel and several adjacent structures had been completely destroyed, while the Khusriwiye Mosque, the Ministry of Justice building, and the police headquarters had been heavily damaged. Between 14 July 2014 and 10 August 2014, the Khusriwiye Mosque was almost completely destroyed, leaving a crater 40m in diameter where the building formerly stood. Similarly, a second 40m crater eliminated the east wing of the Grand Serail. The dome of the public bathhouse was also destroyed.

*Figure 4: Damage to the area south of the citadel*







Between 6 December 2011 (top) and 14 July 2014 (middle), the Ministry of Justice building was heavily damaged (red arrow), as was the Khusriwiye Mosque (green arrow). The Carlton Citadel Hotel (blue arrow) was completely destroyed along with many surrounding structures (yellow arrows). By 10 August 2014, the Khusriwiye Mosque had been almost completely demolished (green arrow), the Grand Serail was heavily damaged (orange arrow) and the dome of the Hammam Yalbougha an-Nasry was destroyed (purple arrow). Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates 36.19N, 37.16E.



Satellite imagery also revealed substantial damage in the area north of the citadel. This area contains buildings dating from the late Mamluk period (13<sup>th</sup>-16<sup>th</sup> century) to the late Ottoman period (19<sup>th</sup> century). The east wall Khan Qurt Bey caravanserai, a historic site dating to the end of the 15<sup>th</sup> century, was also heavily damaged. In addition, most of the structures in the neighborhood immediately east of the caravanserai have been completely destroyed and nearby structures heavily damaged.

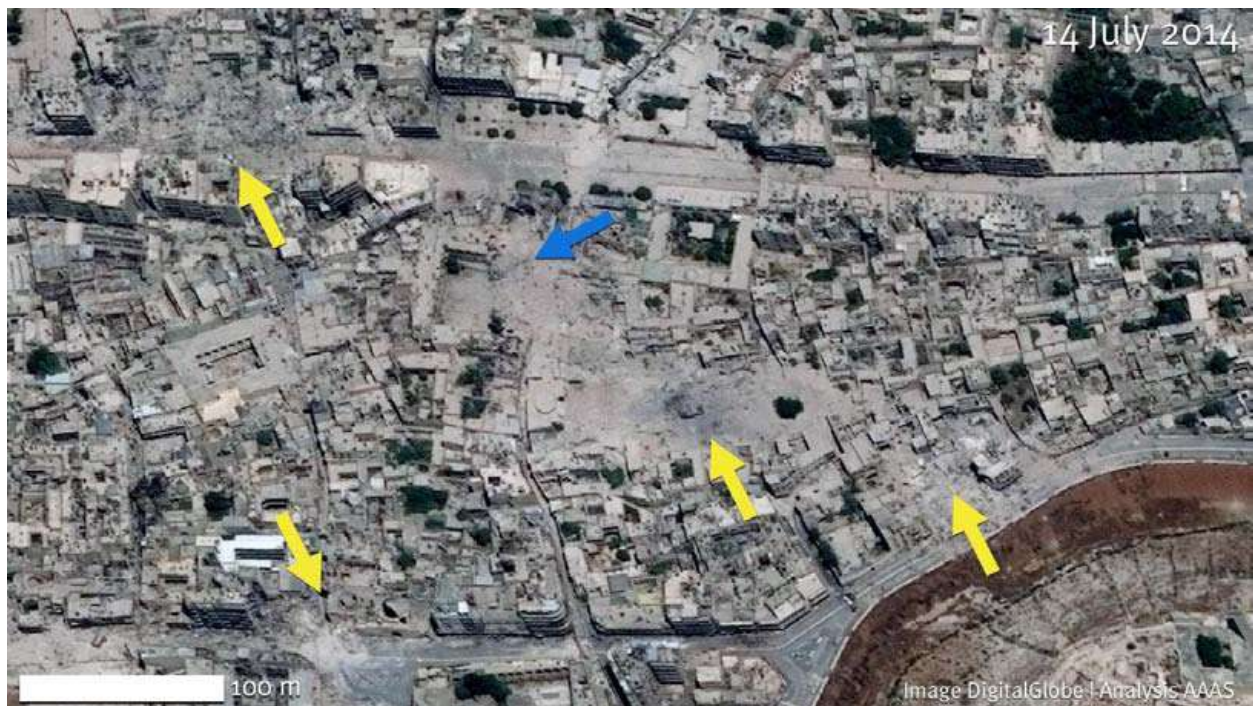
*Figure 5: Ground view of the Grand Serail in Aleppo*



*Ground view of the Grand Serail in Aleppo (The orange arrow in figure 4). Photo: Aleppo Archaeology September 2014. ([www.facebook.com/pages/Aleppo-Archaeology](http://www.facebook.com/pages/Aleppo-Archaeology))*



Figure 6: Damage to the Kahn Qurt Bey caravanserai



Between 6 December 2011 (top) and 14 July 2014, the east wall of the Kahn Qurt Bey caravanserai was demolished (blue arrow). Multiple other nearby structures were also heavily damaged (yellow arrows). Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.20N, 37.15E.

## 2. Ancient City of Bosra

### *Overview*

Located in the southern Syrian Da'ara governorate, the ancient city of Bosra is best known as a major archaeological site with remains from the Roman, Byzantine, and early Islamic periods. The city rose to prominence in the Islamic period when it became an important node on the pilgrim route to Mecca and, at its height, Bosra once included approximately 80,000 residents. However, the city began to decline in the 17<sup>th</sup> century, though it remains an important local urban center. The Ancient City of Bosra includes significant Roman remains from its period as the northern capital of the Nabataean kingdom of the Roman province of Arabia. The 2<sup>nd</sup> century AD Roman theatre is one of the best preserved examples from this period, and there are extensive Roman archaeological remains nearby. After the 5<sup>th</sup> century AD, the theater was fortified as a citadel to protect the route to Damascus. During the Byzantine period, Bosra became an important religious city and caravan stop—evidenced by the Bosra Basilica of the Martyrs (6<sup>th</sup> century) and the Cathedral of Bosra. Islamic period architectural remains in Bosra include the Al-Omari Mosque (AD 720), one of the oldest mosques in the world, and the Madrasa Jami' Mabarak an-Naqua (12<sup>th</sup> century). Bosra has long been recognized as an important archaeological site and was inscribed on the World Heritage List in 1980.<sup>12</sup>

Bosra and its surrounding region in the Da'ara governorate have seen increasing violence during the conflict. Since the autumn of 2012, there are reports of damage to parts of the ancient city caused by tank shelling and bombs.<sup>13</sup> During 2013, there were reports of snipers regularly shooting from the Roman Theater/Fortress.<sup>14</sup>

### *Data*

AAAS acquired imagery of Bosra from two dates: a pre-conflict image acquired during February 2011, and a current image from April 2014. The details of this imagery are outlined in Table 2.

*Table 2: Bosra imagery acquired*

Date	Sensor	Image ID
23 February 2011	WorldView-2	207001009C021000
29 April 2014	WorldView-2	103001003066A400

*All imagery acquired via DigitalGlobe, NextView license*

<sup>12</sup> <http://whc.unesco.org/en/list/22>

<sup>13</sup> <http://arabsaga.blogspot.co.uk/2012/10/assad-forces-bury-cradle-of-kings.html>;  
[http://www.youtube.com/watch?v=IK9hzvsq\\_9M&feature=youtu.be](http://www.youtube.com/watch?v=IK9hzvsq_9M&feature=youtu.be)

<sup>14</sup> <http://www.youtube.com/watch?v=BUB1i7o-Qr8>



## *Analysis*

Signs of conflict were evident in imagery of Bosra, and included phenomena such as roadblocks, destroyed buildings, and earthen fortifications in the modern city. Within the boundaries of the World Heritage site, the Roman theater, often considered the primary attraction of the Ancient City, showed no visible signs of damage, although an earthen ramp has been constructed over a staircase on its eastern entrance and that entryway is surrounded by berms (Figure 7). One hundred fifty meters to the west of the Roman theater, at an area of the site identified as the site of a second amphitheater, a vehicle track was observed leading to a low hillock, adjacent to a government building (Figure 7). In the northern portion of the heritage site, near its boundary with the modern city, two small high-albedo areas are visible, in a pattern that is consistent with mortar impacts. A hole observed in the nearby Al-Omari Mosque (AD 720) provides further evidence that this area was bombarded by mortars. Substantial damage was observed to a few modern buildings, and the shelling appears to have affected a relatively small portion of the Ancient City (Figure 8).

Figure 7: Earthen ramps and berms at the Bosra Roman Theater and nearby road excavations



On 23 February 2011 (top), the Roman theatre and nearby archaeological site are undisturbed. By 29 April 2014, however, earthen ramps and berms have been constructed near the theater's east entrance, and a small hill at the site to the west has been partially excavated (arrows). Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 32.51N, 36.48E.



