# Four Years of Human Suffering

## The Syria conflict as observed through satellite imagery

United Nations Institute for Training and Research

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50 more years of human empowerment

UNOSAT

# PREFACE

During the last four years UNOSAT has documented a wide range of dramatic events directly linked to the impact on civilian life and the corresponding human suffering the people of Syria has endured and still face today. These research findings have been provided to the requesting UN sister agencies since the onset of the Syria conflict.

The complex situation the people of Syria is facing today includes atrocities reportedly carried out by all sides of the conflict, including government forces, local opposition forces and numerous factions of foreign fighters, including Da'esh. Trapped in the middle of all this fighting is a civilian population trying to survive under conditions of extreme hardship. The terrible conditions that children, elderly, women and men are faced with are clearly observed in the satellite imagery UNOSAT has used in this study. Over 3.7 million Syrians have fled the country to neighbouring states, including Egypt, Iraq, Jordan, Lebanon and Turkey, while as many as 6.5 million are displaced inside Syria.[1] Over 220,000 have been reported killed[2] and over one million wounded.[3]

The methodology used by UNOSAT in this study is the same as recently published following the 2014 Gaza conflict and the special report on damage to cultural heritage sites in Syria: Commercially available satellite imagery are collected over specific areas of interest at various time intervals. In the case of Syria, this allows for direct comparison of imagery taken before the conflict started in March 2011 with imagery taken during the ongoing conflict. UNOSAT's analysts are using standard scientific methods to document in detail the observed damage, which is in turn entered into a geographic database for further analysis, mapping and reporting. It is important to note that the satellites used collect impartial information over areas with little or no access by the international humanitarian community. Hence, this information-source is fundamental to provide unbiased information about what goes on in the conflict affected areas.

As this report clearly shows, we have observed dramatic instances of reprisal, increasing number of deaths, indiscriminate attacks on civilian population, including barrel bombing, areas besieged by different opponents in the conflict, destruction of schools, hospitals, residential areas, markets, power plants and the vast cultural heritage of Syria. We have used satellite imagery to assist in the planning, building and monitoring of refugee camps the size of cities. Internally displaced people have been located in the satellite imagery in order to facilitate delivery of life saving humanitarian relief. Over the last year, UNOSAT has provided regular updates to the UN Office for the Coordination of Humanitarian Affairs related to monitoring of UN Security Council resolution 2139 on humanitarian access to the civilian population. Detailed damage assessments have been carried out through the REACH Initiative and widely shared with the humanitarian community. UNOSAT has also collaborated with the World Bank to document damage to residential areas in contribution to future reconstruction planning. The power of satellite imagery is today used for many aspects related to the humanitarian crisis in Syria.

This report is our contribution to the United Nations repeated calls to put an end to the hostilities in Syria and the need to find a political solution to a highly complex situation.

Geneva, March 2015

**Einar Bjørgo**
Manager, UNOSAT

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1   Source: https://data.unhcr.org/syrianrefugees/regional.php
2   Source: http://www.un.org/apps/news/story.asp?NewsID=50306#.VQYIHk10zIU
3   Source: http://www.reuters.com/article/2014/12/19/us-mideast-crisis-health-idUSKBN0JX0V720141219

# FOREWORD

UNOSAT has been playing an important role in humanitarian and development work since it began its rapid mapping service twelve years ago. It provides essential information on humanitarian crises that enables us to deliver aid more quickly to more people, and plays a critical role in the Early Recovery, Shelter and Telecommunications clusters. UNOSAT's maps and photographs often tell the story of a natural disaster or emergency far better than words could do.

Since the start of the war in Syria, UNOSAT's provision of information and analysis has made a major contribution to the delivery of humanitarian assistance through the monitoring of besieged areas where some 212,000 people are living without access to humanitarian aid, including food, clean water and medical supplies. Thanks to UNOSAT, we are able to see, on a real time basis, whether roadblocks and checkpoints are still in place or have been lifted. UNOSAT imagery and analysis of control points and fighting positions have helped us to get a better picture of access constraints across the country. We have also used UNOSAT's images to assess the damage caused by aerial bombardment, including the use of barrel bombs.

This information is particularly important in helping us to monitor compliance with international humanitarian and human rights law and Security Council resolutions on access. By providing it, UNOSAT is helping us to ensure that parties to the conflict are held accountable for their actions. UNOSAT's work is a good example of how technology can be used to support a more effective humanitarian response.

**Valerie Amos**
UN Under-Secretary General for Humanitarian Affairs and Emergency Relief Coordinator
UN OCHA

# INTRODUCTION

The conflict in Syria began as a series of protests against the government of Bashar al-Assad and the ruling Ba'ath Party. Following the so-called Arab Spring that deposed governments in Tunisia, Egypt, Yemen, and elsewhere, protests in Syria began in the city of Daraa during March 2011, spread to other areas, and increased in both size and intensity in the following months. As massive protests drew 100,000 people or more, Syrian government security agencies responded with increasing force, often with lethal outcomes, into the summer months of 2011 and after. With arrests and increasing numbers of lost lives the conflict grew along sectarian lines. Residents in opposition-supported areas started to arm themselves for defensive purposes, but soon also started to attack local security forces. Further military mobilizations occurred, pitting modern heavy weaponry against widespread civilian protests. The result of this process was full scale civil war and devastation to many cities and much of the civilian population in Syria. As seen in the timeline, UNOSAT has supported its sister agencies throughout the conflict. The work has included situation analysis, camp mapping and damage assessments to mention some of the product-types delivered.

UNOSAT's standard analysis methodology and quality control routines use publicly available satellite imagery. For damage analyses, these images are compared at different dates. Images used can be free open source or commercially available. For this report we have used commercially available very high resolution imagery for the detailed damage assessments presented. It should be noted that damage assessments using satellite imagery are limited to relatively significant and catastrophic levels of structural damage and are not intended to catalogue all damage to buildings. Analysis can only assess what is visible from above. All damage originating from small arms fire, heavy machine gun fire, and often-time direct tank or artillery fire is generally not visible unless it results in some form of structural collapse. Given these limitations and thus conservative damage assessments, the following classes of building damage were identified by UNOSAT:

1. Building Destroyed: all or most of the building structure is collapsed (75% - 100% of structure destroyed).
2. Building Severely Damaged: a significant part of the building structure is collapsed (30%-75% of structure destroyed).
3. Building Moderately Damaged: Limited damage observed to the building structure (5%-30% of structure damaged).

Further, the analysis documented craters in roads and fields, resulting from munitions impacts. Such craters include air dropped munitions which are generally readily apparent, as well as craters resulting from mortar and artillery fire which are often, but not always, visible depending on the type of terrain impacted. For example, an artillery or mortar shell impacting a field with loose soil will leave a crater, but a light mortar round impacting a paved area or harder soil surface often will not leave a crater visible in satellite imagery. See figure below for different damage levels.

Buildings/structures
that have suffered
**Moderate Damage**

Buildings/structures
that have suffered
**Severe Damage**

Buildings/structures
that have been
**Destroyed**

# COURSE OF EVENTS

# UNOSAT HUMANITARIAN ANALYSIS

Protests, civil uprising, and defections

**01/11 - 07/11**

Situation mapping
Support to OHCHR fact finding mission

Protests and armed insurgency

**08/11 - 10/11**

Continued situation mapping

Escalation

**11/11 - 03/12**

Initial humanitarian damage assessments
Assessment of damage to energy sector

Ceasefire attempt

**04/12 - 05/12**

Renewed fighting

**06/12 - 07/12**

Identification of mass graves
Humanitarian damage assessments
Effects on local economies / inactive markets

Battles of Damascus and Aleppo

**07/12 - 10/12**

Humanitarian damage assessment
Humanitarian planning support
Refugee camp mapping

Offenses by all sides of conflict

**11/12 - 06/13**

IDP camp mapping
IDP camp damage assessments
Humanitarian damage assessments

Continued fighting

**07/13 - 12/13**

Refugee camp mapping
Humanitarian damage assessments

Fighting between Da'esh and other groups

**01/14 - 03/14**

Support to OHCHR Commission of Inquiry (CoI)
Humanitarian damage assessments

Continued government and Hezbollah offensive

**03/14**

Support to OHCHR CoI
Support to OCHA and monitoring of UN
Security Council Resolution 2139

Continued fighting

**03/14 - 05/14**

IDP location identification and camp mapping
Refugee camp planning and monitoring
Resolution 2139 monitoring
Humanitarian damage assessments

Presidential election

**06/14**

Assessments of besieged areas

Da'esh offensive and continued fighting

**06/14 - 08/14**

IDP location identification for humanitarian
air-drop support
Resolution 2139 monitoring

Continues fighting and coalition airstrikes

**08/14 - present**

Humanitarian damage assessments
Cultural heritage damage assessment
Assessments of damage to electricity
networks
Refugee and IDP camp mapping

# MASS GATHERINGS, REPRISAL AND RESPONSE
## INTRODUCTION

UNOSAT humanitarian mapping and analysis efforts in support of United Nations partners sought to understand the nationwide reports of violence and mortality in Syria. These analyses took advantage of the large amount of open reporting available as the uprising developed, a hallmark of Arab Spring protests. In addition, satellite imagery analyzed by UNOSAT provided important confirmation of reports of deployments of armor and other heavy weapons outside of military bases to positions near towns and villages known to be in opposition to the government. This display of lethal force was sadly soon joined by imagery indicating increasing number of graves and funerals in cemeteries within cities like Idlib. By summer of 2012, the UN was investigating multiple attacks on civilians and massacres, with input from UNOSAT imagery analysis that identified both military units and UN investigators. The conflict in Syria would soon devastate the country, and normal life ceased in many areas, for example with markets in urban areas deserted as civilians largely stayed in hiding.

Figure 1 is an example of some of the initial analysis produced by UNOSAT in support of the UN humanitarian community. It presents an overview of reported protests and violent clashes in cities and towns across the Syrian Arab Republic, as well as the reported movements of the Syrian army into the protest areas.



**FIGURE 1**

Protests, violent clashes, reported deaths, and reported army movements across Syria between March and November 2011.
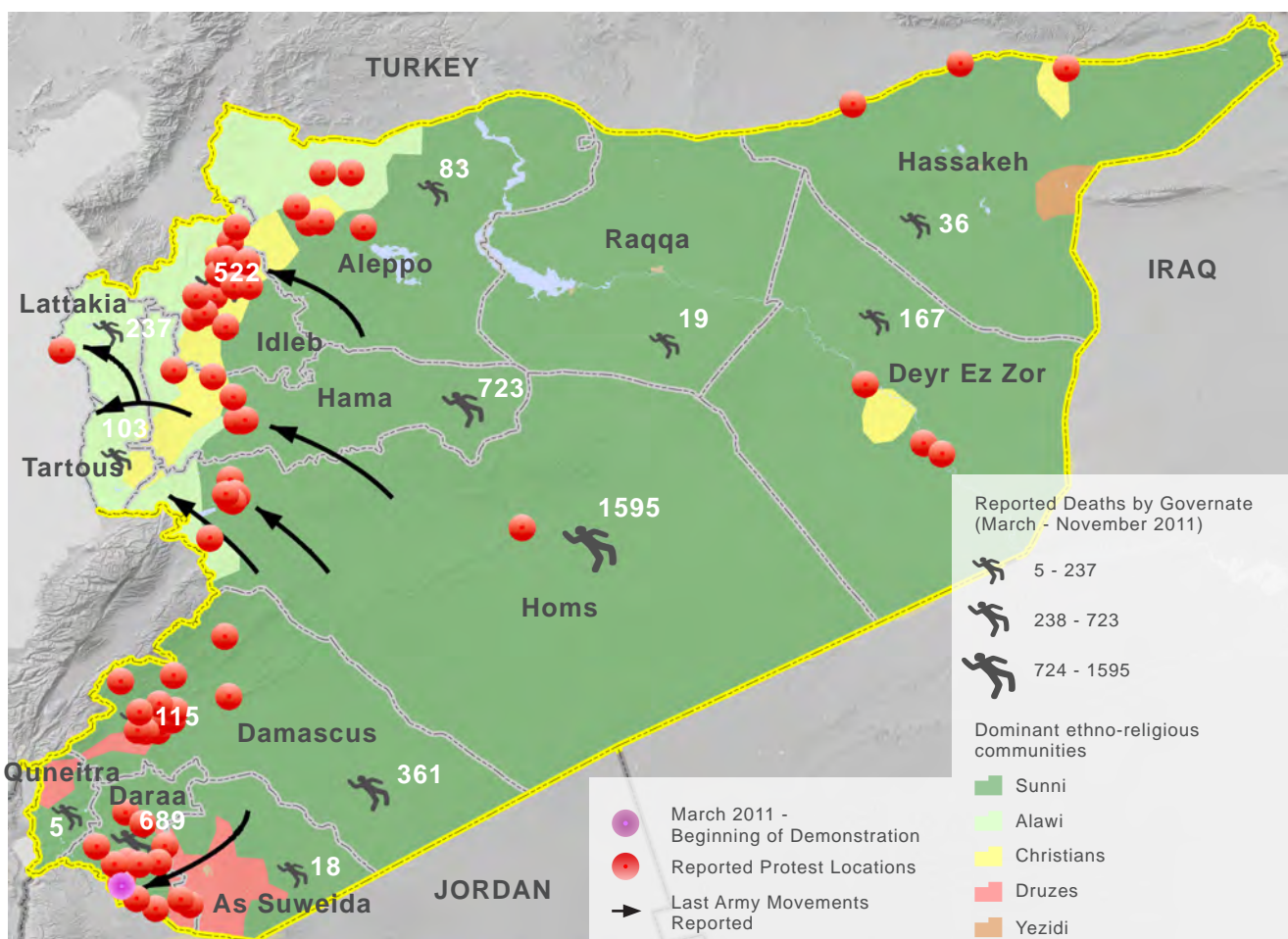
UNOSAT analysis also includes the number of reported deaths occurring since March 2011 until 30 November 2011, aggregated by Governorate. Further, the spatial distribution of the dominant ethnic-religious communities in the country has been included as background context to the larger social and political uprising. Event locations and figures presented in this map are based exclusively on a number of open reporting sources and have not been verified on the ground. It is possible that not all incident locations have been depicted. This type of analysis was frequently updated in the early stages of the conflict.

