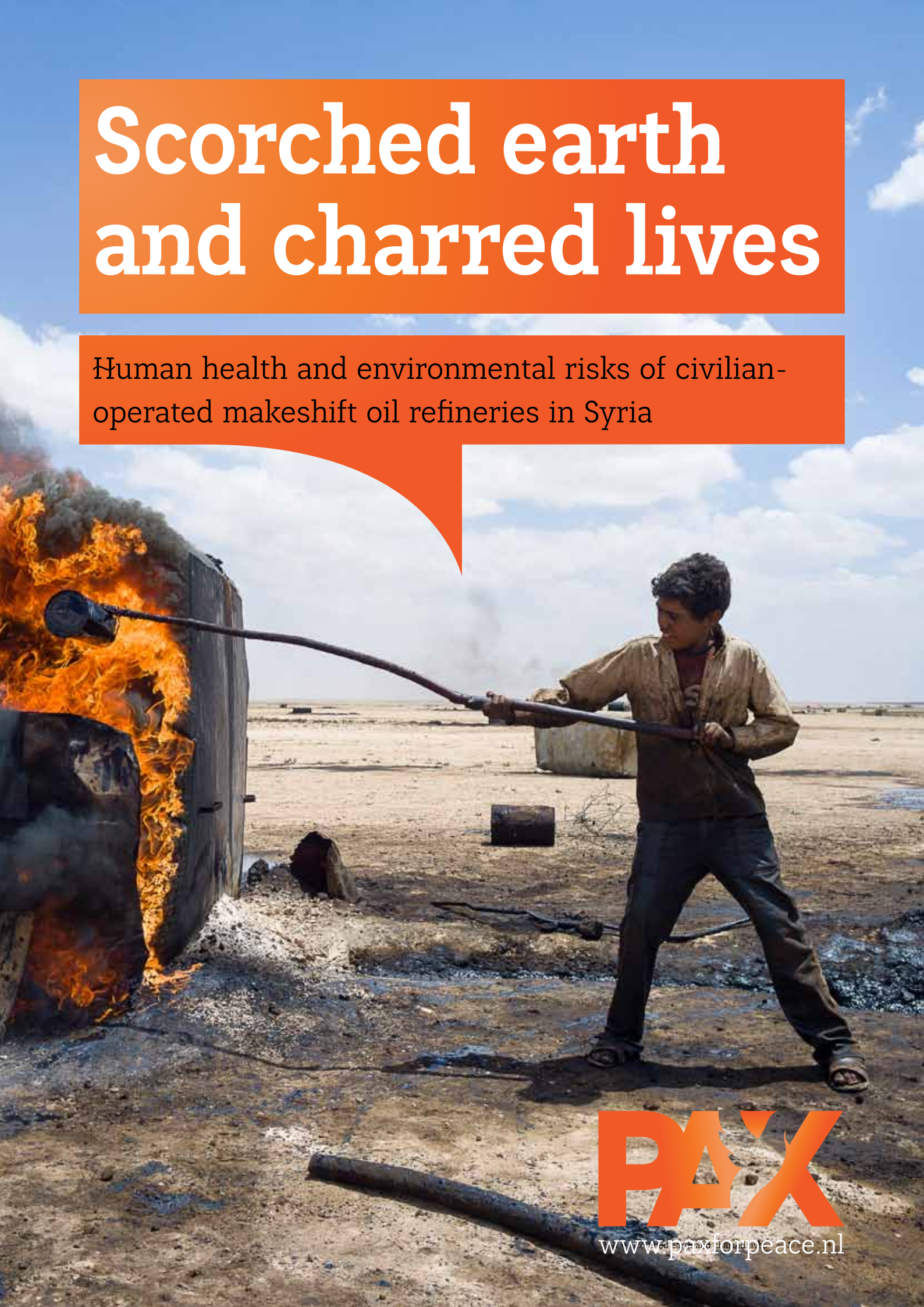
Scorched earth and charred lives

Human health and environmental risks of civilian-operated makeshift oil refineries in Syria



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Human health and environmental risks of civilian-operated makeshift oil refineries in Syria

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PAX means peace. Together with people in conflict areas and concerned citizens worldwide, PAX works to build just and peaceful societies across the globe. PAX brings together people who have the courage to stand for peace. Everyone who believes in peace can contribute. We believe that all these steps, whether small or large, inevitably lead to the greater sum of peace.