Figure 8: Shell craters and structural damage at the Bosra World Heritage site



Between October 2009 and April 2014, a number of probable shell craters associated with structural damage have appeared in the Bosra World Heritage site (yellow arrows) including a hole in the roof of the Al-Omari Mosque. A probable shell crater is also present in the standing ancient Roman ruins. Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 32.51N, 36.48E.

### 3. Ancient City of Damascus

#### *Overview*

Damascus is Syria's capital and one of the oldest cities in the world. Beginning with the Aramaic kingdom (11<sup>th</sup>-7<sup>th</sup> centuries BC), Damascus grew into the political and urban hub for the region. Today, the ancient city encompasses over 125 cultural heritage sites that represent Damascus' long history, including archaeological and architectural remains from the Hellenistic, Roman, Byzantine, Islamic, and Ottoman periods. The ancient city still follows the orientation established during the Hellenistic period and the Roman city street plan and city walls are visible today. Damascus is perhaps best known for the surviving remains from when the city was the capitol of the Umayyad caliphate. The best-preserved architecture from the Umayyad building program is the Great Mosque (8<sup>th</sup> century), which lies on top of an Assyrian temple, Roman temple and Christian basilica. The Ayyubid Citadel is another famous Damascus site with massive defensive architecture and courtyards (11<sup>th</sup> century). Today, most historic buildings within the Ancient City of Damascus World Heritage site boundary date from the period after the Ottoman conquest (16<sup>th</sup> century). The ancient city of Damascus was inscribed on the World Heritage List in 1979.

The Syrian Ministry of Culture's Directorate-General of Antiquities and Museums has reported mortar damage in the vicinity of the Old City.<sup>15</sup> These claims have been repeated in a recent report by the American Schools of Oriental Research.<sup>16</sup> The AAAS analysis has not been able to identify or locate this damage. The Ancient City of Damascus has been largely protected from the violence that has heavily impacted neighborhoods surrounding the city. Isolated incidents, such as car bombs and firefights, have taken place in central neighborhoods in Damascus, with no known reports of damage inside the ancient walled city.<sup>17</sup> In contrast, the outskirts of Damascus have been heavily impacted by clashes and many suburbs have been decimated, though, as of this writing, there are no known reports of this conflict impacting the area inside the World Heritage site boundaries of the Ancient City.<sup>18</sup>

#### *Data*

*Table 3: Damascus imagery acquired*

Date	Sensor	Image ID
11 May 2011	WorldView-2	103001000A8B0F00
12 August 2014	WorldView-2	1030010035079600

*All imagery acquired via DigitalGlobe, NextView license*

<sup>15</sup> <http://www.dgam.gov.sy/?d=314&id=1369>

<sup>16</sup> <http://www.asor-syrianheritage.org/shi-weekly-report-i-august-11-2014>

<sup>17</sup> <http://www.reuters.com/article/2012/03/17/us-syria-idUSBRE8280G820120317>;  
<http://www.aljazeera.com/news/middleeast/2012/07/20127189355415804.html>;  
<http://www.cbsnews.com/news/syria-mortar-fire-kills-12-in-damascus-hrw-accuses-regime-of-barrel-bomb-civilians/>; <http://www.bbc.com/news/world-middle-east-24981294>

<sup>18</sup> <http://www.reuters.com/article/2014/04/02/us-syria-crisis-impact-idUSBREA3118E20140402>



## Analysis

Figure 9: Ancient City of Damascus

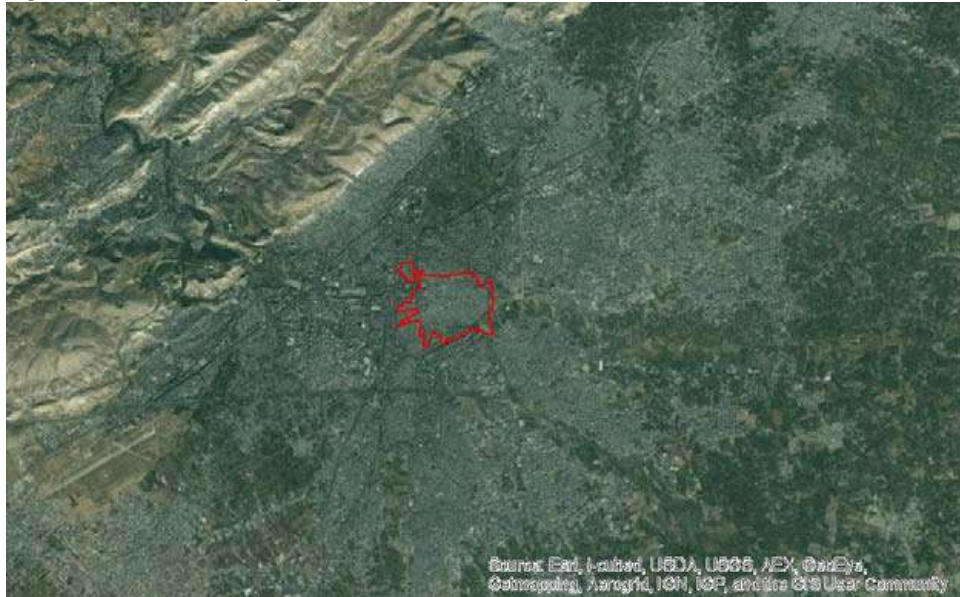


Image ©2014, DigitalGlobe, NextView License | Analysis AAAS.

Two images of the Ancient City of Damascus were acquired and analyzed (Table 3). The first, from 11 May 2011, was captured around the time that protests against the Syrian government were starting. The second, captured on 12 August 2014, was the most recent image available. Analysis of these images revealed no major signs of conflict within the Ancient City. Though damage to structures, as well as roadblocks, were observed in other areas of Damascus, neither were observed within the boundary of the Ancient City. The density of structures within the Ancient City obscured the view of many streets, so it is possible that structures were damaged in ways that were not observable from the overhead vantage point provided by satellite imagery.

## 4. Ancient Site of Palmyra

### *Overview*

In the middle of Syrian desert, Palmyra's monumental Greco-Roman and Persian ruins were one of the major tourist attractions in Syria prior to the present conflict. The Ancient Site of Palmyra gained its position of prominence through its location as the main stop for caravan trade from approximately 44 BC to 272 AD. Palmyra's grand colonnade is a 1,100m long Roman period street that connects a temple to the god Bel with the area known as the Camp of Diocletian. Other archaeological remains in the ancient city of Palmyra include an agora, theatre, urban quarters, and other temples that comprise what is generally considered by scholars to be the finest example of surviving Roman architecture in the Eastern Mediterranean. Four cemeteries outside the city wall are in an area known as the Valley of the Tombs. Also in the archaeological zone of Palmyra stands the Fakhr-al-Din al-Ma'ani Castle (also known as the Palmyra Castle or Qal'at ibn Mann). This heavy fortification dates to the 13<sup>th</sup> century and overlooks the rest of the site. The northern portion of Palmyra also hosts a modern camel racetrack. Palmyra was inscribed on the World Heritage List in 1980.<sup>19</sup>

The Ancient Site of Palmyra and its surrounding archaeological area have all sustained significant damage, as it has been caught in the middle of intense firefighting accompanied by extensive military occupation. Reports of looting and thefts in the Palmyra archaeological zone and thefts began in spring 2012 and continue.<sup>20</sup> By March 2013, the first reports of shelling damage to the site emerged<sup>21</sup> and around that same time were the first reports of snipers positioned in the Roman theater and in other standing ruins.<sup>22</sup> Throughout 2013, the Syrian military forces ramped up its efforts to control the area and used the site to house its equipment. Reports indicated the presence of rocket launchers and tanks inside the archaeological site.<sup>23</sup> As the Syrian Arab Republic Government (SARG)'s military forces gained ground, extensive defensive berm and road construction were reported throughout Palmyra.<sup>24</sup>

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<sup>19</sup> <http://whc.unesco.org/en/list/23>

<sup>20</sup> <http://www.dailystar.com.lb/Culture/Art/2012/Apr-06/169378-experts-sound-alarm-over-syria-archaeological-treasures.ashx#ixzz1rL7tZd6a>; <http://syria-today.com/index.php/life/20077-sos-for-a-precious-legacy>; [https://www.facebook.com/photo.php?fbid=358680730866924&set=a.168560016545664.36383.168536393214693&type=1&relevant\\_count=1&ref=nf](https://www.facebook.com/photo.php?fbid=358680730866924&set=a.168560016545664.36383.168536393214693&type=1&relevant_count=1&ref=nf); <http://english.alarabiya.net/en/News/2013/03/16/Syria-s-ancient-city-of-Palmyra-on-brink-of-destruction.html>