# MILITARIZATION

At the request of the UN Office of the High Commissioner for Human Rights, in support of the Fact Finding Mission on Syria established as the result of the Human Rights Council's resolution 16/1, UNOSAT performed a rapid assessment of the Syrian town of Jisr Al Shugar. Satellite imagery acquired on 18 June 2011 was assessed to confirm the presence of deployed military units in the town of Jisr Al Shugar, Idlib Governorate. The analysis showed multiple locations with armored vehicles around the town. A large concentration of almost 30 armored vehicles, including at least three tanks, is visible just north of Jisr Al Shugar.

**FIGURE 2**
Military presence in the outskirts of
Jisr Al Shugar, Idlib Governorate

500 METERS TO
JISR AL SHUGAR

POSSIBLE
TANKS

18 JUNE 2011

# FUNERAL PROCESSIONS & GRAVEYARDS

The example seen in Figure 3 shows one of Idlib's main cemeteries, located in the south-eastern part of the city. UNOSAT analyzed available satellite imagery identifying a significant increase in the number of burials within Idlib's cemeteries, during the early stages of Syrian conflict, between 16 September and 28 December 2011. During this period, the cemetery expanded in two areas by 900m², with the likely addition of approximately 74 new graves. A probable funeral was also identified by the presence of three local taxis and a small gathering of people numbering about fifty.

16 SEPTEMBER 2011

51 NEW GRAVES DUG BETWEEN 16 SEPTEMBER & 28 DECEMBER

PROBABLE FUNERAL WITH ESTIMATED 50 MOURNERS

23 NEW GRAVES DUG BETWEEN 16 SEPTEMBER & 28 DECEMBER

28 DECEMBER 2011

**FIGURE 3**
An increased number of burials were seen within Idlib's cemetery during the early stages of the Syrian conflict.

# EARLY RESPONSE

UNOSAT performed a satellite imagery analysis over the town of Tremseh to investigate a reported massacre occurring on 12 July 2012. Using imagery collected on 14 July UNOSAT identified a strong military presence around the town and signs of potential damage to structures in the town. As seen in Figure 4, the presence of a possible UN convoy approaching Tremseh, likely part of the United Nations Supervision Mission in Syria (UNSMIS), could be observed in the imagery. UNSMIS was established by Security Council resolution 2043 of 21 April 2012 as part of the UN and Arab League Joint Special Envoy to Syria six-point plan designed to end the escalating conflict.

**FIGURE 4**
A possible UN convoy, likely part of the United Nations Supervision Mission in Syria (UNSMIS), approaching the town of Tremseh.

2KM TO TREMSESH

14 JULY 2012
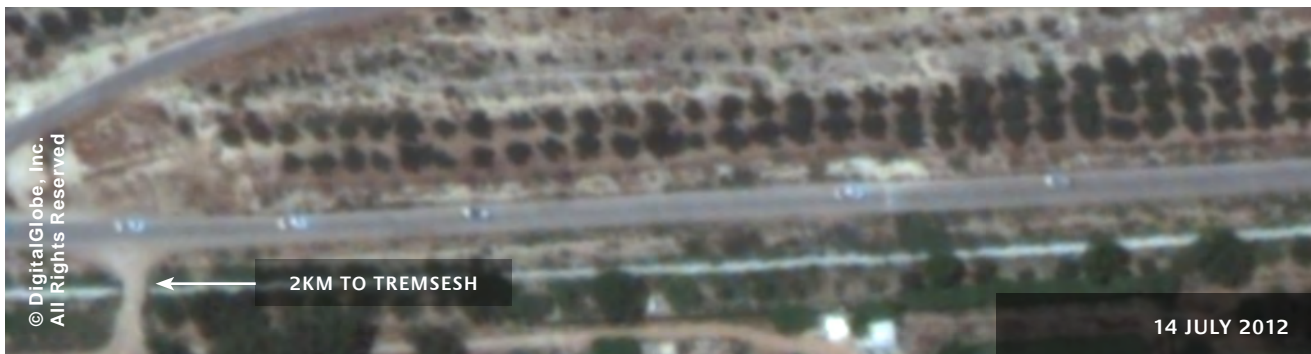
# MARKETS

Imagery collected on 26 June 2013 shows the lack of activity present at the Cardamomo Market, in Deir Ez Zor after 2 years of conflict, in contrast with the imagery collected on 6 December 2010 (8:25 UTC) when numerous cars, and market stalls are visible as well as a big crowd, see Figure 5. Such deserted urban market areas are now common throughout many Syrian cities as normal civilian life has long since ceased to exist.

**FIGURE 5**
Pre-conflict and post-conflict imagery of Cardamomo Market, Deir Ez Zor.

6 DECEMBER 2010

26 JUNE 2013

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# INDISCRIMINATE ATTACKS ON CIVILIAN POPULATION
## INTRODUCTION

Following the mass protests and crackdowns by the Syrian government, the conflict in Syria quickly developed into widespread combat between irregular militias, the Syrian military, and paramilitary forces. Most urban areas soon became combat zones and use of heavy weapons inflicted heavy damage across the country. In the early months of the conflict, only the Syrian military possessed artillery, tanks, and other heavy weapons, and as the conflict progressed the opposition forces and paramilitaries also acquired these assets in significant numbers. However, throughout the conflict air power has been available only to the Syrian military. Unfortunately, combat in the Syrian civil war has almost always taken place amongst heavily populated and urbanized areas, and there have been relatively few protracted battles in the countryside. And while many civilians have fled contested areas, many remain in place either unable or unwilling to relocate. This has resulted in large numbers of casualties during the war, with the latest UN estimate counting 220.000 people killed.[4]
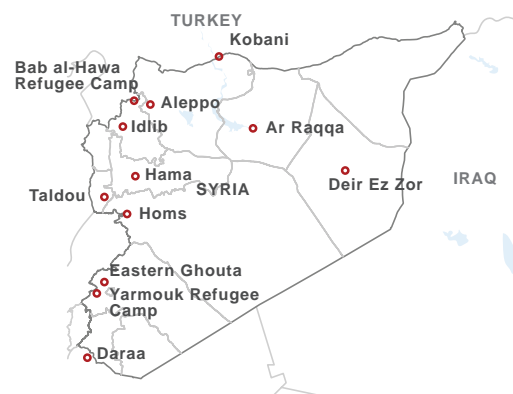
UNOSAT analysis of satellite imagery has documented numerous attacks on civilians and on civilian infrastructure in Syria. One of the earliest and most dramatic images of the war showed an oil pipeline blazing on the outskirts of the city of Homs in February 2012, near the onset of significant combat in the city which would deprive civilians of essential goods. By May of 2012 UNOSAT was documenting to the Commission of Inquiry reported mass graves linked to massacres of civilians in multiple towns of northern Syria. The growth in killings and destruction were well documented[5] in postings to social media, and the conflict in Syria has the distinction of being the most widely filmed war in history, with many of these social media posts directly assisting satellite imagery analysis. In June of 2012 satellite imagery showed numerous artillery pieces oriented on targets in Homs. Syrian government forces razed an entire neighborhood in the city of Hama using bulldozers over the course of September and November 2012. In late November 2012 an egregious bombing of a camp for internally displaced persons, waiting to cross the border into Turkey, was documented at Bab-al Hawa, with impact craters clearly visible amidst tent shelters.

As the subsequent years passed destruction to civilian areas and infrastructure became overwhelming, and by the summer of 2014 UNOSAT documented more than 30,000 destroyed or damaged buildings in the cities of Aleppo, Ar Raqqa, Daraa, Deir Ez Zor, Hama, and Homs. Some of this devastation was caused by dropping barrels filled with explosives from helicopters. This was often filmed and video posted to YouTube, allowing UNOSAT analysts to study these videos to find the corresponding impact locations and damages in satellite imagery. While residential buildings are the primary damaged type in Syria due to their sheer numbers, destruction commonly affects markets, schools, hospitals, mosques, power stations and more. In addition to detailed satellite imagery analysis, UNOSAT has utilized new methods for mapping city lights at night to document areas where the conflict has left large areas of cities without power, creating additional hardship for the affected civilian population.

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4  Source: http://www.un.org/apps/news/story.asp?NewsID=50306#.VQYIHk10zIU

5  See for example The Syrian Observatory for Human Rights (http://syriahr.com) and the Syrian Uprising Information Center (https://www.facebook.com/syrianuprising).

# IDP CAMP BOMBING AND SHELLING

The Bab-al Hawa border crossing was bombed on 26 November 2012. A temporary settlement for internally displaced persons (IDPs) at that location houses people waiting to cross into Turkey as refugees. A total of 596 shelters for the IDPs are visible in the satellite image acquired on 26 November 2012, prior to the reported bombing. In an image acquired the next day, on 27 November, a crater and blast area, measuring approximately 40 meters across, is visible on the northwest portion of the settlement, with a second crater located 127 meters northwest and outside the IDP settlement area, see Figure 6. A total of 47 shelters are seen to be damaged or destroyed on 27 November within the IDP settlement and an additional six shelters located 70 meters southeast of the crater are likewise damaged or destroyed. The source of the damage and destruction for these latter six shelters is unclear but almost certainly related to the bombing and perhaps due to debris or shrapnel. Most likely, surrounding tent shelters are damaged as well. Additional possible munitions impacts are visible elsewhere in the image.

**FIGURE 6**
The Bab al Hawa IDP camp with craters and blast area visible as of 27 November 2012, a consequence of a reported airstrike.

TO TURKEY 500 METERS

CARGO INSPECTION AREA

BORDER CROSSING ENTRY

IMMIGRATION STATION

CARGO INSPECTION AREA

26 NOVEMBER 2012

BOMB CRATERS

47 DAMAGED SHELTERS

6 DAMAGED SHELTERS

27 NOVEMBER 2012

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# REFUGEE CAMP BOMBING AND SHELLING

Yarmouk Camp is a district of Damascus and is considered as an unofficial refugee camp that shelters more than 18,000 Palestinian refugees. As requested by UN OCHA and in support to Security Council resolution 2139, UNOSAT has performed multiple security analyses to monitor the situation in Yarmouk, and specifically whether it is accessible for humanitarian assistance. As seen in Figure 7, imagery from 15 January 2014 clearly show Yarmouk as besieged, with numerous roadblocks and security controls along strategic roads and controlling access to the district. Such roadblocks and checkpoints were used to restrict all traffic into the area, including humanitarian resupply, leading to deplorable conditions within Yarmouk including shortages of food, medicines, and other essential items. Due to conflict between the Syrian government and opposition forces inside Yarmouk damage was also heavy in specific areas. Damage from bombing and shelling has reduced multiple buildings in Yarmouk to rubble, with damage along its primary road to Damascus observed as extreme.

**FIGURE 7**
Destruction in Yarmouk refugee settlement, Damascus.

11 MAY 2011

ALBASHEER MOSQUE

FALESTEEN CAMP

YARMOUK CAMP

VISIBLE DAMAGE

15 JANUARY 2014

JANUARY 2014

# DESTRUCTION IN RESIDENTIAL AREAS

DESTROYED BUILDINGS

FRONT END LOADER

POSSIBLE DUMP TRUCK

27 SEPTEMBER 2012

The images seen in Figures 8 and 9, depict the results of the demolitions that occurred in Masaa Al Arbaeen Hama's district between 27 September and 23 October 2012. Imagery collected on 27 September 2012 shows heavy vehicles, including dump trucks and heavy equipment such as bulldozers and front-end loaders, as they began to raze the neighborhood. Residents living in this area were perceived as sympathizing with the opposition.

**FIGURE 8**
The presence of heavy vehicles on 27 September 2012 as they began to raze the neighbourhood of Masaa Al Arbaeen.

The Masaa Al Arbaeen Hama's district was then systematically razed over the following month. As of 23 October 2012 the whole of the district is demolished, affecting a total of 3,256 buildings that were reduced to rubble.

6 AUGUST 2010

23 OCTOBER 2012

**FIGURE 9**
The Masaa Al Arbaeen neighborhood of Hama was razed between 27 September and 23 October 2012, affecting a total of 3,256 buildings.

**FIGURE 10**
Damage density in the cities of Homs, Aleppo, Hama, Deir ez Zor, Ar Raqqa, and Daraa.

AR RAQQA

12 FEBRUARY 2014

DARAA

1 MAY 2014

HAMA

5 MARCH 2014

DEIR EZ ZOR

13 MAY 2014

HOMS

21 APRIL 2014

ALEPPO

23 MAY 2014

High Damage

Low Damage

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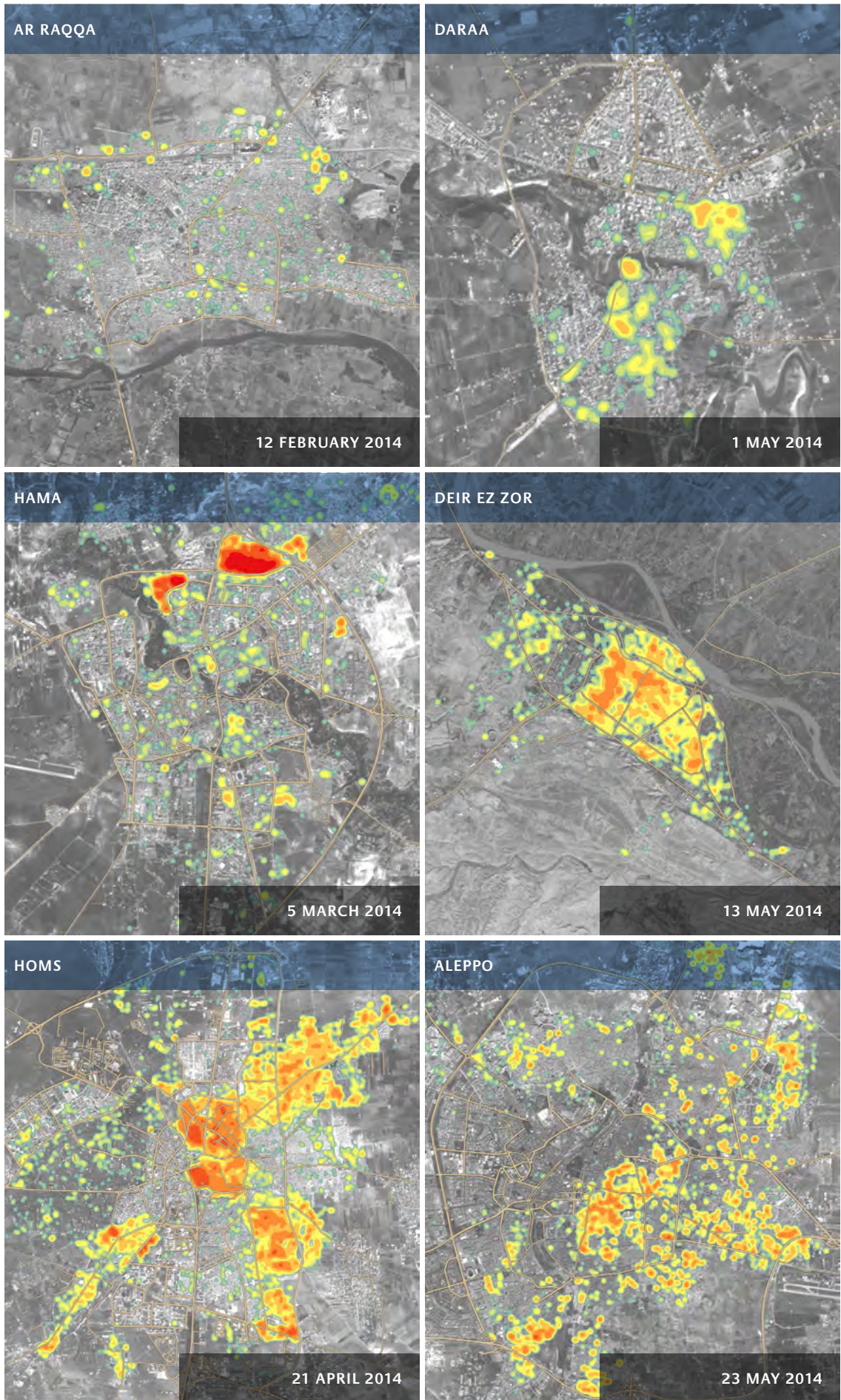
UNOSAT, as part of the REACH Initiative, performed a comprehensive shelter damage assessment in the cities of Homs, Aleppo, Hama, Deir Ez Zor, Ar Raqqa, and Daraa. Using commercial high resolution satellite imagery from 2014, 2013, 2011, and 2010, UNOSAT identified destruction and damage to residential structures and health, educational and religious facilities across each city. Figure 10 shows the relative density of damaged structures for each city and is designed to illustrate the most damaged areas across Syria. City-wide analyses revealed a total of 13,778 affected structures in Homs, 8,510 in Aleppo, 5,233 in Hama, 3,112 in Deir Ez Zor, 467 in Ar Raqqa, and 351 in Daraa, see Figure 11. Most areas of damage were the site of protracted battles on the ground and involved tanks, artillery, and air dropped munitions, as well as small arms fire, grenades, and explosives. Some areas of isolated damage may reflect air strikes only, including barrel bombing.[6] In Figure 12, the damage for Homs is also overlaid on an image of New York City to provide a comparison.

| Damaged Shelters | | | | |
|---|---|---|---|---|
| City | Destroyed Shelters | Serverely Damaged Shelters | Moderately Damaged Shelters | Total Damaged Shelters |
| Aleppo | 1,543 | 4,847 | 2,120 | 8,510 |
| Ar-Raqqa | 239 | 90 | 138 | 467 |
| Dar'a | 35 | 121 | 195 | 351 |
| Deir ez-Zur | 454 | 1,045 | 1,613 | 3,112 |
| Hama | 4,671 | 216 | 346 | 5,233 |
| Homs | 3,082 | 5,750 | 4,946 | 13,778 |
| Idlib | 102 | 101 | 104 | 307 |
| Total | 10,126 | 12,170 | 9,462 | 31,758 |

**FIGURE 11**
Comprehensive shelter damage assessment results.
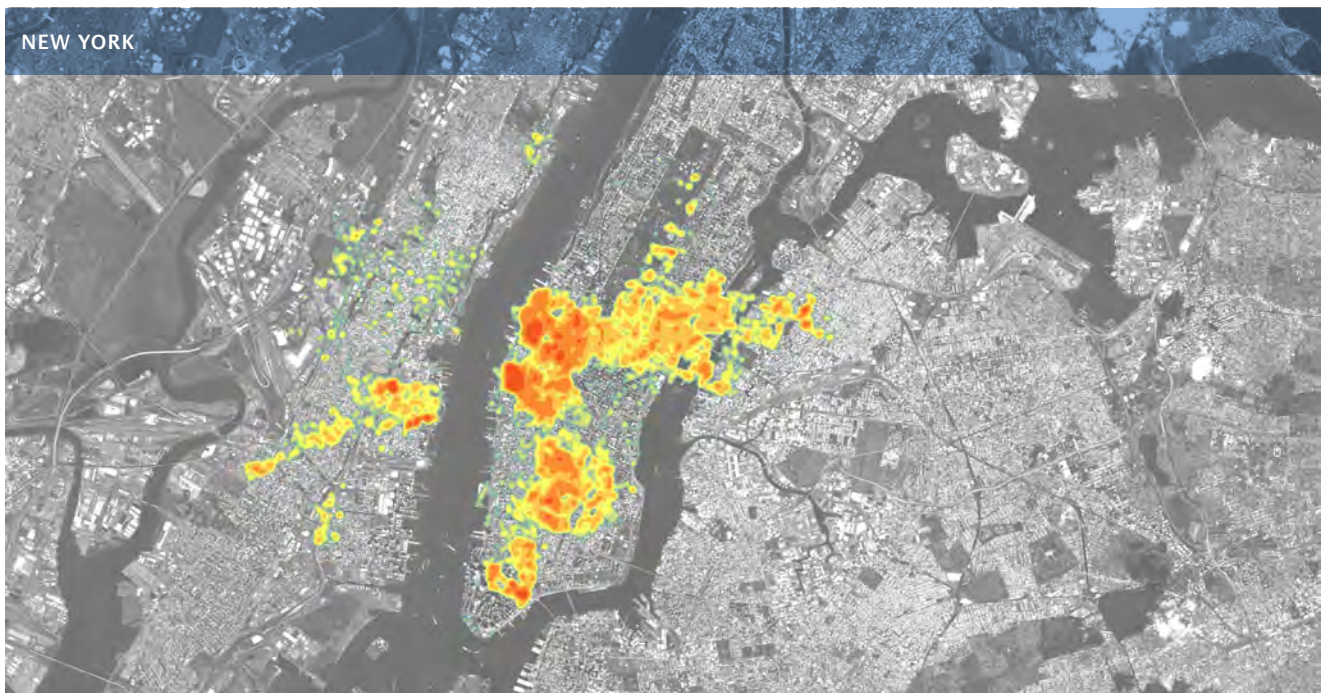


**FIGURE 12**
Relative density of damaged structures for Homs overlaid on the city of New York.

High Damage

Low Damage

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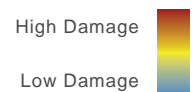
6   Airstrikes and barrel bombing of civilian areas have become common in the Syria conflict, see:
    http://www.un.org/apps/news/story.asp?NewsID=46834#.VPhSYeH-SPU. Many barrel bombing attacks have been captured on video, see for example:
    https://www.youtube.com/watch?v=KIZRycHM3vs

**FIGURE 13**
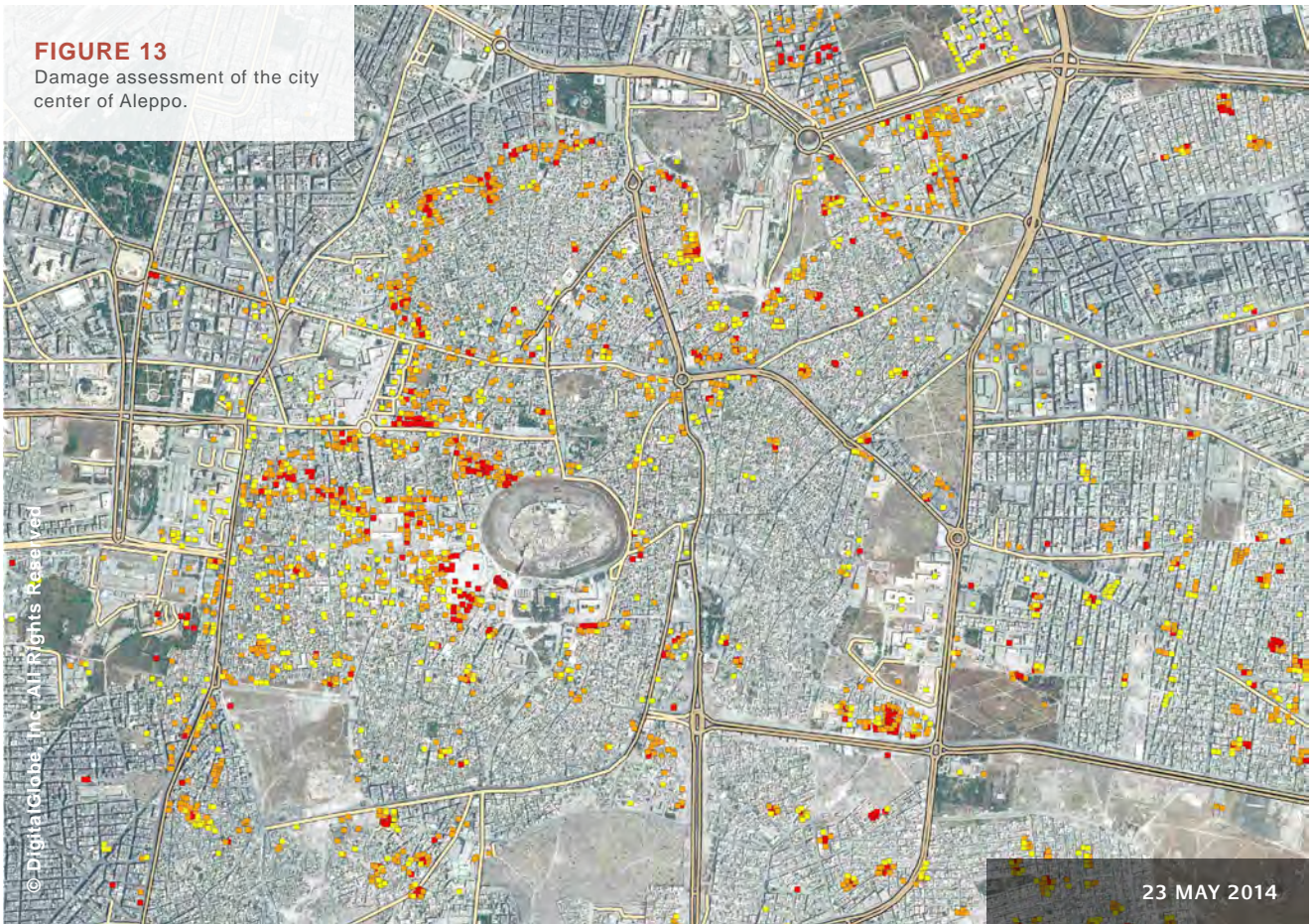Damage assessment of the city center of Aleppo.

**23 MAY 2014**

Figure 13 depicts a more detailed view of the comprehensive shelter damage assessment performed in the city of Aleppo, also as part of the REACH Initiative. Using satellite imagery acquired 23 May 2014, 23 September 2013, and 21 November 2010, UNOSAT identified a total of 2,625 affected structures within the center of Aleppo. Approximately 449 of these were destroyed, 1,412 severely damaged, and 1,118 moderately damaged. The city-wide analysis of Aleppo revealed a total of 8,510 affected structures, of which 1,543 were destroyed, 4,847 severely damaged, and 2,120 moderately damaged. While some of the city was damaged by 23 September 2013, 7,937 structures were newly damaged and 17 structures experienced an increase in damage between that date and 23 May 2014.