<sup>21</sup> <http://english.alarabiya.net/en/News/2013/03/16/Syria-s-ancient-city-of-Palmyra-on-brink-of-destruction.html>; [http://www.huffingtonpost.com/2013/04/03/temple-of-bel-damaged-syria\\_n\\_3005392.html](http://www.huffingtonpost.com/2013/04/03/temple-of-bel-damaged-syria_n_3005392.html); <http://www.youtube.com/watch?v=MqJrQ9-dKY8>

<sup>22</sup> <http://www.bubblews.com/news/373180-syrian-city-archaeological-site-palmyra-in-danger-of-collapse>

<sup>23</sup> <http://www.youtube.com/watch?v=EETpJkQt6tc&feature=youtu.be>; [https://www.facebook.com/photo.php?fbid=416115868495530&set=a.384545504985900.1073741827.324869057620212&type=1&relevant\\_count=1&ref=nf](https://www.facebook.com/photo.php?fbid=416115868495530&set=a.384545504985900.1073741827.324869057620212&type=1&relevant_count=1&ref=nf)

<sup>24</sup> <http://www.youtube.com/watch?v=sKWKWRPXFUc>; <http://www.youtube.com/watch?v=DrhMNng1fOAI>; <http://www.heritageforpeace.org/wp-content/uploads/2014/03/26-March-2014.pdf>; [http://www.nytimes.com/2014/04/17/world/middleeast/syrian-war-takes-heavy-toll-at-a-crossroad-of-cultures.html?\\_r=1](http://www.nytimes.com/2014/04/17/world/middleeast/syrian-war-takes-heavy-toll-at-a-crossroad-of-cultures.html?_r=1)

## Data

The current state of the Palmyra World Heritage Site was assessed using imagery from 2009 and 2014, as described in Table 4.

*Table 4: Palmyra imagery acquired*

Date	Sensor	Image ID
10 October 2009	WorldView-1	1020010009C60F00
8 March 2014	WorldView-2	103001002DAE2400

*All imagery acquired via DigitalGlobe, NextView license*

## Analysis

A comparison of imagery revealed that the site of Palmyra had been substantially altered from its pre-conflict state. New roads, flanked by earthen berms, were cut through the center of the Northern area of the Palmyra Archaeological Park, and groups of military vehicles were visible occupying fortified positions at that location, as well as at a parking area built atop the ancient city wall, which was destroyed by this construction (Figures 10-12). Comparing this imagery to video acquired by ground-based activists reveals that some of these vehicles are BM-21 Grad multiple launch rocket systems. Also confirmed by ground-based imagery was the construction of temporary structures adjacent to Fakhr-al-Din al-Ma'ani Castle, in the northwestern corner of the site (Figure 11). Additional earthen fortifications, though unoccupied at the time of image acquisition, were scattered throughout the site (Figures 10 and 12). The effect of this massive earth movement on the site's archaeological integrity is unknown, but appears to be substantial. Within the Roman barracks of Diocletian's camp the previously well-defined outlines of ancient ruins appear to have been softened, though the precise reason for this is unclear (Figure 12). Ground-based photos show that several walls at the site, formerly intact, have been demolished and their building materials strewn about, providing one possible explanation for the phenomenon (Figure 13).

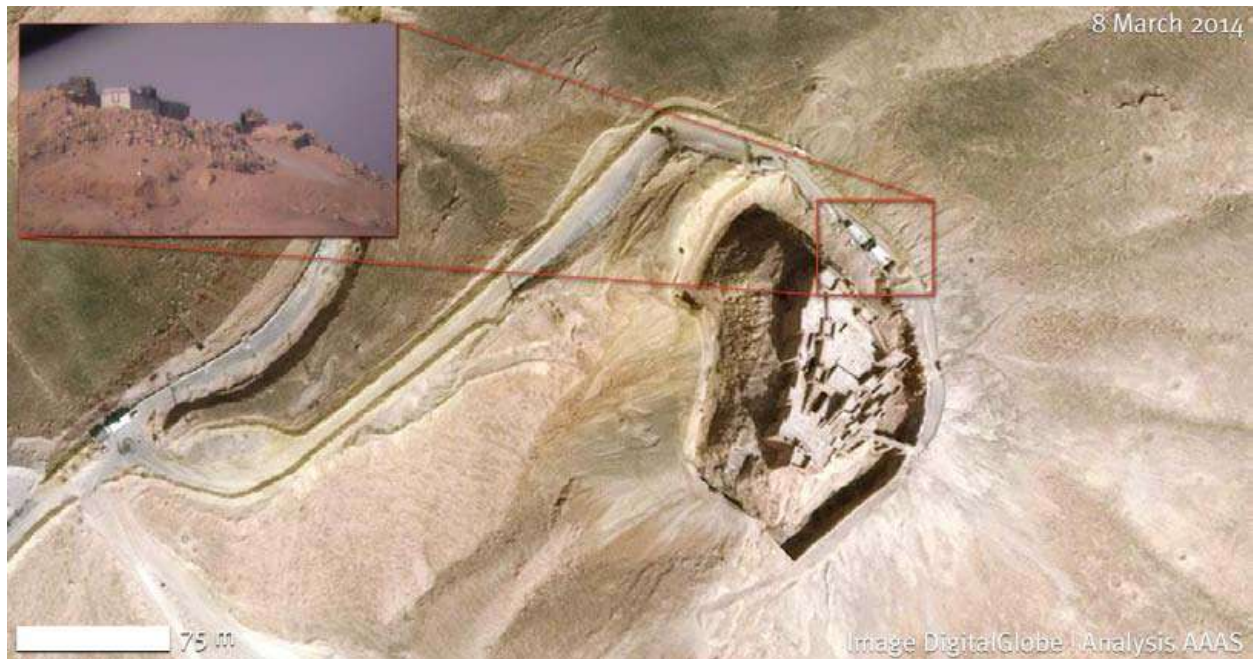
Figure 10: Disruptions in the Northern Section of the Palmyra Archaeological Park



Between 10 October 2009 (top) and 8 March 2014 (bottom), the northern section of the Palmyra Archaeological Park has been disrupted by the construction of a new road traversing the site, and numerous earthen berms (pink arrows), many of which are being used to provide cover for military vehicles (yellow arrows). Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 34.55N, 38.26E.



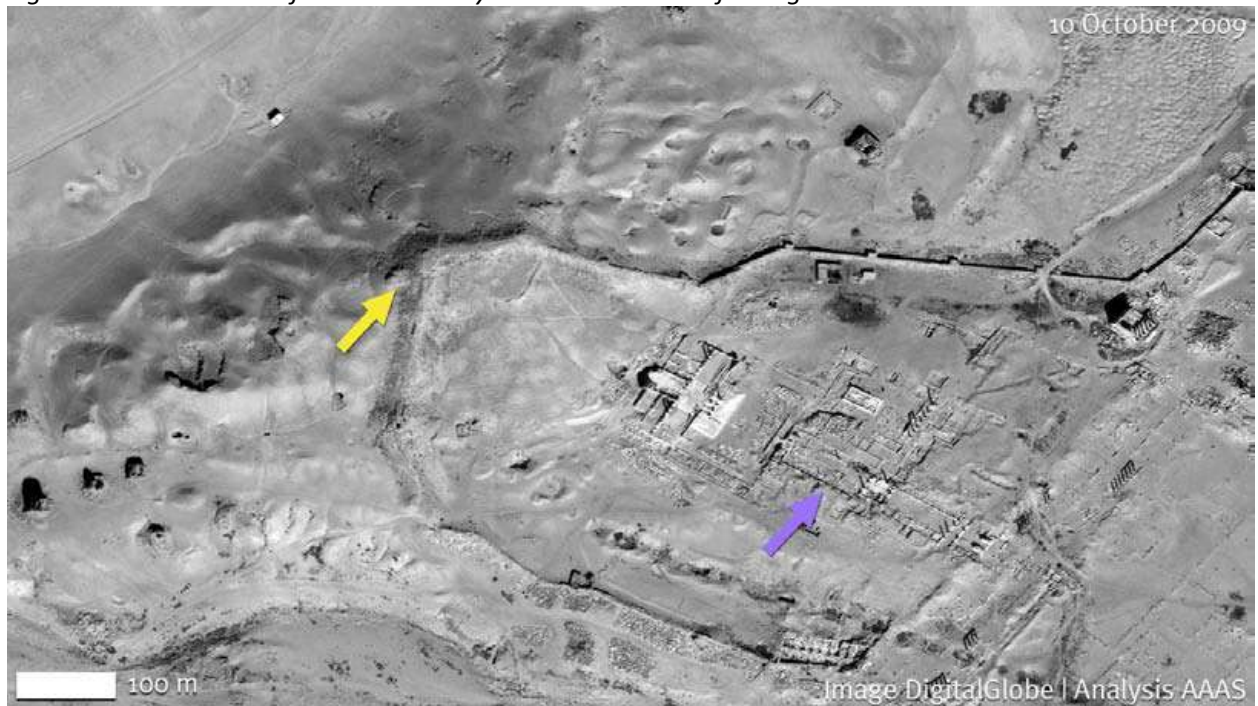
Figure 11: Trailers on the Fakhr-al-Din al-Ma'ani Castle



Between October 2009 (top) and March 2014 (bottom), the road leading to Fakhr-al-Din al-Ma'ani Castle has been reinforced with earthen berms, and two trailers have been emplaced near the citadel – an observation which corresponds to ground-based photographs (bottom, inset). Photo: Association for the Protection of Syrian Archaeology, August 2014 ([www.apsa2011.com](http://www.apsa2011.com)). Satellite images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 34.55N, 38.26E.