Destroyed Structure ■
Severely Damaged Structure ■
Moderately Damaged Structure ■
Highway / Primary Road ══
Secondary Road ══
Local / Urban Road ──

**FIGURE 14**
Overview of damage over a portion of Aleppo close to the Old Citadel with large craters visible. Several structures and a large section of The Souq appear collapsed.

ALEPPO CITADEL

**21 JANUARY 2010**

CARLTON HOTEL DESTROYED

LARGE SECTIONS OF THE SOUQ COLLAPSED

**23 MAY 2014**

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Imagery from 16 July 2012 collected at 14:17 local time in Homs shows a smoke plume in a residential area, near Al Qarabis Mosque, in the Al Qarabis neighbourhood of Homs, see Figure 15. Inside a military base southeast of Homs city artillery pieces are visible. The approximate fire bearing of the individual artillery pieces in that base were calculated and subsequent preliminary fire cones were generated, see Figure 17. The trajectory described for the artillery bearing intersects with the smoke plume next to the Al Qarabis Mosque, located about 18 km away from the artillery batteries. A subsequent image collected on 14 September 2012 shows repositioning of several artillery pieces, a possible indicator that the artillery unit inside the military base was active and targeting other areas of the city as well. Additionally, military resupply activity was visible in the area as well. Two ammunition resupply trucks were visible on 16 July 2012 but not in the subsequent image, see Figure 16. Multiple other military sites are placed around the city of Homs, especially in the south eastern part of the city, as well as missile sites and other types of armament such as mortar batteries.

**FIGURE 15**
A smoke plume in the Al Qarabis neighborhood of Homs as of 16 July 2012.



**FIGURE 16**
Two artillery pieces from an artillery battery adjusted their firing angle between 16 July 2012 and 14 September 2012.

**FIGURE 17**
The bearing of individual artillery pieces present in a military base southeast Homs as of 16 July 2012.

Artillery Piece
Populated Place
Military Area
Fire Bearing
Primary Road
Secondary Road

Hubub ar Rih
Tayr Ma`lahAl Rhannto
Ad Dar al Kabirah
Al Ghasibiyah
Dayr Ba`albah
Umm al Qassab
Kharkhar
Ad Duwayr
**SMOKE PLUME: WITHIN ARTILLERY FIRING RANGE**
**HOMS**
Az Zarzuriyah
Shaluh
*HOMS*
Al Mahmuri
Bab `Umar
Rabi`ah    Birabu`Aysun
Hadidat al `Asi
Kafr `Aya
Fayruzah
Dar al Wakarah
Tall ash Shur
Qattinah
Nadirah
Maskanah
Al Mubarakiyah
Abil
Al As`adiyah

**ARTILLERY POSITION: SEVEN 130MM ARTILLERY FIELD GUNS WITH A FIRE BEARINGS RANGING FROM 323 TO 346 DEGREES AND A RANGE OF 27.5KM (17 MILES) AIMING TOWARDS HOMS**

**16 JULY 2012**

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# BARREL BOMBING

Labels on image: SEVERE DAMAGE · POSSIBLE FIELD OF VIEW · ELECTRICITY PYLON · POSSIBLE RECORDING LOCATION · POSSIBLE DAMAGE LOCATION (INSET) · MOSQUE · 4 APRIL 2014

In support of the UN Office for the Coordination of Humanitarian Affairs and to monitor implementation of United Nations Security Council resolutions related to humanitarian access and attacks on civilians in Syria, UNOSAT gathered social media information on barrel bombing and reviewed available satellite imagery to verify alleged damage. An example of this work is seen in Figure 18, which illustrates an analysis done with satellite imagery from 3 March and 4 April 2014 compared with a video report of an alleged barrel bomb attack that took place on Daraa, Syria on 11 March 2014. The analyzed video shows an unidentified helicopter dropping a probable barrel bomb and impacting an area of the Tariq al Sad neighborhood in Daraa close to a mosque. UNOSAT was able to triangulate the possible location of the alleged barrel bomb attack by identifying a number of visible landmarks on the video on the satellite imagery from 3 March 2014, including a minaret and three electrical pylons visible on the background of the video, see Figure 19. Imagery from 4 April 2014 shows one severely damaged building in the area of interest which was possibly close to the location of impact.

## VIDEO
Scan QR code with smartphone or tablet to see video referred to in the text. For digital report versions, click on the QR code to see video.
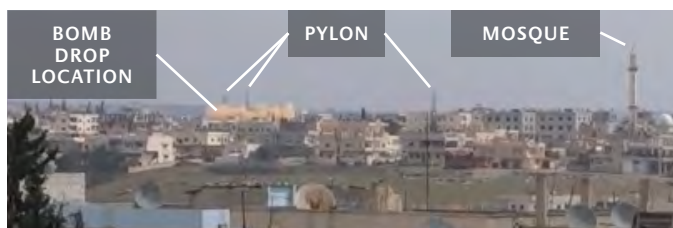




Labels on image: BOMB DROP LOCATION · PYLON · MOSQUE

# KEY CIVILIAN INFRASTRUCTURE

UNOSAT used imagery from a lower resolution satellite sensor to identify the blackout conditions in Aleppo resulting from about two years of fighting in the area. This sensor is able to measure light emitted in towns and cities during the night over cloud free areas, enabling the monitoring of regions without power. As these images are updated multiple times per night UNOSAT uses this sensor for near-real-time monitoring capabilities. Figure 20 illustrates satellite-detected areas of visible light at night in an area of Aleppo on two different dates. Imagery collected on 15 August 2012 shows night time lights prior to widespread violent conflict in Aleppo and the main towns in the surrounding area. As of 1 May 2014, a large area of the city of Aleppo as well as multiple outlying towns and villages appear obscured and are likely to be experiencing electricity blackout conditions. These areas of blackout correspond closely with areas of known destruction and combat.
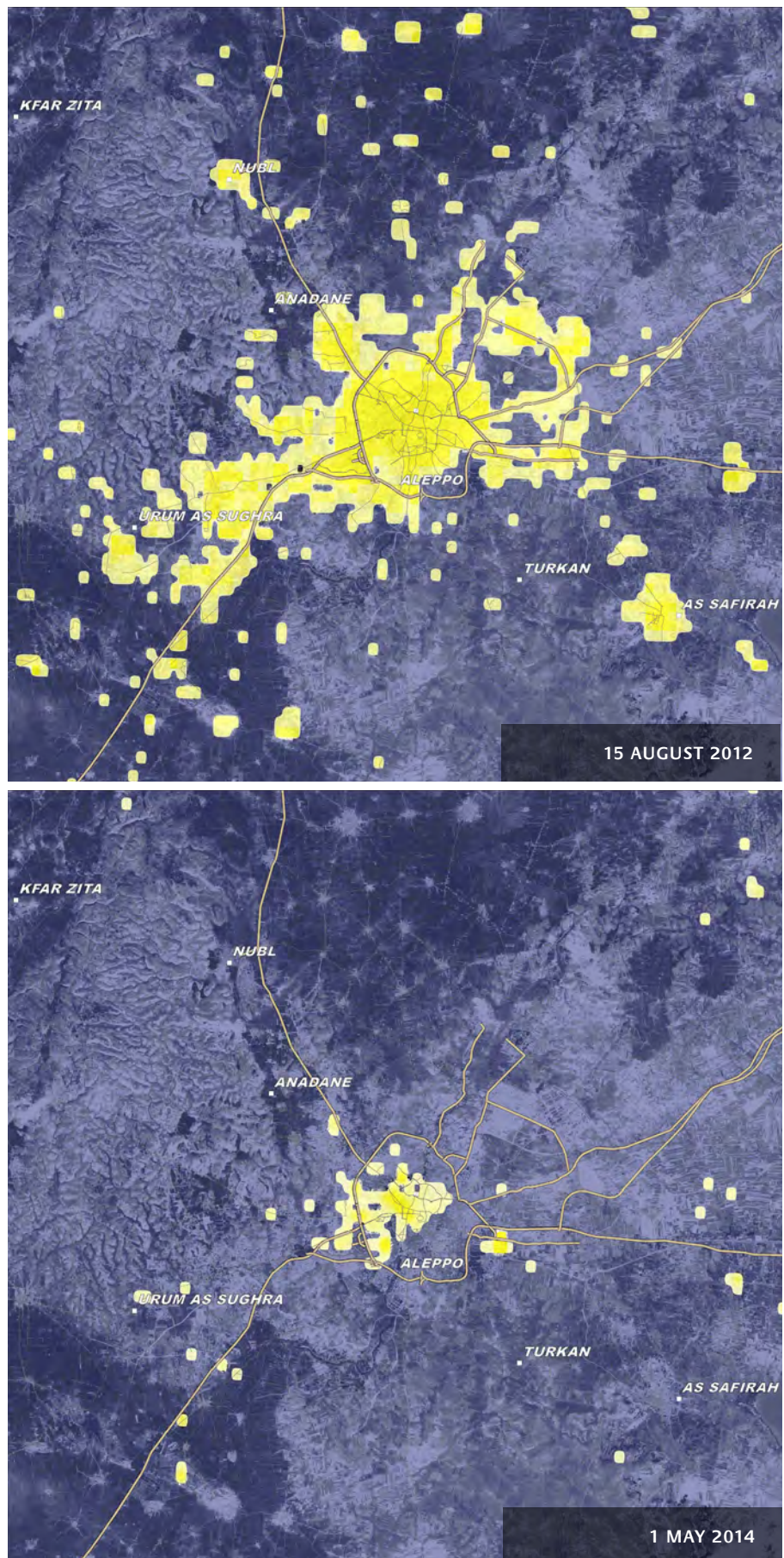


**FIGURE 20**
Areas of visible light at night on 15 August 2012 and 1 May 2014 that illustrate the blackout conditions existing in the city of Aleppo.

13 FEBRUARY 2013

AL HUSAINYAH

TO DEIR EZ ZOR
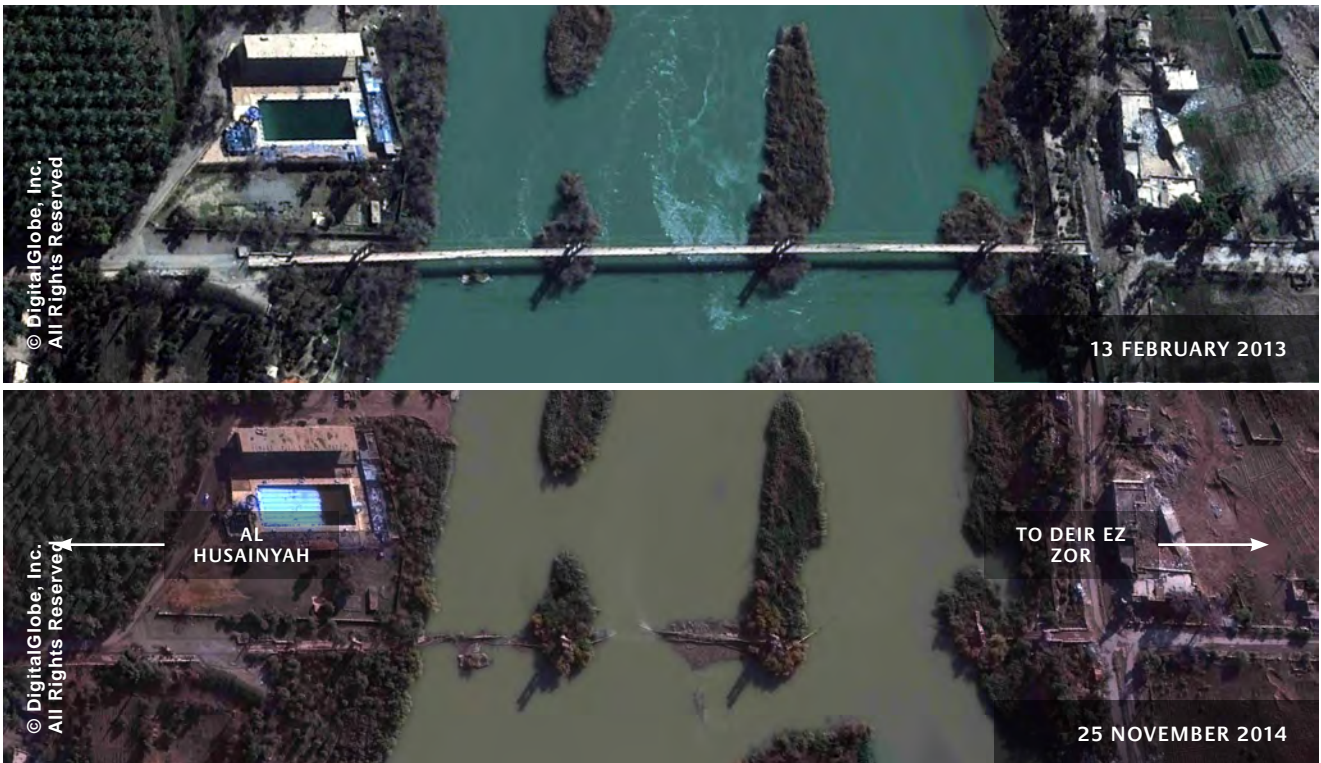
25 NOVEMBER 2014

On the 2nd of May 2013 in Deir Ez Zor City, the historic pedestrian suspended bridge across the Euphrates River was reported as completely destroyed by shelling. Imagery from 25 November 2014 confirmed the destruction of the bridge, which severed communication to the neighborhood of Hasakeh, cutting off the access to an estimated 50,000 people. The same image indicates the nearby Syasiyeh Bridge, designed for vehicle traffic, was also destroyed.