Figure 12: Destruction of the ancient city wall and terrain softening



The ancient city wall of Palmyra (yellow arrow) and the barracks of Diocletian's camp (purple arrow) are intact in October 2009 (top). By March 2014 (bottom), a portion of the wall has been destroyed for a military encampment (pink arrow), fortified by earthen berms (blue arrows), and the terrain in the camp has softened. Images ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 34.55N, 38.26E.

*Figure 13: Ground view of possible causes of terrain softening*



*Photo: Association for the Protection of Syrian Archaeology, August 2014 (www.apsa2011.com)*

## **5. Ancient Villages of Northern Syria**

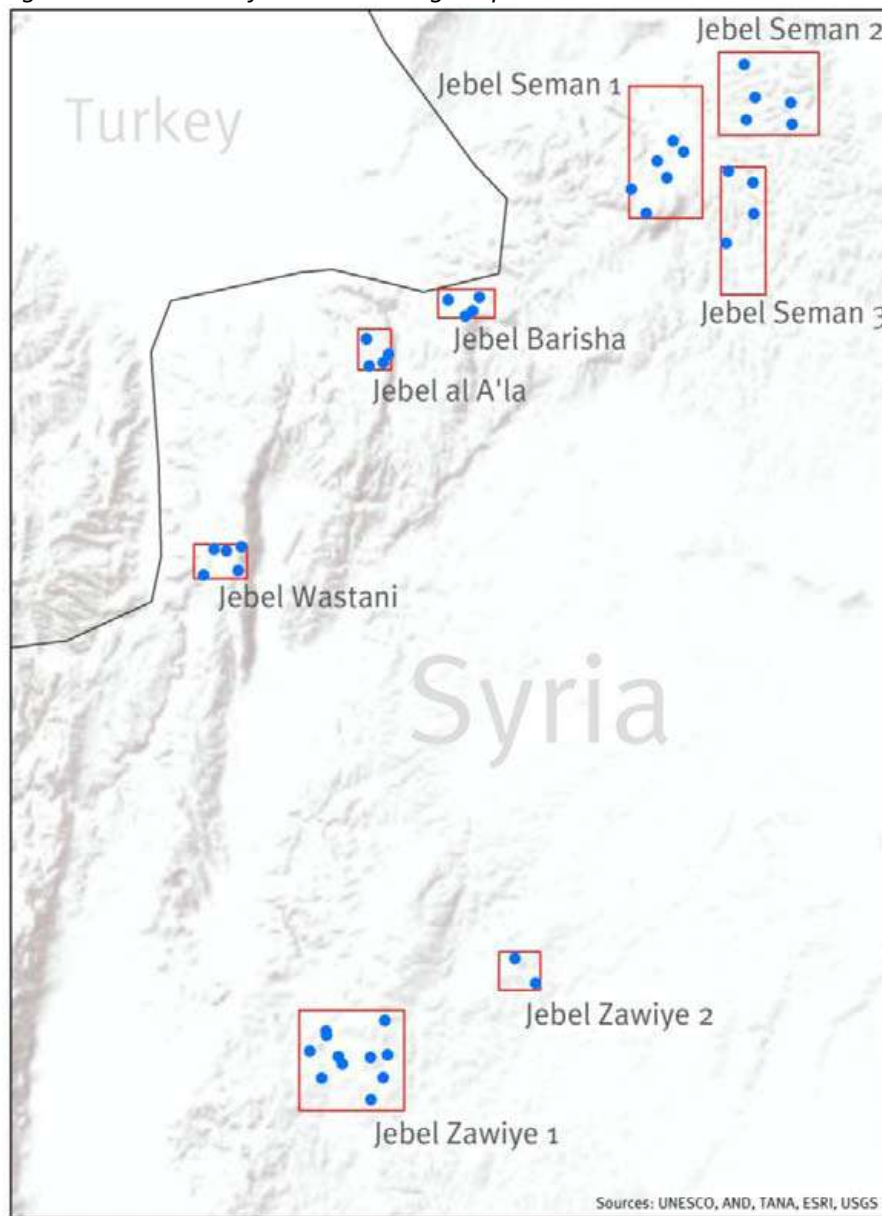
### *Overview*

The Ancient Villages of Northern Syria, also known as the “Dead Cities,” are archaeological parks in northwestern Syria. This cultural landscape is marked by an abundance of standing archaeological ruins that date primarily to the Late Antique and Byzantine periods (approximately the 1<sup>st</sup>-7<sup>th</sup> centuries). Inscribed on UNESCO’s World Heritage List in 2011, this cultural heritage site is comprised of eight parks (Jebel al A’la, Jebel Barisha, Jebel Seman 1, Jebel Seman 2, Jebel Seman 3, Jebel Wastani, Jebel Zawiye 1, and Jebel Zawiye 2), and these include forty individual village sites.<sup>25</sup> Altogether, the sites within these park boundaries and additional sites in surrounding areas outside the boundaries total nearly 180. Analysis was limited by the availability of recent imagery, and as a result, the archaeological parks of Jebel Zawiye 1, Jebel Zawiye 2, and the sites outside the World Heritage site were not included in this study. When new imagery becomes available, AAAS will update these sites and analyze the full extent of the Dead Cities, not only those within the World Heritage site boundaries.

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<sup>25</sup> <http://whc.unesco.org/en/list/1348/>

Figure 14: Location of the archaeological parks included in the Ancient Cities of Northern Syria



Map: AAAS

A significant risk for the Dead Cities is their proximity to contested areas. Bab al-Hawa is a major border crossing between Syria and Turkey and the entry point for supplies to armed combatants throughout Syria. According to news reports, these supplies were stored in warehouses at the nearby Byzantine site of Babisqa in the Jebel Barisha World Heritage archaeological park. In December 2013, a firefight took place in the area, resulting in damage to the site and military force buildup in the surrounding area of the archaeological park.<sup>26</sup> It is

<sup>26</sup> <http://www.apsa2011.com/index.php/en/provinces/idlib/sites/770-idleb-villes-antiques-du-nord-de-la-syrie-destruction-des-monuments-byzantins-a-babisqa-2.html>;  
<http://carnegieendowment.org/syriaincrisis/?fa=53896&reloadFlag=1>



important to note that not all damage is visible in high-resolution satellite imagery, and the many reports of looting at these archaeological parks cannot be verified through this analysis. Affiliated ground assessments of this type of damage are ongoing (Figure 15).

In northwestern Syria, there is particular concern over the status and condition of internally displaced persons (IDPs). Established Syrian IDP camps have been analyzed with satellite imagery through UNITAR;<sup>27</sup> however, no work to date has documented the extent of the displacement crisis outside of established camps. The World Heritage archaeological parks in this region have been broadly reported to be housing IDPs as well as armed combatants. The Jebel Seman 1-3 parks are the closest to Aleppo, and, as the conflict in Aleppo intensified, IDPs and rebel groups have passed through or set up camp in the archaeological park.

Jebel Zawiye 1 and 2 have seen an influx of IDPs due to the impact of major fighting nearby at Maarat al-Numan beginning in October 2012. Maarat al-Numan is a strategically significant town located on the highway between Damascus and Aleppo. Rebels seized the town on 9 October 2012, followed by heavy fighting and raids by government jets.<sup>28</sup> On 14 April 2013, the Syrian Army broke the siege of the military compounds outside of Maarat al-Numan and heavy fighting engulfed the area.<sup>29</sup> Since that time fighting in the region has escalated,<sup>30</sup> and many international news sources have reported that IDPs who fled the violence in the vicinity of Maarat al-Numan are living inside ancient tombs and among the ruins of the Dead Cities.<sup>31</sup>

As part of this study, a review was undertaken of IDPs across the archaeological parks of the Ancient Villages of Northern Syria World Heritage site and the broader Dead Cities region. The results will not be detailed in this report. Upon examination of the findings and after consultations with humanitarian aid organizations, this project's investigators have determined that discussing the spatial distribution of IDPs would place them at undue risk for harm. This portion of the study will be made available to humanitarian organizations upon request.

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<sup>27</sup> [www.unitar.org/unosat/maps/108](http://www.unitar.org/unosat/maps/108)

<sup>28</sup> <http://www.aljazeera.com/news/middleeast/2012/10/2012109224646736885.html>;

<http://www.bbc.com/news/world-europe-19972456>;

<http://www.aljazeera.com/video/middleeast/2012/11/20121126155755269939.html>

<sup>29</sup> [http://www.nytimes.com/2013/04/16/world/middleeast/assad-loyalists-breach-rebels-blockade-of-military-bases.html?\\_r=0](http://www.nytimes.com/2013/04/16/world/middleeast/assad-loyalists-breach-rebels-blockade-of-military-bases.html?_r=0); [understandingwar.org/backgrounder/syria-update-regime-breaks-siege-wadi-al-deif](http://understandingwar.org/backgrounder/syria-update-regime-breaks-siege-wadi-al-deif)

<sup>30</sup> [http://syriahr.com/en/index.php?option=com\\_news&nid=2408&Itemid=2&task=displaynews](http://syriahr.com/en/index.php?option=com_news&nid=2408&Itemid=2&task=displaynews) - .VBT3c8Z5-LE

<sup>31</sup> [www.npr.org/2013/03/08/173788537/displaced-syrians-find-shelter-in-ancient-dead-cities](http://www.npr.org/2013/03/08/173788537/displaced-syrians-find-shelter-in-ancient-dead-cities);  
[www.clovekvtisni.cz/en/articles/people-in-need-has-helped-almost-100-000-syrians-refugees-in-idlib-provided-with-shelter-blankets-and-food](http://www.clovekvtisni.cz/en/articles/people-in-need-has-helped-almost-100-000-syrians-refugees-in-idlib-provided-with-shelter-blankets-and-food); [www.cbsnews.com/news/syrian-refugees-fight-for-survival-in-dead-cities/](http://www.cbsnews.com/news/syrian-refugees-fight-for-survival-in-dead-cities/)

*Figure 15: Ground photos of a tomb from the site of Al Bara in the Jebel Zawiya Archaeological Park*



*Ground photos of a tomb from the site of Al Bara in the Jebel Zawiya archaeological park illustrate looting that is not visible in satellite imagery. Source kept anonymous for protection. Distributed by Le patrimoine archéologique syrien en danger (PASD), 2013.*

## Jebel al A'la - Ancient Villages of Northern Syria

### Data

Table 5: Jebel al A'la imagery acquired

Date	Sensor	Image ID
7 July 2011	WorldView-2	103001000CBEB900
16 June 2014	WorldView-2	1030010031301900

All imagery acquired via DigitalGlobe, NextView license

Two images of the Jebel al A'la Ancient Village Park were acquired and analyzed (Table 5). The first, from 7 July 2011, was captured prior to the start of major fighting. The second, from 16 June 2014, was the most recent image available at the time of analysis. Analysis of the imagery did not reveal any damage to archeological sites within the Park. In addition, only a small number of new structures in the Park were observed. These new structures were primarily near existing settlements, with none were constructed on or near archeological sites.

## Jebel Barisha - Ancient Villages of Northern Syria

### Data

Table 6: Jebel Barisha imagery acquired

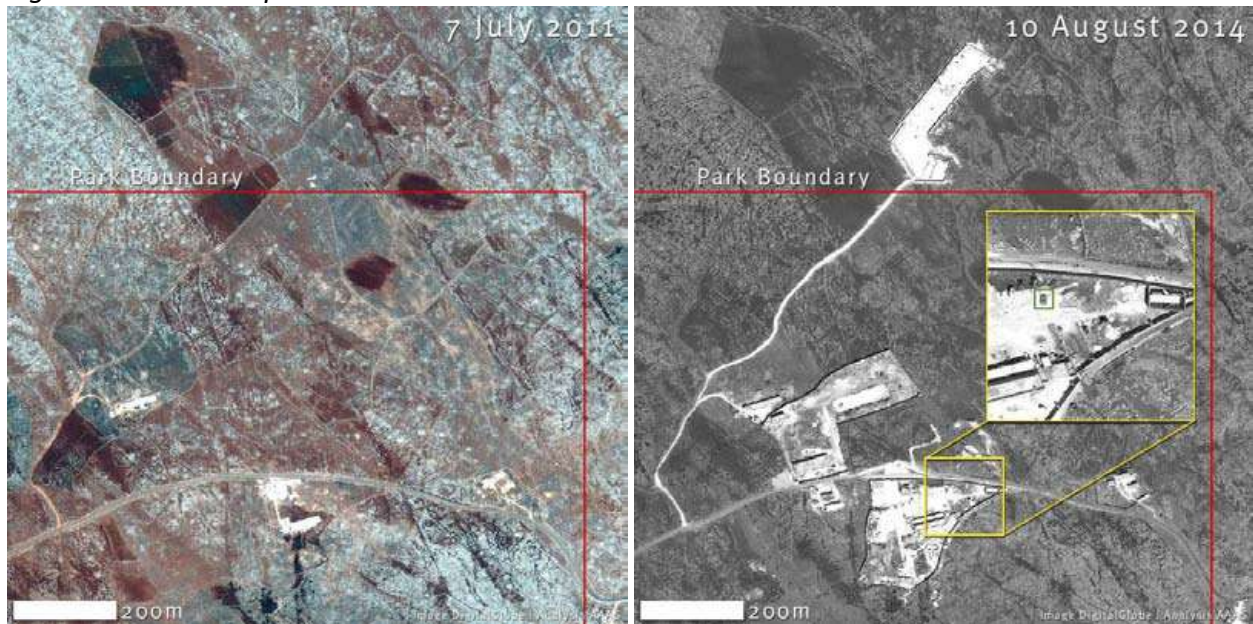
Date	Sensor	Image ID
7 July 2011	WorldView-2	103001000CBEB900
17 July 2013	WorldView-2	1030010024C92A00
7 September 2013	WorldView-2	1030010026478400
6 February 2014	WorldView-2	103001002C91FC00
23 March 2014	WorldView-2	102001002D506400
23 May 2014	WorldView-2	1030010031405100
10 August 2014	WorldView-1	1020010032BDC900

All imagery acquired via DigitalGlobe, NextView license

Two images of the Jebel Barisha Ancient Village Park were initially acquired and analyzed. The first was captured on 7 July 2011, and shows the park at the start of the Syrian civil war. The second, captured on 10 August 2014, was the most recent image available at the time of analysis. Analysis of the two initial images revealed the creation of three compounds: two within the Park boundaries and one just outside the park (Figure 16). An armored vehicle was observed at one of the compounds, suggesting a military function. Six additional images between 23 March 2013 and 23 May 2014, were acquired to further investigate these compounds.



*Figure 16: New compounds at Jebel Barisha*



Three new compounds were constructed between 7 July 2011 (left) and 10 August 2014 (right). An armored vehicle (green square) was observed at one compound inside the park boundary Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.21N, 36.67E.

Construction of the compounds was underway by 17 July 2013 and appears to have been completed by 6 February 2014. It involved the construction of two compounds in the southern area and one in a northern location (Figure 17). Heavy vehicles were observed at the southern two compounds, but the only distinctly military equipment observed was the armored vehicle present on 10 August 2014.