**FIGURE 21**
Destruction of the pedestrian suspended bridge across the Euphrates River in Deir Ez Zor city.

Imagery collected on 3 June 2014 shows extensive damage to the Damascus Southern Ring Road that makes it impassable for normal vehicle traffic, see Figure 22. This damage to the road acts as a barrier, compromising communication between Jobar neighborhood (Damascus) and the besieged area of Ein Tarma, Eastern Ghouta. Vehicle traffic is also completely absent along this highway on 3 June 2014 and the surrounding roads, and numerous roadblocks and checkpoints are visible in the area. UNOSAT analyzed the Eastern Ghouta area multiple times to document barriers to humanitarian access and damage to civilian areas.



JOBAR NEIGHBORHOOD - DAMASCUS

EIN TARMA - EASTERN GHOUTA

11 MAY 2011

DAMASCUS SOUTHERN RING ROAD

3 JUNE 2014

**FIGURE 22**
Heavy damage to the Damascus Southern Ring Road that impedes vehicle traffic in the area.

As a result of the comprehensive shelter damaged assessment carried out in the city of Homs, UNOSAT found damaged educational facilities in the neighborhoods of Akrama, Al Bayadah, Al Hamidiyah, Al Khaldiyah, Al Qarabis, Al Waer, Bab Amr, Bab Al Dreib, Bab Houd, Deir Ba Alba, Groves, Jobar, Karm Al Zeitun, Karm Shamsham, Old City, and the Walid Suburb. This imagery from 21 April 2014 shows three educational facilities in the Al Hamidiyah neighborhood that show different levels of damage: moderate, severe, and one facility that appears completely destroyed, see Figure 23. The area around the "Khalid ibn al-Walid Mosque", one of the most famous mosques in Homs and located in the Al Hamidiyah neighborhood, has been a target of numerous attacks since the Syria conflict started.

29 JUNE 2010

KHALID IBN AK-WALID MOSQUE

MODERATELY DAMAGED

SEVERLY DAMAGED

DESTROYED

21 APRIL 2014

**FIGURE 23**
Widespread damage that affects three educational facilities in the Al Hamidiyah neighborhood of Homs.

As part of the analysis of the city of Homs, UNOSAT identified a total of 32 damaged health facilities over the neighborhoods of Jouret Al Shayyah, Al Hamidiyah and Al Waer. Fourteen structures were categorized as destroyed, five were severely damaged and 13 indicated moderate damage. Due to numerous attacks during 2012–2013, the National Hospital complex in the Jouret Al Shayah neighborhood of Homs experienced heavy damage, as did multiple surrounding buildings along Al Korniche Street, visible in imagery acquired 21 April 2014, see Figure 24.

29 JUNE 2010

NATIONAL HOSPITAL

VISIBLE DAMAGE

21 APRIL 2014

**FIGURE 24**
Heavy damage at the National Hospital complex in the Jouret Al Shayah neighborhood of Homs.

## FIGURE 25
Damaged structures in Daraa Gover-
norate.



**DAMASCUS**

**AL QUNAYTIRAH**

● Ghabagheb

● Kafr Shams

● As-Sanamayn

● Hara

● Ankhal

● Jasim

**DARAA**

● Nawa

● Izra'

● Tassil

● Sheikh Miskine

● Bisr Elharir

● Abtaa

**AS SUWEIDA**

● Da'el

● Tafs

● Hrak

● Kherbet Ghazala

● Mzeireb

● Karak
● Eastern Ghariyeh

● Dar'a

● Sayda

● Mseifra

● Jizeh

● Busra Esh-Sham

In support of the World Bank and OCHA, UNOSAT conducted analysis to map destruction and damage for areas in the governo-rate of Daraa. UNOSAT analyzed 24 towns with populations of more than 10,000 people, reviewing 458 square kilom-eters and detecting a total of 6,268 destroyed or moderately damaged structures and 196 craters on roads, see Figure 25. UNOSAT also analyzed specific features including bridges, educa-tional facilities, government facilities, medical facilities, religious facilities, and cultural sites. Figure 26 shows the National Hospital in Jasim, one of the features assessed by UNOSAT. Satellite imagery collected on 3 March 2014 shows the hospital severely damaged, as well as a proximate electric substation that might affect electricity supply in the area. This hospital has been the scene of heavy fighting in the area due to its strategic position, north of the town, along the road that gives access to the town of Jasim.

**2,344**

**3,924**

**458**SQKM

**DAMAGED STRUCTURES**

● 0-99

● 100-299

● 300-599

● 600-999
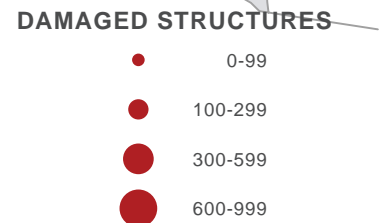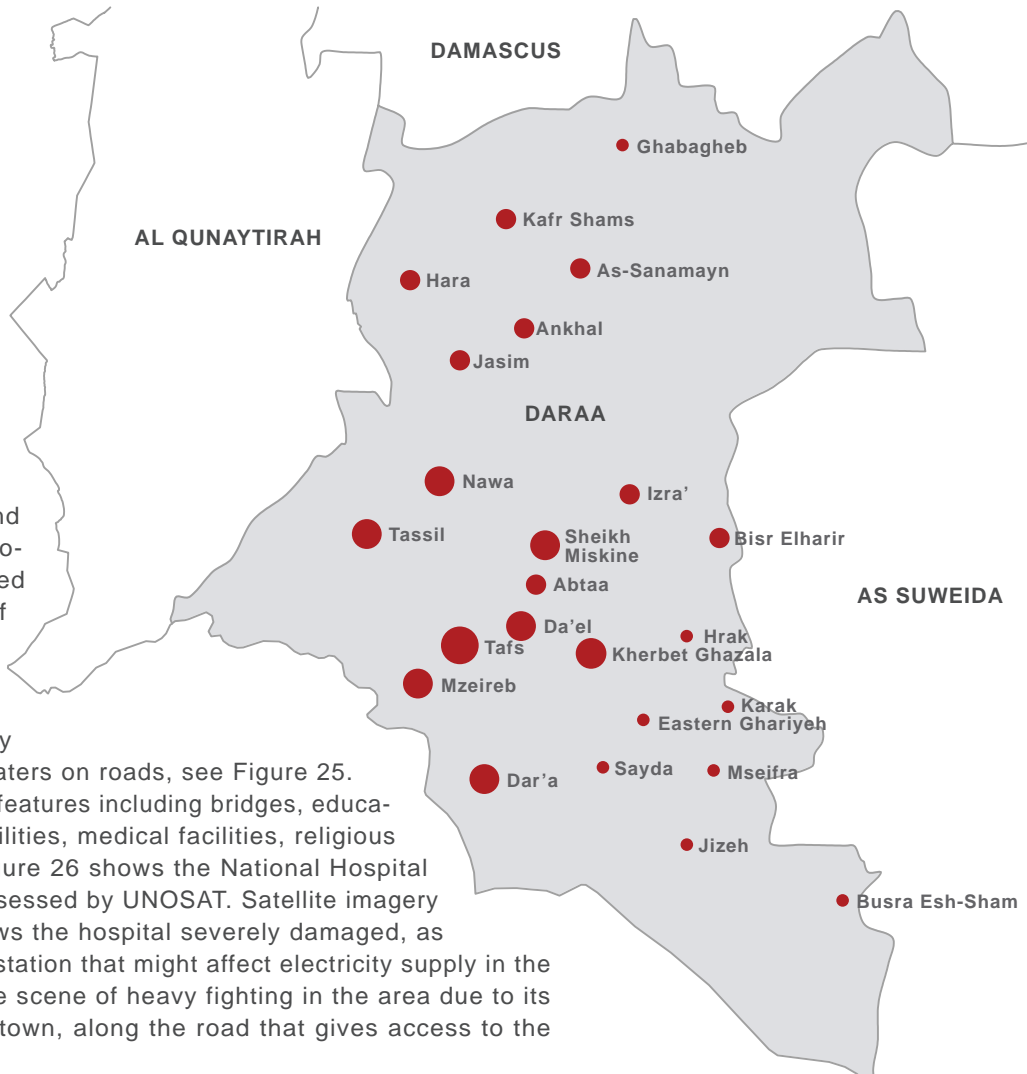
## FIGURE 26
Severe damage visible in Jasim's
National Hospital and electrical
substation.



ELECTRICAL
SUBSTATION

JASIM
NATIONAL
HOSPITAL

**17 MARCH 2011**



SEVERE
DAMAGE

SEVERE
DAMAGE

**3 MARCH 2014**

unitar

Imagery from 15 February 2012 shows a large plume of smoke and the oil pipeline on fire due to an explosion on the outskirts of the Baba Amr neighborhood in Homs. This pipeline carries oil to a refinery on the western edge of the Syrian city of Homs.

15 FEBRUARY 2012

**FIGURE 27**
Damaged oil pipeline on the outskirts of the Baba Amr neighborhood, Homs.

SOUQ AL-HAL
MARKET

TO TURKEY
450 METERS

WATER
TOWER

6 SEPTEMBER 2014

IMPACT
CRATERS

SEVERLEY
DAMAGED

6 NOVEMBER 2014

Imagery from 6 November 2014 shows severe damage to the Souq al-Hal market in the northern area of Kobane, just 400 meters from the Turkish military border station. Impact craters are clearly visible inside the market and additional damage is found in the surrounding area, with multiple destroyed and damaged buildings visible, see Figure 28.

**FIGURE 28**
Severe damage to the Souq al-Hal market in the northern area of Kobane.

# MASS GRAVES

The Houla region, a cluster of three villages located in Homs governorate, approximately 25 kilometers north-west of Homs city, was the location of a reported massacre occurring on 25 May 2012 when approximately 100 Syrian civilians were allegedly killed. UNOSAT conducted a detailed analysis of Houla, linked to the reported massacre of civilians and based on the request from the Commission of Inquiry for the Syrian Arab Republic. As a result of the analysis using satellite imagery acquired on 25 May and 26 May 2012, UNOSAT identified the location of a likely mass burial site in the northern part of the city of Taldou. In the 25 May image the location of this site shows up as bare soil in a town square, while on the 26 May image, the observed features correspond with that of mass graves. This location is further supported by external information (media pictures). Additional surrounding features, such as a clock tower, power-lines and buildings features seen in the photo correspond with what is observed in 26 May satellite images. The two observed mass graves, as seen in Figure 29, were measured in the satellite imagery to 20 meters by 3 meters and 11 meters by 2.5 meters.

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25 MAY 2012

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ELECTRICITY PYLON

CLOCK TOWER

LIKELY MASS GRAVES

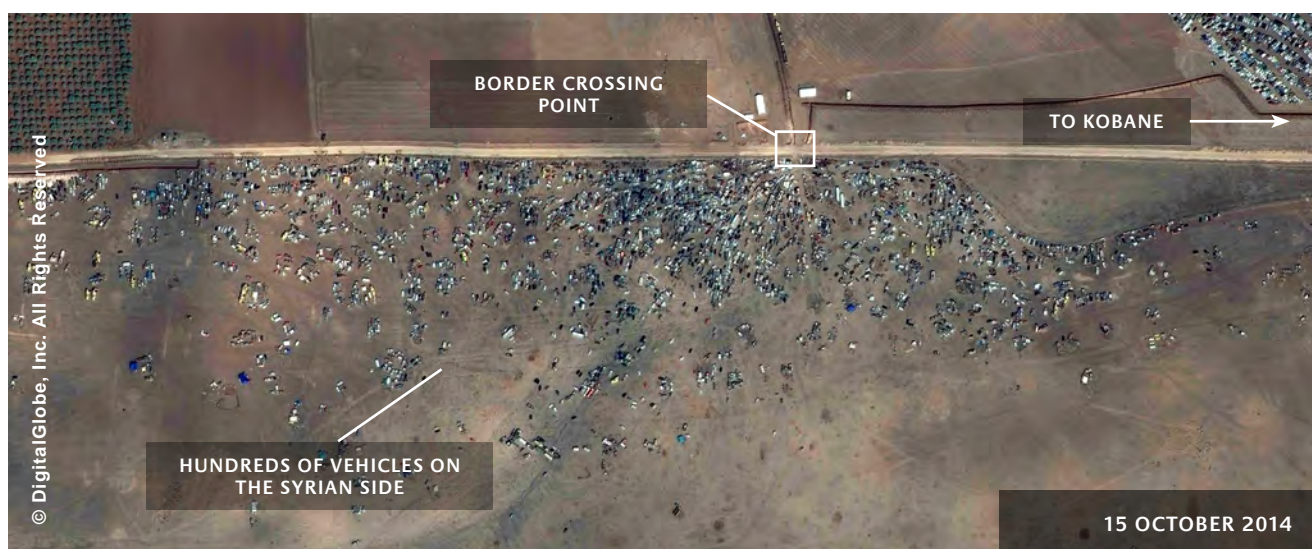26 MAY 2012

# DISPLACED POPULATION

The number of people displaced from the conflict now amounts to 40% of the pre-conflict population numbers. People are either displaced internally or have crossed the Syrian border and entered into neighboring states. The latest available figures at the time of this report list 6.5 million people to be internally displaced, while 3.7 million are refugees residing in Egypt, Iraq, Jordan, Lebanon and Turkey. About half of the displaced population is children.[7]

Most of the displaced population live with family members or pay commercial rent for apartments. However, a large number of displaced live in camps specifically constructed to host the displaced. UNOSAT has assisted the UN Refugee Agency (UNHCR) and UN OCHA in mapping out existing camps for internally displaced, as well as camps for refugees. In addition, following specific requests from sister agencies, UNOSAT has used satellite imagery to identify locations of people whose exact whereabouts were not know, thus allowing UNHCR and its implementing partners to provide humanitarian relief to this population. Satellite imagery is also used in the detailed planning of refugee camps. To build a camp, one needs detailed information about the terrain and area that has been designated. UNOSAT has provided this to UNHCR for engineers to construct the camps with as up-to-date imagery as possible, and also to monitor for example camp growth. Some of the camps grow to the size of cities, which means that camp planners must have access to as recent imagery as possible. Below are several examples of the work done as it relates to internally displaced or refugees from the Syria conflict.