*Figure 17: Construction of the three compounds*

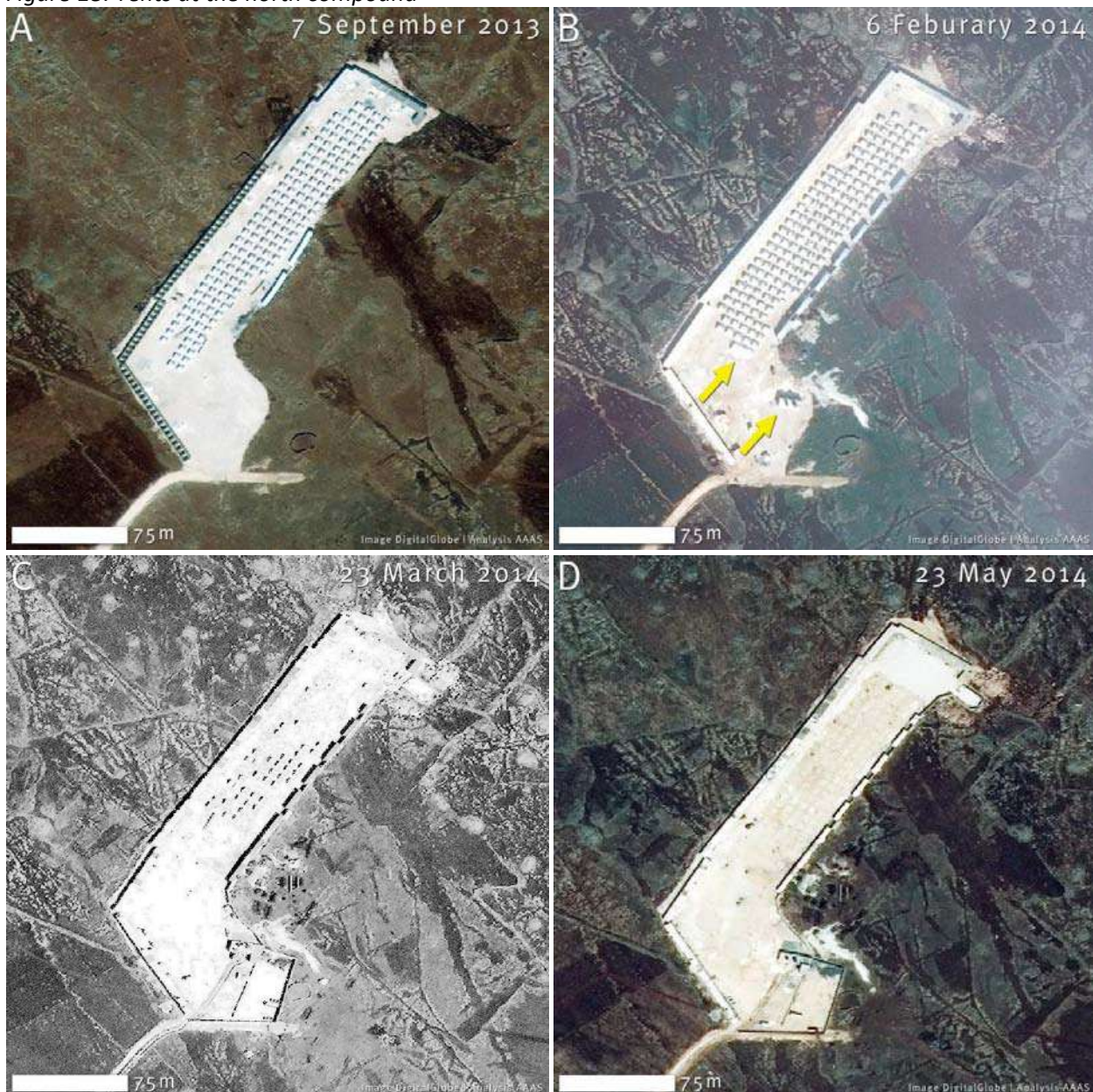


Construction on all three compounds had begun by 17 July 2013 (yellow arrows, left) and was completed by 6 February 2014 (right). Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.21N, 36.67E.



At the northern compound, 148 structures, possibly tents, were observed on 7 September 2013. The structures had dimensions of approximately 4x4m and were laid out in orderly rows, which suggest a military purpose. By 6 February 2014, the tents had been rearranged slightly, and nine new tents were present, bringing the total to 157. In addition, two larger structures had been added. By 23 March 2014, only 39 tents remained at the site and all had been removed by 23 May 2014 (Figure 18).

*Figure 18: Tents at the north compound*

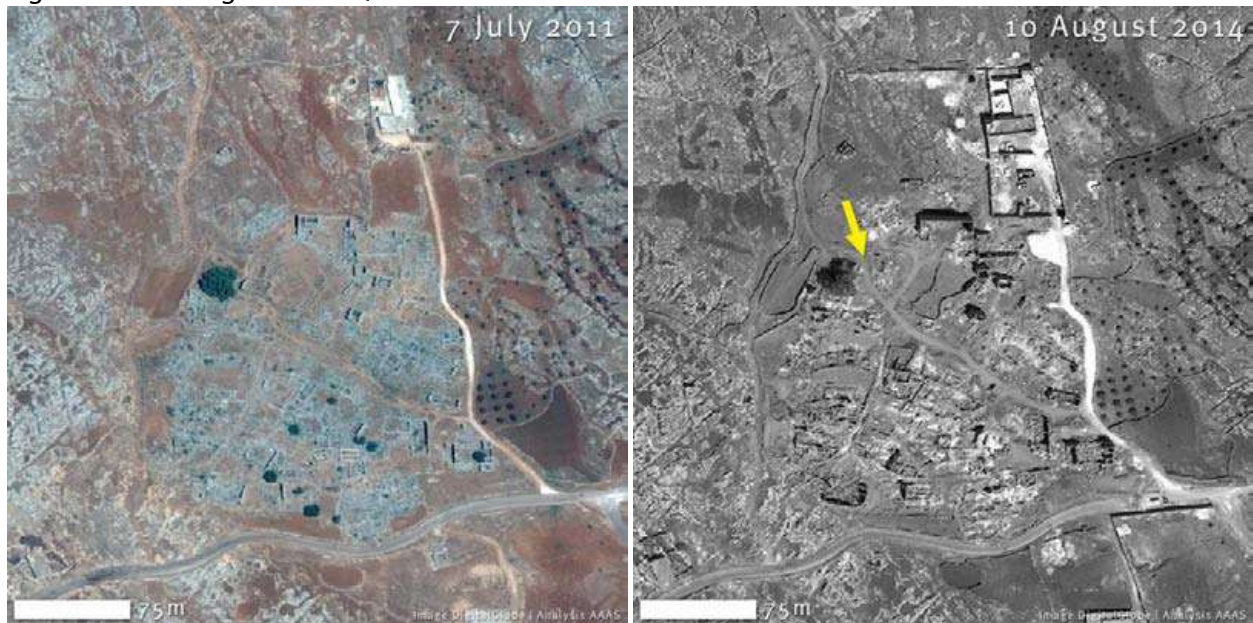


On 7 September 2013 (A), 148 tents were observed at the north compound. By 6 February 2014 (B), the tents had been rearranged slightly and two larger structures had been added (yellow arrows). On 3 March 2013 (C) only 39 tents were present and all had been removed by 23 May 2014 (D). Image ©2014, DigitalGlobe, NextView License / Analysis AAAS. Coordinates: 36.22N, 36.67E.



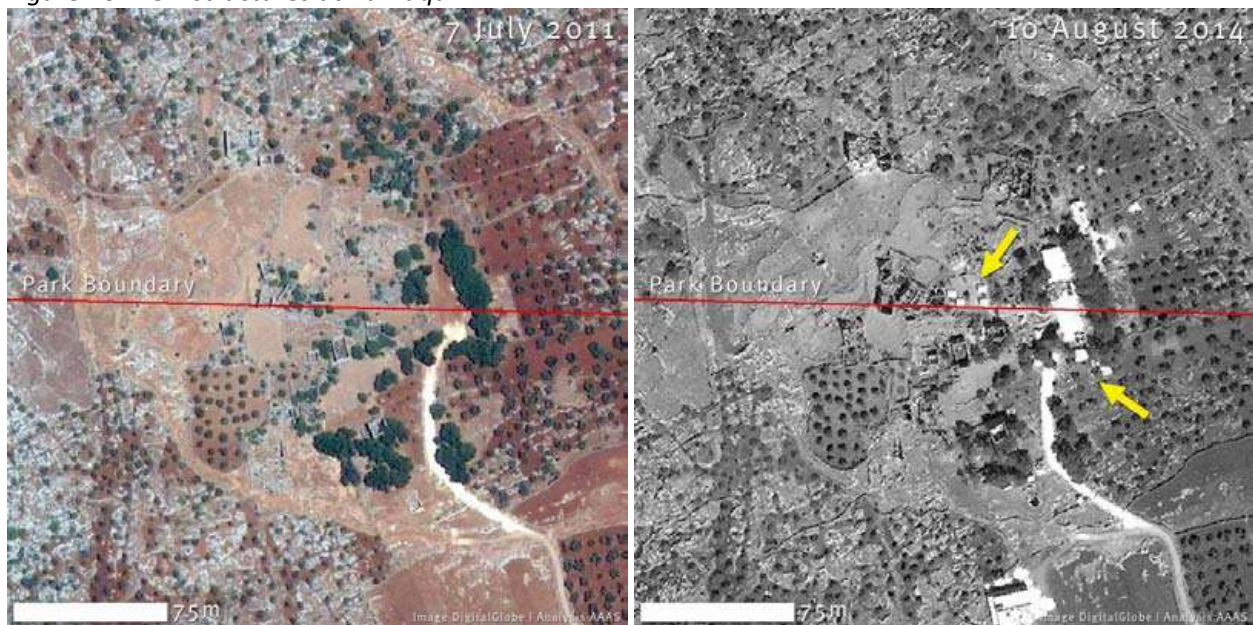
In addition to the construction of military compounds in and around the park, damage to two archeological sites was observed. At the ancient village site of Dar Qita, standing ruins were knocked down to make way for a new road (Figure 19). New structures were also observed within the site of Bamuqa (Figure 20). Bamuqa straddles the park boundary, but new structures were observed on both sides of the boundary.