Due to the increasing violence in the city of Kobane, most of the civilian population was forced to flee the area and seek refuge in Turkey. On 15 October 2014 hundreds of vehicles are visible on the Syrian side of the border clustered around a border crossing point. In addition on the Turkish side of the border a portion of the ground has been prepared for the storage of cars.
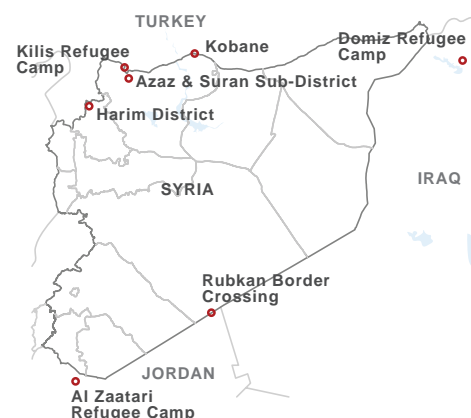
**FIGURE 30**
Vehicles clustered around Kobane's border crossing point.



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BORDER CROSSING POINT

TO KOBANE

HUNDREDS OF VEHICLES ON THE SYRIAN SIDE

15 OCTOBER 2014

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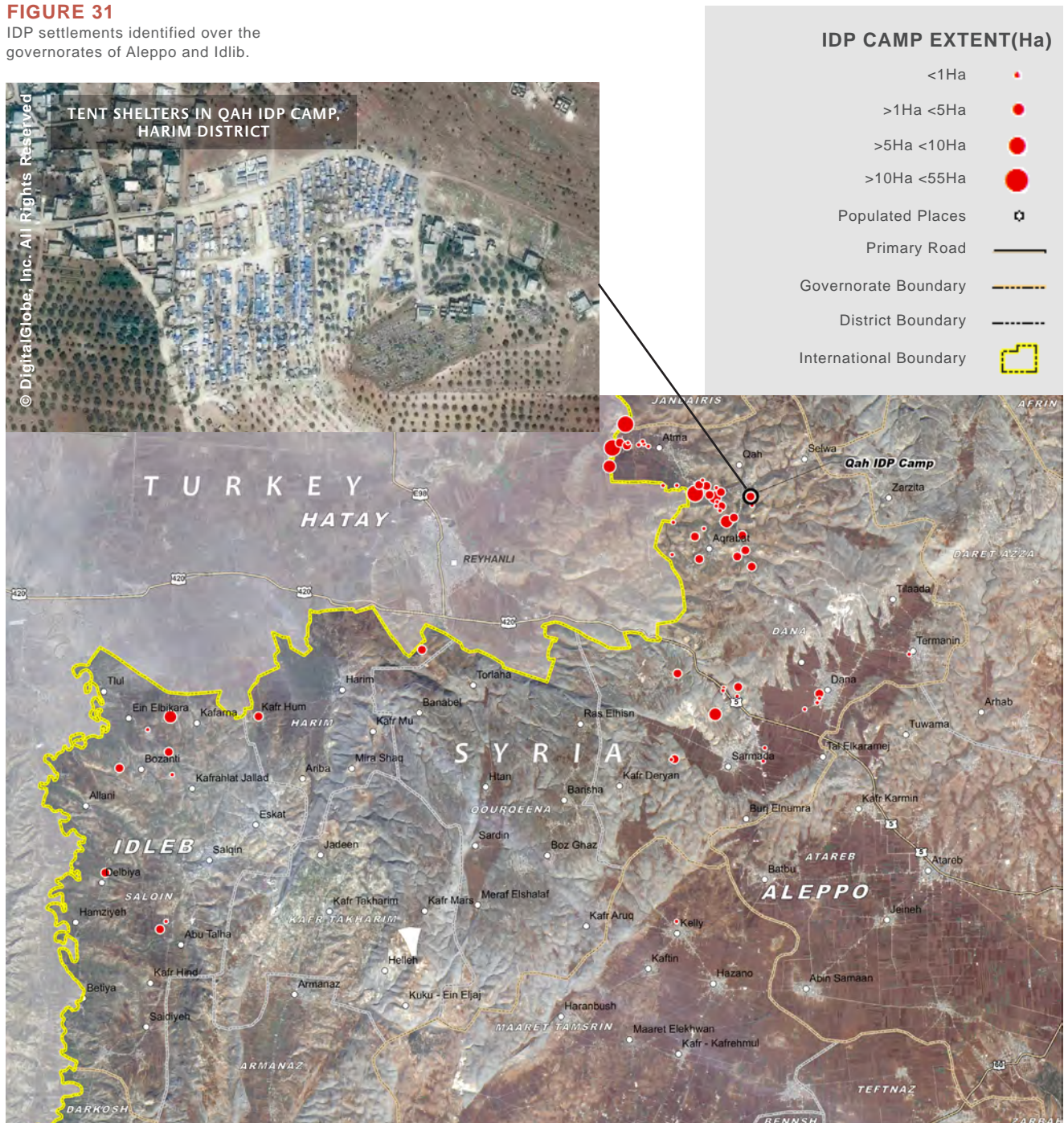7 Source: https://data.unhcr.org/syrianrefugees/regional.php

# INTERNALLY DISPLACED POPULATION

UNOSAT has periodically reviewed 1,450 square kilometers over the governorates of Aleppo and Idlib searching for IDP settlements. Most recently UNOSAT used satellite images collected during the period July to September 2014. In this analysis, 49 IDP settlements were identified, one settlement was under construction and 13 additional possible IDP settlements were spread across Harim District in Idlib Governorate.

Most of these are gathered in the northern part of the Harim district and along the Syrian-Turkish border. In addition, ten IDP settlements were identified, two settlements under construction and 22 possible IDP settlements were spread out in the Azaz and Suran Sub-Districts in Aleppo Governorate.

**FIGURE 31**
IDP settlements identified over the
governorates of Aleppo and Idlib.



TENT SHELTERS IN QAH IDP CAMP,
HARIM DISTRICT

**IDP CAMP EXTENT(Ha)**

| | |
|---|---|
| <1Ha | · |
| >1Ha <5Ha | ● |
| >5Ha <10Ha | ● |
| >10Ha <55Ha | ● |
| Populated Places | ⬡ |
| Primary Road | ▬▬▬ |
| Governorate Boundary | ------- |
| District Boundary | ------- |
| International Boundary | ▢ |

# REFUGEES

The Al Zaatari refugee settlement was established in the Mafraq Governorate of northern Jordan in July 2012 to host Syrians fleeing violence in Syria. This was at a time when the refugee outflow started to escalate. Since its establishment, UNOSAT has monitored the evolution of the settlement by analyzing it more than twenty times. The first analysis performed by UNOSAT using an image from 21 August 2012 shows a total of approximately 1,382 shelters and 336 infrastructure and support buildings within the 84 hectares of the settlement. By 11 November 2014, the date of the last UNOSAT analysis of Zaatari, a total of 29,243 shelters were detected as well as 1,915 infrastructure and support buildings within the 534.4 hectares of the settlement. This indicates an approximate 2,016% increase in the number of shelters between 21 August 2012 – 11 November 2014 and the size of the settlement is more than 6 times bigger since the first analysis was performed by UNOSAT. Currently, the Al Zaatari refugee settlement has become the second-largest refugee settlement in the world and the fourth largest city in Jordan.

> ## THE AL ZAATARI HAS BECOME THE SECOND-LARGEST REFUGEE SETTLEMENT IN THE WORLD, AND THE FOURTH LARGEST CITY IN JORDAN

**FIGURE 32**
Evolution of Al Zaatari refugee settlement from 15 November 2012 to 10 July 2013

15 NOVEMBER 2012

3 JANUARY 2013

26 FEBRUARY 2013

10 JULY 2013
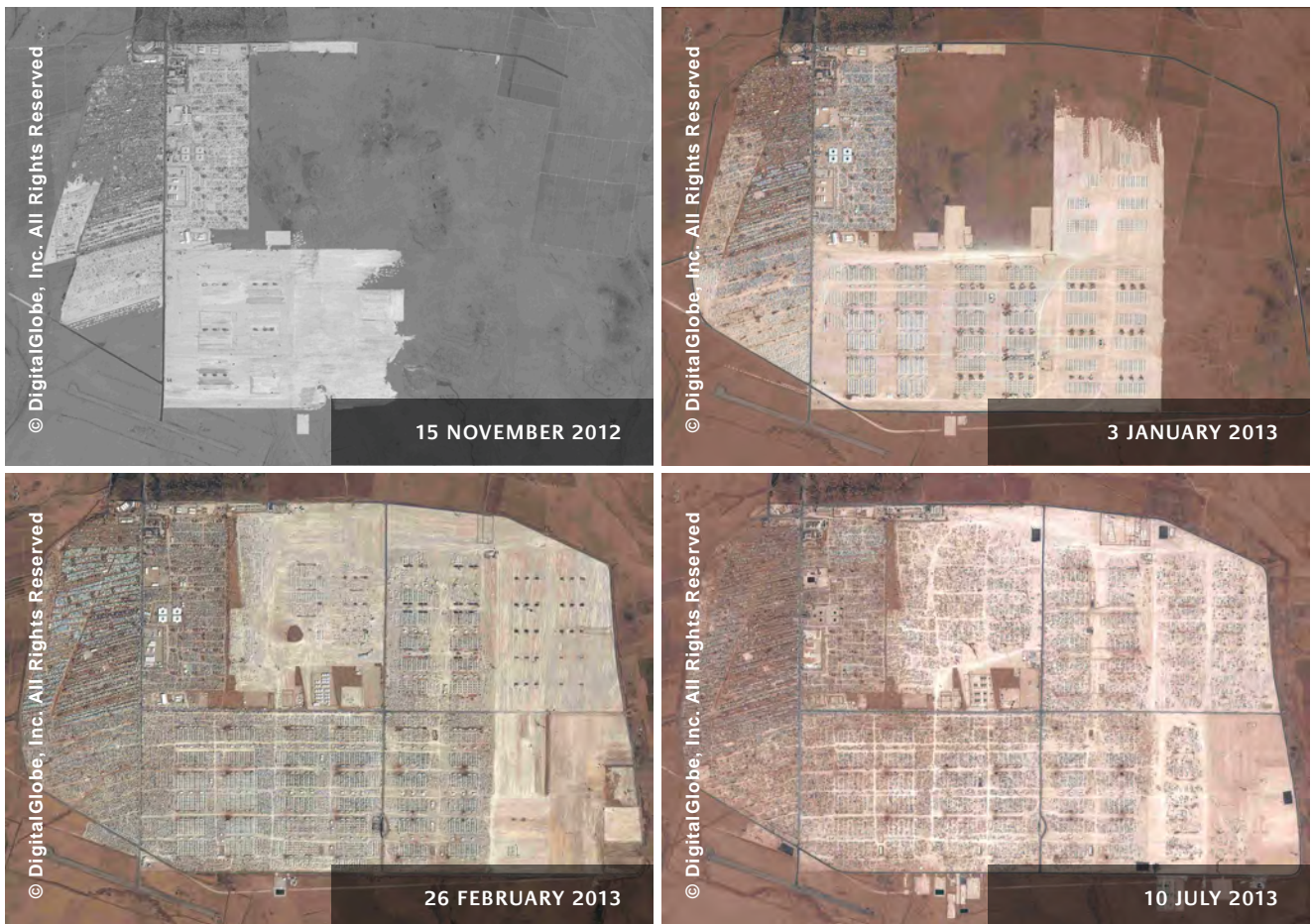
**VIDEO**
Scan QR code with smartphone or tablet to see video interview with UNHCR Country Representative in Jordan on use of satellite imagery for managing Al Zaatari camp.
For digital report versions, click the QR code to see video.
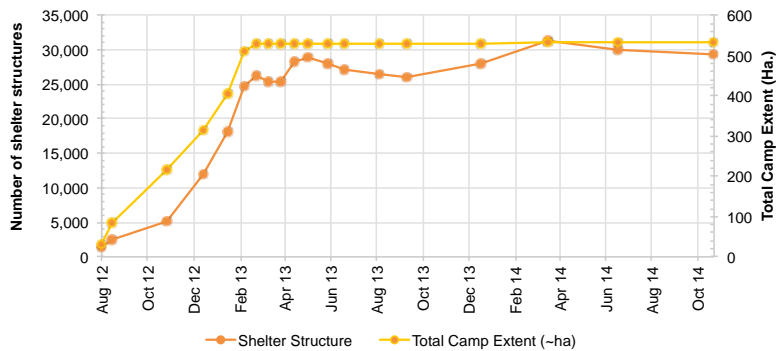
unitar

Imagery from 26 February 2013 shows tents used as shelter structures by the Syrian refugees in the early stages of the Al Zaatari settlement. Two years after the Al Zaatari refugee settlement opened the temporary structures that were used in the early stages became permanent structures. Imagery from 6 July 2014 shows the transition of these tent shelters into caravan trailers.