*Figure 19: Damage to Dar Qita*



Between 7 July 2011 (left) and 10 August 2014 (right), a standing ruin was knocked down to make way for a new road (yellow arrow). Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.21N, 36.66E.

*Figure 20: New structures at Bamuqa*



Multiple tents (yellow arrows) appear at Bamuqa between 7 July 2011 and 10 August 2014. Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.20N, 36.63E.



## Jebel Seman 1 - Ancient Villages of Northern Syria

Two images of the Ancient Village Park of Jebel Seman 1 were acquired and analyzed (Table 7). The first, captured on 1 November 2010, shows the Park prior to the outbreak of the Syrian civil war. The image captured on 26 August 2014 was the most recent image available at the time of analysis. Analysis of the Park revealed new structures on or near several archeological sites. In addition, at one site, Takleh, a road had been constructed near the site leading to what appears to be a small quarrying operation. A similar phenomenon was observed within both the Jebel Seman 2 and Jebel Seman 3 at a larger scale. As a result, this will be discussed in greater detail in those sections.

### Data

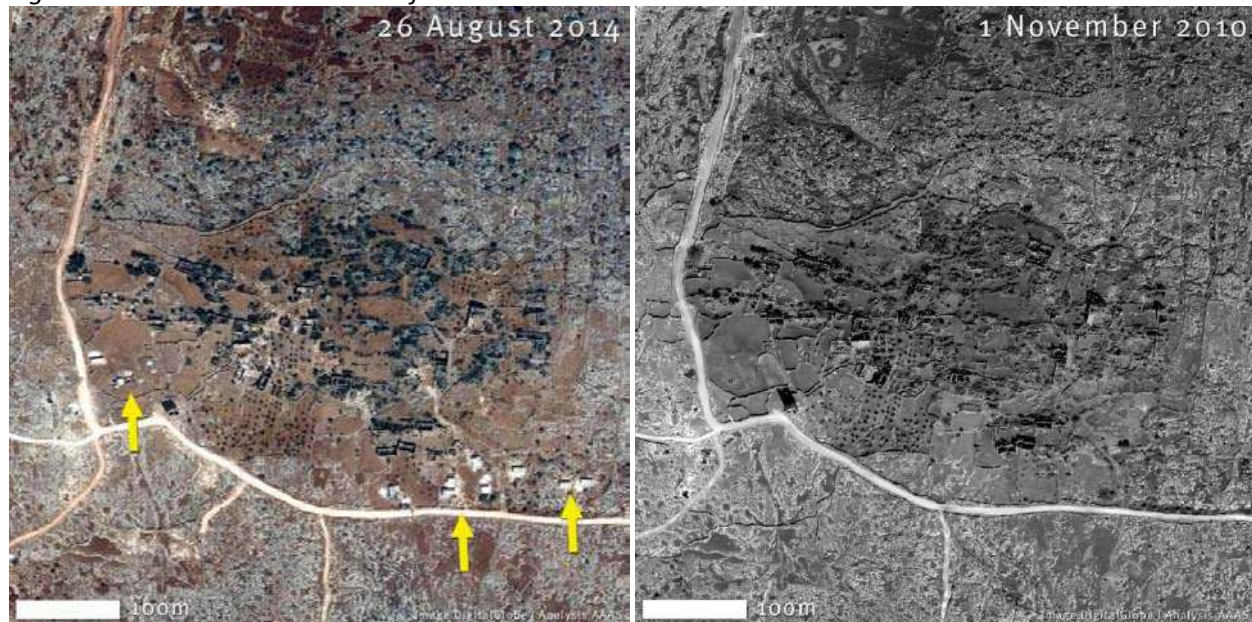
Table 7: Jebel Seman 1 imagery acquired

Date	Sensor	Image ID
1 November 2010	WorldView-1	207001009DB3B100
26 August 2014	WorldView-2	1030050033F8A600

All imagery acquired via DigitalGlobe, NextView license

In addition to the damage to Takleh, new structures were observed on and near archeological sites. At the Dead City site of Refade, multiple tent-like structures were observed within the ruins (Figure 21). Several new structures were also observed near the town of Deir Semaan. The town is situated between archeological sites. Between 1 November 2010 and 26 August 2014, structures were built on, or in close proximity to, some of these sites (Figure 22). Finally, a tent-like structure was erected inside the walls of the Basilica of Saint Simeon (Figure 23).

Figure 21: New structures near Refade



Multiple new structures (yellow arrows) appear between 1 November 2010 (left) and 26 August 2014 (right). Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.31N, 36.82E.



*Figure 22: New structures at Deir Semaan*



Multiple new structures appear between 1 November 2010 (left) and 26 August 2014 (yellow arrows, right). Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.21N, 36.83E.

*Figure 23: New structure within the Basilica of Saint Simeon*



A tent-like structure (yellow arrow) was observed within the Basilica of Saint Simeon on 26 August 2014 (right). Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.33N, 36.84E.



## Jebel Seman 2 - Ancient Villages of Northern Syria

### Data

Table 8: Jebel Seman 1 imagery acquired

Date	Sensor	Image ID
1 November 2010	WorldView-1	207001009DB3B100
3 July 2014	WorldView-2	102001002F790A00

All imagery acquired via DigitalGlobe, NextView license

The archaeological features of the site consist of several foundation clusters spread across an area of approximately 80 km<sup>2</sup>, the western boundary of which is located two kilometers to the east of “Jebel Seman 1.” As was the case at the Jebel Seman 1, this site shows evidence of substantial mining activity between 2010 and 2014, with areas of previously undisturbed rock removed and pushed aside, while new access roads were constructed to enable access to the existing transportation network. The establishment of these extractive industries was observed to have taken place in close proximity to ancient foundations (Figure 24). Several modern villages also exist within the boundaries of the Jebel Seman 2 archaeological park. Between 2010 and 2014, a small number of new structures were erected on the periphery of these settlements; however, due to their small number, this development most likely represents regular population expansion.

Figure 24: Mining activity in close proximity to ancient city



Between 2010 (left) and 2014 (right), mining activity (yellow arrow) has taken place directly adjacent to Kafr Nabo, an archaeological site inside the Jebel Seman 2 World Heritage Site (red arrows). Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 36.35N, 36.91E.



### Jebel Seman 3 - Ancient Villages of Northern Syria

Jebel Seman 3 encompasses a 4.5 km x 12.5 km strip of territory oriented along a north-south axis. The northern edge is approximately three kilometers south of Jebel Seman 2. As at Jebel Seman 1 and 2, new roads and earthmoving activity consistent with mining activities were observed. Available evidence suggests that, while the disturbed areas have expanded, the extractive activity itself pre-dates the present conflict. No unambiguous signs of damage related to the current conflict were observed at this site.

### Jebel Wastani - Ancient Villages of Northern Syria

#### *Data*

*Table 9: Jebel Wastani imagery acquired*

Date	Sensor	Image ID
5 December 2010	WorldView-1	2070011E75891900
15 July 2014	WorldView-1	1020010032B8E200

*All imagery acquired via DigitalGlobe, NextView license*

Two images of Jebel Wastani were acquired and analyzed (Table 9). The first, captured on 5 December 2010, shows the park before the start of the conflict. The second, from 15 July 2014, was the most recent image available at the time of analysis. Analysis of the imagery did not reveal any damage to archeological sites within the park. Only a small number of new structures were observed within the park during this time period. These were primarily near existing settlements and not constructed on or near archaeological sites.