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26 FEBRUARY 2013

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AMERICAN SCHOOL

SAVE THE CHILIDREN'S RAINBOW KINDERGARTEN

6 JULY 2014



**Evolution of Al Zaatari Refugee Camp**

— Shelter Structure    — Total Camp Extent (~ha)

**FIGURE 34**
Evolution of the number of structures and settlement extent at the Al Zaatari refugee settlement.

**VIDEO**
Scan QR code with smartphone or tablet to see BBC video about Al Zaatari refugee camp. Click on QR code in digital report format to see video.

**VIDEO**
Scan QR code with smartphone or tablet to see video showing growth of Al Zaatari refugee camp in satellite imagery. Click on QR code in digital report format to see video.
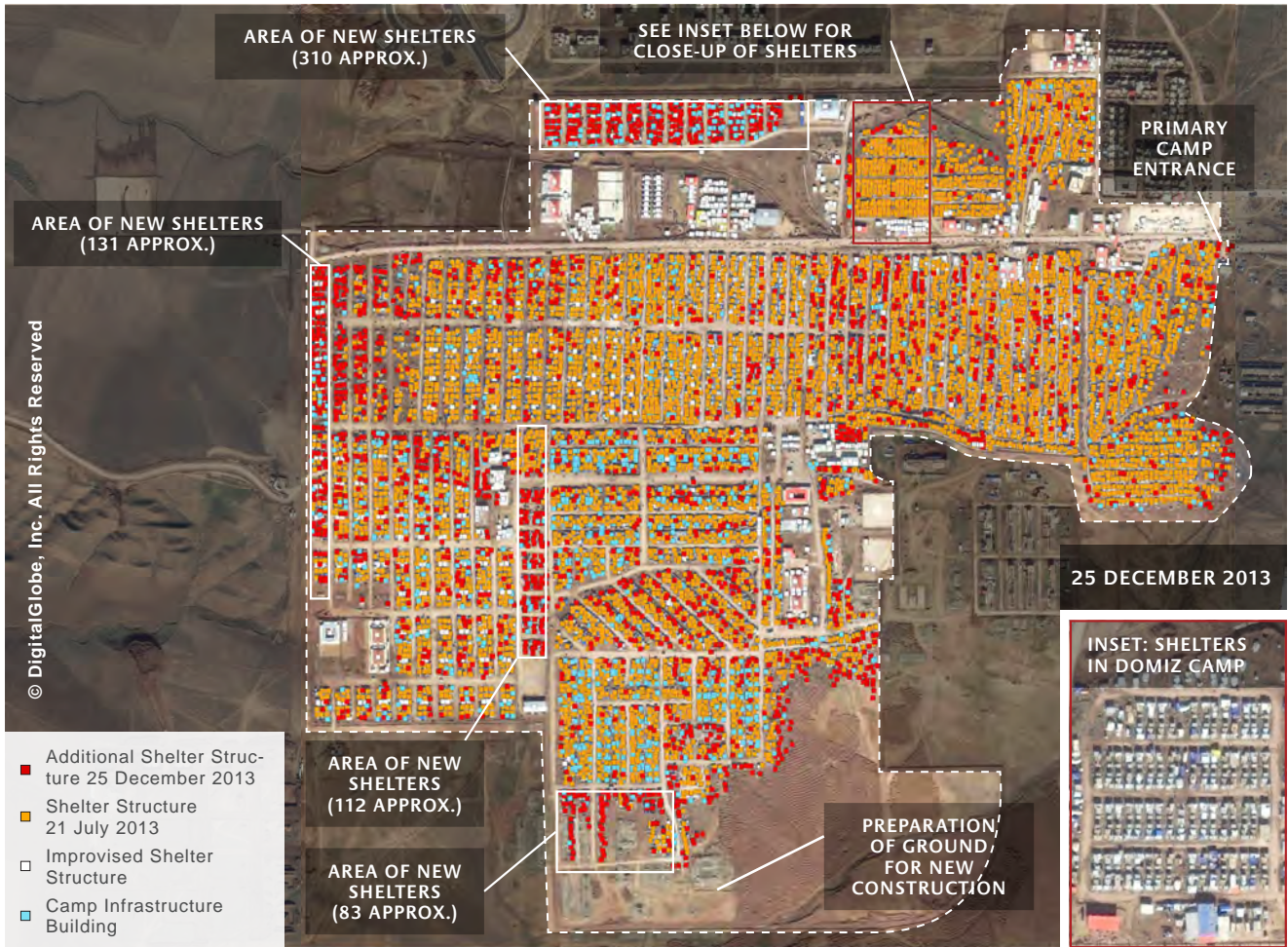


**Source: UNCHR / B. Sokol**
An overview of Zaatari Refugee Camp in Jordan. Panorama taken on 21 November, 2012.

The Domiz refugee settlement was established in April 2012 to host Syrian Kurds in Duhok Governorate, Iraq. Imagery from 25 December 2013 shows shelters and other buildings at the Domiz refugee settlement in Duhok Governorate, Iraq. As of 25 December 2013 a total of 9,367 standard shelters were detected, with 990 improvised structures likely being used for shelter and other purposes, and 592 infrastructure and support buildings. The Domiz refugee settlement is encircled by a fence that surrounds its perimeter and delineates its 149.76 hectares.

" 6.5 MILLION PEOPLE TO BE INTERNALLY DISPLACED, WHILE 3.7 MILLION ARE REFUGEES RESIDING IN EGYPT, IRAQ, JORDAN, LEBANON AND TURKEY.

AREA OF NEW SHELTERS (310 APPROX.)

SEE INSET BELOW FOR CLOSE-UP OF SHELTERS

PRIMARY CAMP ENTRANCE

AREA OF NEW SHELTERS (131 APPROX.)

25 DECEMBER 2013

INSET: SHELTERS IN DOMIZ CAMP

■ Additional Shelter Structure 25 December 2013
■ Shelter Structure 21 July 2013
□ Improvised Shelter Structure
■ Camp Infrastructure Building

AREA OF NEW SHELTERS (112 APPROX.)

AREA OF NEW SHELTERS (83 APPROX.)

PREPARATION OF GROUND FOR NEW CONSTRUCTION

**FIGURE 35**
Domiz refugee settlement, Iraq.

13 NOVEMBER 2012

TURKISH CUSTOMS AREA
ENTRANCE

TURKISH CUSTOMS
INSPECTION AREA

8 DECEMBER 2013

**FIGURE 36**
Kilis refugee settlement, Turkey.

Imagery from 8 December 2013 shows Kilis refugee settlement along the Turkey/Syria border in Kilis, Turkey. An estimated 2,143 structures were detected in the settlement which has an approximate area of 60 hectares. Since the Kilis refugee settlement was opened in 2012, it featured a high degree of organization with climate controlled container-style structures for the incoming refugees.



132 PROBABLE IDP
SHELTERS

1 OCTOBER 2014

**FIGURE 37**
Refugees at Rubkan border
crossing point.

Along the border separating Syria to Jordan, there are 45 unofficial crossing points where people attempt to cross. However, since the end of September 2014, Syrian refugees were restricted from entering Jordan and were not able to return to home due to continuing conflict. More than 4,000 Syrian refugees were trapped in the middle of the desert between the Syrian and Jordanian borders. UNOSAT found some evidences of these trapped refugees at the Rubkan crossing along Jordanian side about 25 kilometers southwest of the official Al Waleed border crossing and at the Hadalat crossing along the Syrian side of the border about 107 kilometers southwest of Iraq border. Satellite imagery collected 1 October 2014 shows temporary shelters in the area of the Rubkan crossing. Approximately 132 shelters were identified in the open desert and along the Jordanian side of the border. UNOSAT performed subsequent analysis over the same area, finding that on 2 November 2014 the number of probable shelters had increased about 17%.

# CULTURAL HERITAGE

Cultural heritage plays a vital role in civil society. It defines a common history and ties a society together. As for Syria, its vast cultural heritage is world known. Many of its sites are listed as UNESCO World Heritage Properties and several cities date back thousands of years. During UNOSAT's humanitarian damage assessment work, analysts noticed damage also to cultural heritage. In fact, for many locations the damage was so considerable, that it was found to merit a special analysis. This resulted in the recently published report by UNITAR-UNOSAT "Satellite-based damage assessment to cultural heritage sites in Syria", in which damage was documented in detail. The report is available for download from www.unitar.org/unosat/chs-syria

A total of 18 cultural heritage areas were analysed by UNOSAT, including six inscribed as UNESCO World Heritage Properties. Based on the available satellite imagery, a total of 290 cultural heritage locations were found to be affected over the last three years. Of these 24 were destroyed, 104 severely damaged, 85 moderately damaged and 77 possibly damaged. Damage is primarily found in sites being located inside conflict zones, thus exposed to heavy munitions and other military activities, as well as in sites were looting is identified. Other damage is caused by civilian activities, such as construction inside heritage sites. Aleppo is by far the most affected area when it comes to damage to cultural heritage sites. In addition, Apamea, Damascus, Dura Europos, Ebla and Palmyra are heavily impacted. Other areas have specific locations seriously damaged, like in Raqqa, although the total numbers for this area are less than for the most affected places mentioned above. Two examples from the recent report are provided below.

In the city of Ar Raqqa, the Shrine to Uwais Al-Qarani and Ammar Bin Yasser contain the remains of two martyrs from the battle of Siffin (657 AD). Unfortunately, these shrines, including the mosque housing each tomb and the minaret, were found to be severely damaged from explosives, most likely detonated on-site. At the time of the reported detonations, the location was under Da'esh control.

**SOURCE: APSA**
(The Association for the Protection of Syrian Archaeology). Shrine to Uwais Al-Qarani & Ammar Bin Yasser. Crater on the roof of the mosque caused by alleged bombing.

**FIGURE 38**
Extensive damage to the buildings and structures of the Uwais al-Qarani and Ammar Bin Yasser shrines in Ar Raqqa.

26 FEBRUARY 2013

PROBABLE INTERIOR DAMAGE

DESTROYED

DESTROYED

ROOF CRATER

6 OCTOBER 2014

4 SEPTEMBER 2011

2 APRIL 2014

In Dura Europos, an ancient walled city dating back to 303 BC, which was at the time located on the frontier of the East and the West and was part of a series of military colonies setup by Hellenistic, Parthian and Roman ruling forces. It is highly important from an archaeological point of view since the city has not been built over since it was abandoned due to conquest in 256-7 AD. The site has been looted in the past, which was also observed in the imagery from 2009. However, from analysing imagery acquired in 2014, the site is currently subject to extensive looting. This can be observed in thousands of holes dug both over the city and the necropolis located outside of the city walls. Observed looting holes are now larger in diameter, likely dug using earth-moving equipment and drilling machinery. All these activities result in severe damage to Dura Europos.

It should be noted that professional archaeologists across Syria, both within the Directorate General of Antiquities and Museums (DGAM) as well as in opposition-controlled areas, are doing all in their power to safeguard the wide range of cultural treasures. This is being done under extremely difficult conditions, but the common understanding of the need to protect Syria's cultural heritage is fundamental and not linked to political affiliation amongst these professionals. UNESCO is playing a key role in supporting these efforts, recently demonstrated at a dedicated workshop held in Beirut, Lebanon.

**FIGURE 39**
Signs of severe looting can be seen within the walls of Dura Europos, and most of the ruins have become unrecognizable from the looting activity. Additional looting holes are visible in the northern section of the image outside the walls of Dura Europos.

**GROUND PHOTOS SOURCE: ENDANGERED ANITQUITIES OF SYRIA**.

# HUMANITARIAN ACCESS
## BESIEGED AREAS

Following a period of intense negotiations, the UN Security Council on 22 February 2014 adopted resolution 2139 to ease much needed aid delivery to the Syrian population. This resolution was passed unanimously and it called on all parties in the conflict to immediately cease attacks against civilians and to lift the siege of numerous populated areas. Such action is fundamental for humanitarian aid to be delivered to the affected civilian population, both in areas besieged by government forces, as well as areas besieged by opposition forces. The Security Council, through resolution 2139, demanded safe and unhindered evacuation of all civilians wishing to leave besieged areas and to allow for free passage to all areas for medical personnel and equipment. Furthermore, the Security Council called on all parties to allow unhindered humanitarian access for United Nations agencies and its partners.

Following adaptation of resolution 2139, UN OCHA requested UNOSAT support to monitor the adoption of resolution 2139 as it played out in the affected areas. This request was later merged with request for support related to resolution 2165 and 2191 on cross-border humanitarian access.

The use of satellite imagery to monitor such Security Council resolutions contributes to up-to-date information over areas where no or only limited facts from the affected areas are available. Through detailed and regular analysis of imagery taken over specific areas of interest, UNOSAT provided OCHA with monthly updates as input to the regular reports on resolutions 2139, 2165 and 2191 to the UN Security Council. The below examples from this work illustrates the level of details this monitoring was carried out at.

Figure 42 illustrates UNOSAT security analysis for the towns of Harasta and Doma, in Eastern Ghouta, Damascus Governorate. Imagery from 3 June 2014 showed 201 possible roadblocks and 11 possible checkpoints along the roads that connect and give access to these two towns, indicating that the area is besieged. Some of the roadblocks are due to debris caused by heavy damage or craters on the surface of the road which makes them impassable. Figure 40 shows an example of a checkpoint located on the M5 highway. The combination of roadblocks, a chicane barrier and a possible guard post indicate that this is a checkpoint used to control the access to Harasta and Douma. Figure 41 shows a roadblock constructed with earth materials in the outskirts of Harasta.
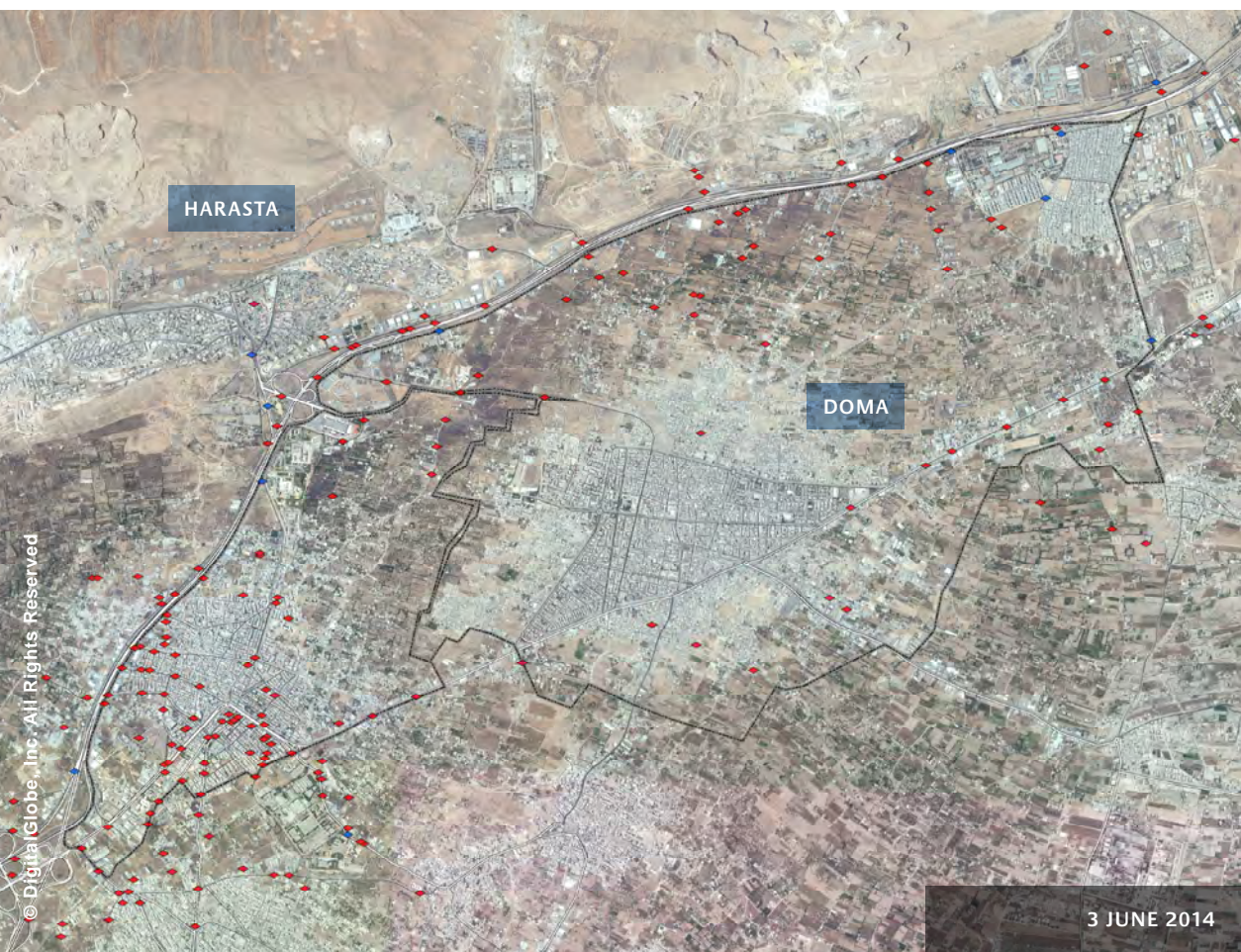
**FIGURE 40**
Checkpoint located
on the M5 Highway,
Eastern Ghouta.

M5 HIGHWAY

POSSIBLE
GUARDPOST

HOSPITAL

ROADBLOCK

CHICANE
BARRIER

3 JUNE 2014

**FIGURE 41**
Roadblock located
on the outskirts
of Harasta.

HARASTA -
EASTERN GHOUTA

ROADBLOCK -
CONSTRUCTED WITH
EARTH MATERIALS

3 JUNE 2014

**FIGURE 42**
Security analysis
of the towns of
Doman and Harasta
indicating the area
is besieged.

HARASTA

DOMA

Checkpoint ◆

Roadblock ◆

3 JUNE 2014

# ROAD ANALYSIS

Figure 43 illustrates road-blocks and obstructing debris along highway 214 as it passes near Tal Rifat Kafin, Mayvir Village, Nubl, Zahraa, Hayan, Anadan and Hreitan in Syria as seen in a satellite image collected on 26 February 2013. Within the analysis area a total of 67 distinct roadblocks were detected, both on highway 214 and on proximate roads, as well as 64 locations with obstructing debris which would impede vehicle traffic but may or may not have been intentionally placed as roadblocks. Along highway 214 itself 43 separate roadblocks were detected, often in groups, and thus comprising 13 separate areas of roadblocks. Some of these roadblocks were simple barriers to traffic, while others were arranged as a "chicane" designed to slow or stop vehicle traffic. Vehicle traffic along highway 214 was very sparse on 26 February, with a total of 9 vehicles on the road and an additional 31 vehicles stopped or parked within 20 meters of the highway. Eight separate areas of military fortifications are also visible in the analyzed area within 150 meters of highway 214, and are comprised of 59 separate trenches, fighting positions, and similar features.
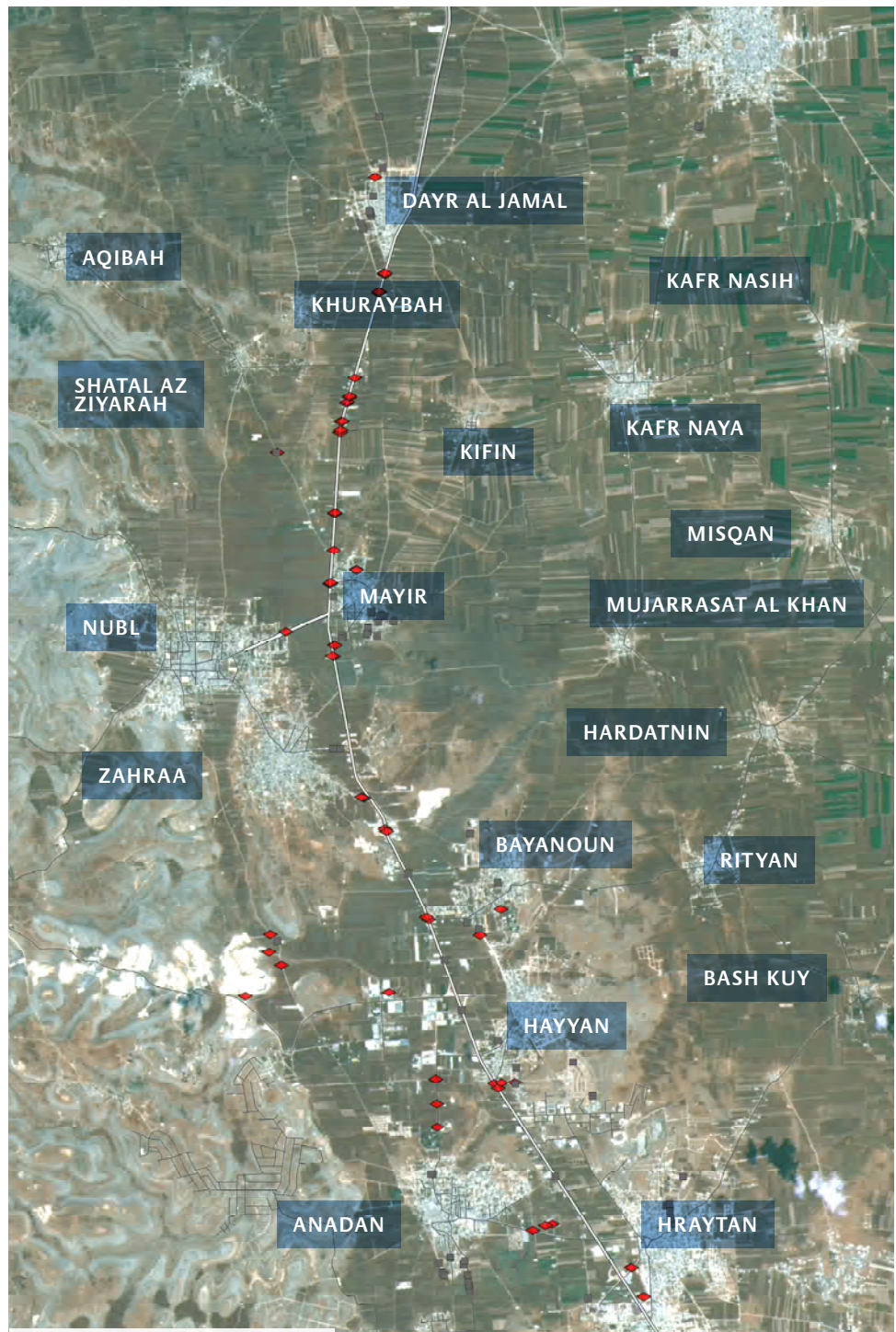


**FIGURE 43**
Roadblocks and obstructing debris along highway 214 as it passes near Tal Rifat Kafin, Mayvir Village, Nubl,Zahraa, Hayan, Anadan and Hreitan

Obstructing Debris ■
Roadblock ◆

# ATTACK ON HUMANITARAN CONVOY

Imagery from 8 February 2014 collected at 10:27 (local time in Homs, Syria) shows the possible location of a portion of the U.N. aid convoy, including four SUVs and one cargo truck, on Abd Al Hameed Al Drouby Street. Additionally, several security checkpoints and roadblocks were identified alongside the reported route taken by the U.N. aid convoy. The convoy came under sniper attack on Abd Al Hameed Al Drouby Street, which resulted in some vehicles being left behind, as seen in the imagery, while the rest continued towards the end-location. However, the remaining vehicles came under likely mortar attack in the area where one can see a smoke plume in the satellite image. Unfortunately, the narrow street and shadows on the Old City of Homs precluded the identification of the location of the rest of the U.N. aid convoy.

**FIGURE 44**
An U.N aid convoy en route in Homs on 8 February 2014.



UN AID CONVOY

NEW CLOCK SQUARE

ABD AL HAMEED AL DROUBY STREET

ABD AL HAMEED AL DROUBY MOSQUE

© CNES (2014), Distribution AIRBUS DS

8 FEBRUARY 2014



NEW CLOCK SQUARE

OLD CLOCK SQUARE

SMOKE PLUME POSSIBLE MORTAR ATTACK

ABD AL HAMEED AL DROUBY MOSQUE

© CNES (2014), Distribution AIRBUS DS

8 FEBRUARY 2014

**VIDEO**
Scan QR code with smartphone or tablet to see video on UN aid convoy attacked in Homs. Click on QR code in digital report format to see video.

| | |
|---|---|
| Location of U.N. Aid Convoy | 🚌 |
| Safir Hotel Homs | 🛏 |
| Checkpoint | ◆ |
| Roadblock | ◆ |

# CONCLUSIONS

This report illustrates the immense human suffering endured by the Syrian people over the last four years as observed through satellite imagery. We have high-lighted the humanitarian effects of the conflict in a range of fields, including:

• Impact on local economies through shut-down of markets;
• Destruction of power supplies;
• Destruction of schools and hospitals;
• Indiscriminate attacks on civilian population;
• Internally displaced and refugee populations;
• Cultural heritage and;
• Humanitarian access.

UNOSAT's analyses have been provided to the requesting UN entity, such as OCHA, UNHCR, UN-HABITAT, UNESCO, and OHCHR. By using such technolo-gies, UNOSAT is able to generate timely and objective information, often over areas where no other impartial information sources exist. The use of satel-lite imagery technology has now become the norm in humanitarian assistance provided by the United Nations, allowing for a more coordinated response and better targeted and timely assistance.

This report is our contribution to the UN call to put an end to the hostilities as it depicts with no uncertainty the terrible human suffering to which the people of Syria are exposed.

Part of Yarmouk refugee camp with destroyed areas as seen in satellite imagery as of 15 January 2014