### 6. Crac des Chevaliers and Qal'at Salah El-Din

#### *Overview*

Located on high ridges, these two castles are in key defensive positions and represent the best-preserved examples of Crusader fortification architecture. These sites are, therefore, known as Crusader castles, but their still-standing architectural elements date from the Byzantine through Islamic periods. Crac des Chevaliers is also known as Qal'at al-Hosn, and originally dates to the 11<sup>th</sup> century. It was first called the Castle of the Kurds. Crac des Chevaliers was rebuilt by the Hospitaller Order during the Crusader period and again in the late 13<sup>th</sup> century by the Mamluks. The Qal'at Salah El-Din, also known as the Fortress of Sayun or Chateau de Saone, originally dates to the 10<sup>th</sup> century, was rebuilt in 12<sup>th</sup> century, and added to in the late 12<sup>th</sup> to mid-13<sup>th</sup> century. Although it is less well preserved than Crac des Chevaliers, its Byzantine through Ayyubid period architectural elements are still visible.<sup>32</sup>

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<sup>32</sup> <http://whc.unesco.org/en/list/1229>

Reports of damage to Crac des Chevaliers and violence in the surrounding region have been plentiful. As early as May 2012, there were reports of gunmen at the castle.<sup>33</sup> By July 2012, Free Syrian Army fighters were reported to be using the site, and, in response, the Syrian military shelled the castle, including the historic chapel.<sup>34</sup> Airstrikes on Crac des Chevaliers were reported in January 2013,<sup>35</sup> May 2013,<sup>36</sup> July 2013,<sup>37</sup> and March 2014,<sup>38</sup> and the shelling continued and intensified until the World Heritage site was captured by the Syrian Arab Republic Government's military forces on 20 March 2014.<sup>39,40,41</sup> In contrast, there are no currently known reports of damage at Qal'at Salah El-Din.

#### Data

The Crac des Chevaliers World Heritage site was imaged on three dates, as shown in Table 10.

#### Data

*Table 10: Crac des Chevaliers imagery acquired*

Date	Sensor	Image ID
3 December 2008	WorldView-1	2070011E729D9800
26 September 2013	WorldView-1	1020010025D44A00
26 October 2013	WorldView-2	103001002A203400

*All imagery acquired via DigitalGlobe, NextView license*

Qal'at Salah El-Din, northwest of Crac des Chevaliers, was analyzed using the imagery described in Table 11.

#### Data

*Table 11: Qal'at Salah El-Din imagery acquired*

Date	Sensor	Image ID
1 November 2010	WorldView-1	102001000E540000
8 July 2014	WorldView-2	1030050030F8D400

*All imagery acquired via DigitalGlobe, NextView license*

<sup>33</sup> <http://www.foxnews.com/world/2012/05/01/syria-cultural-treasures-latest-uprising-victim/>

<sup>34</sup> <https://www.youtube.com/watch?v=xmOIQFlqNw>; <http://www.youtube.com/watch?v=jlgrE9daT8E>;

<http://www.youtube.com/watch?v=2MWNQROy75g>;

<http://www.independent.co.uk/opinion/commentators/fisk/robert-fisk-syrias-ancient-treasures-pulverised-8007768.html>

<sup>35</sup> <http://thelede.blogs.nytimes.com/2013/01/04/video-shows-airstrikes-near-crusader-castle-in-syria/>

<sup>36</sup> [http://seattletimes.com/html/nationworld/2020930227\\_syriacastlesxml.html#.UYgWxOtgTDU.facebook](http://seattletimes.com/html/nationworld/2020930227_syriacastlesxml.html#.UYgWxOtgTDU.facebook)

<sup>37</sup> <http://www.dailystar.com.lb/News/Middle-East/2013/Jul-13/223560-syrias-famed-crusader-fort-hit-in-air-raid.ashx#axzz2YwAUdsSk>

<sup>38</sup> <https://www.youtube.com/watch?v=IXQ5NzPJg-8&feature=youtu.be>

<sup>39</sup> <http://www.wmf.org/slide-show/conditions-crac-des-chevaliers-syria-2009%E2%80%932014>

<sup>40</sup> <http://www.news.va/en/news/asiasyria-violence-and-death-in-the-valley-of-the>

<sup>41</sup> <http://www.wmf.org/slide-show/conditions-crac-des-chevaliers-syria-2009%E2%80%932014>

### *Analysis*

Crac des Chevaliers appears to have sustained moderate structural damage. Its southeast tower has sustained damage measuring approximately 6m across, with an associated debris apron upon the lower parts of the structure. Three additional craters are visible on the northern areas of the castle, although, unlike the impact on the south tower, none of these appear to have penetrated the roof (Figure 25). At Qal'at Salah El-Din, no damage to the structure was apparent, although a single structure, which may have been temporary, was observed to have disappeared from the car park between 2010 and 2014.



Figure 25: Visible damage to Crac des Chevaliers



Between 2008 and 2013, a number of craters (yellow arrows) have appeared at Crac des Chevaliers, one of which appears to have breached the roof of the south turret. Image ©2014, DigitalGlobe, NextView License | Analysis AAAS. Coordinates: 34.75N, 36.29E.

## Conclusion

The findings documented in this report by the AAAS Geospatial Technologies and Human Rights Project aimed to reveal the status of the six Syrian World Heritage sites using pre-conflict imagery coupled with the most recently collected high-resolution satellite images available. This analysis of high-resolution satellite imagery shows that five of the six Syrian World Heritage sites have sustained visible damage since the start of the conflict, with the Ancient City of Damascus being the only site without visible damage. It is important to note that there are forms of damage that are not visible from space, due to a variety of reasons, including limited sensor resolution; such as; the layout of the sites, particularly in urban areas; and the materials employed for construction (for discussion of these issues, refer to previous reports by AAAS on the Syrian conflict).<sup>42</sup> It is, therefore, possible that damage visible at ground level is not reflected in this analysis simply because it was not visible in the satellite imagery. Despite the difficulties associated with image analysis of damage, evidence found that largely corroborates reports of damage from a variety of sources, ranging from traditional and social media to on-the-ground reporting.

Major findings of this report include the documentation of many instances of visible damage to cultural heritage sites. In Aleppo, massive destruction is obvious throughout the city, and especially within the World Heritage site of the Ancient City. The destroyed structures documented in the report include historic mosques and madrasahs, government buildings, and civilian structures, such as the Great Mosque of Aleppo; the nearby Suq al-Madina; the Grand Serail of Aleppo; the Hammam Yalbougha an-Nasry; the Khusruwiye Mosque; the Carlton Citadel Hotel; and the Khan Qurt Bey caravanserai, in addition to a vast number of historic buildings in the area north of the citadel. At the Ancient City of Bosra there was a different degree and type of damage than what was observed in Aleppo, with a newly constructed fortified vehicle track through an archaeological area observed, as well as a number of probable shell craters within the Ancient City and damage to the Al-Omari Mosque within the border of the World Heritage site. No damage in the Ancient City of Damascus was visible in the available imagery, although reports indicate that some damage has occurred. The site of Palmyra had been substantially impacted by the conflict. Earthen fortifications are scattered throughout, damaging a vast portion of the site. The Roman barracks of Diocletian's camp were also damaged. New roads flanked by earthen berms have been cut throughout the site, with military vehicles inside fortified positions, including one fortification built atop the ancient city wall. There are also new defensive structures adjacent to the Fakhr-al-Din al-Ma'ani Castle. The Ancient Villages of Northwestern Syria comprise the largest area analyzed in this report, and results point to significant and unique damage at specific sites, but not to the entire site. In the Jebel Barisha Ancient Village Park, there are three new military compounds: two within the park boundaries and one just outside the park. Heavy vehicles and an armored vehicle were observed in these compounds and, in addition, at one point the northern compound contained 148 structures, possibly tents. New construction also damaged the ancient village site of Dar Qita and Bamuqa. In the Ancient Village Park of Jebel Seman 1, new structures were observed

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<sup>42</sup> <http://www.aaas.org/aleppo> ; [http://www.aaas.org/aleppo\\_retrospective](http://www.aaas.org/aleppo_retrospective)

on or near several archeological sites. At Takleh, a road and quarrying operation have been constructed. At Refade and Deir Semaan, tent-like structures were observed within the ruins. Damage in the Jebel Seman 2 Ancient Village Park consisted primarily of substantial mining activity and new road construction. No signs of damage were observed inside the Ancient Village Parks of Jebel Seman 3 and Jebel Wastani. Finally, this analysis found that Crac des Chevaliers appears to have sustained structural damage with multiple craters visible in the imagery of the site. No damage is visible to the structure was At Qal'at Salah El-Din.

The AAAS Geospatial Technologies and Human Rights Project produced this overview report of the Syrian World Heritage sites as the first in a series of reports that will examine damage to cultural heritage sites throughout the country, as well as assess risk factors for further damage. This series of AAAS reports will comprise the geospatial analysis portion of a larger project undertaken in partnership with the PennCHC and the Smithsonian Institution that documents current conditions and future preservation needs in Syria. The geospatial analysis for this project aims to contribute the verification and review of ground reports as well as new data observed during the AAAS analysis.

Future analysis by AAAS will examine each individual World Heritage site to verify timelines constructed from the various reporting sources noted above by acquiring multiple satellite images. This analysis will provide further detail on the timing of damage observed in this report. The aim is to create a record of damage to each site, which will aid in a better understanding of how heritage destruction is implicated in the trajectory of these types of conflicts and will enable U.S. policymakers and other humanitarian agencies working in conflict zones to design more effective interventions.