If you have questions, remarks or comments on this report you can send them to info@paxforpeace.nl
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Illustration on page 11: Frans van der Vleuten
Cover photo: Krahim splashes crude oil on a rudimentary refinery tank to keep it hot enough to boil kerosene. He's ten years old and works nine hours a day. Deir ez-Zor, Syria, 2013. Copyright Jean-René Augé-Napoli.

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1 Executive summary

Syria's professional oil production facilities have undergone a major decline since the start of the uprising against President Assad's regime in 2011. The resulting protracted armed conflict led to a steep drop in oil revenues from lost capacity, caused by attacks on oil facilities and an absence of professional workers who joined the fighting or fled the country. With demand for oil for a range of public and household services as well as transportation remaining high, civilians started to operate their own so-called backyard or makeshift oil refineries, where they produce a range of oil products from processing crude oil. However, these attempts come with a heavy price, as this practice exposes these workers - including an alarmingly high number of orphaned children - to highly toxic compounds. From exploding fuel barrels to exposure to carcinogenic chemicals and inhalational toxins, these makeshift oil refineries will have a long-lasting health impact on communities and their environment. Satellite analysis undertaken by PAX for this report finds that at least 5,791 of these makeshift refineries have sprung up at selected site in eastern Syria, near Deir ez-Zor since 2012, involving thousands of civilians who operate them under deplorable circumstances. Based on the scarce information available, at least 36 of these sites with various sizes have been located, scattered throughout the whole of Syria. According to currently-available information about civilians working in the known locations, this indicates that overall number of civilians facing huge health risks working in these toxic environments is expected to be in the tens of thousands, including a significant amount of children.

Furthermore, there are concerns over the unintended consequences of targeting oil infrastructure. Even though makeshift oil refineries were already used on a large scale from 2012 onwards, our research highlights how the rapid increase of these vast makeshift oil sites are likely to be a direct result of the increased targeting of the Islamic State in Iraq and al-Sham (ISIS) controlled professional static oil refineries by the United States-led Coalition forces and the Russian Air Force. Such target acquisition has likely resulted in ISIS also becoming a major force in driving makeshift oil refining, resulting in tens of thousands of makeshift refineries being set up. Most of these are operated by civilians.

Though it should be noted that these refineries are also commonplace in Kurdish-controlled areas, and are often operated by local civilians to provide income, these sites seem to be more limited in size compared with the ones in ISIS-controlled areas.

This research highlights wider concerns about the unpredictable consequences of conflict on public and environmental health, and urges the international agencies, relevant member states and their armed forces, and relevant humanitarian actors to prepare intervention strategies for dealing with the serious health impacts of civilian-operated oil refineries, as well as socio-economic development plans to support alternative ways of generating income.

Lastly, this research builds on PAX's previous desktop study *Amidst the debris*… which was published in October 2015.[1] This study identified four types of hazards - feasible scenarios in which the environmental impact of the conflict may have a direct and or long-term impact on the public health of the Syrian people. These hazards include the targeting of industrial facilities and critical infrastructure, the heavy damage to residential areas and exposure to hazardous building rubble, contamination from the intense use of weapons and the breakdown of environmental governance**.** PAX believes that a broader approach to assessing conflict-related environmental damage should be part of humanitarian response planning and military operations to prevent civilian harm during and after conflict.[2] ♦

2. Syria's oil industry and the rise of makeshift refining

Background

With the takeover of the oil industry in Syria by ISIS in 2014, the economic dynamics around work on oil sites drastically changed. Demand for oil went up, yet supply decreased due to the ongoing conflict, which forced many experts operating the professional refineries to flee for their safety. With the start of Operation Inherent Resolve (OIR), Coalition forces started targeting the professional oil production and storage facilities to disrupt ISIS's oil revenues and attacked transport trucks that were smuggling oil to Kurdistan, Turkey, Iraq and Syria. Initial reports indicated that there was a marked drop in oil incomes from ISIS, but this report demonstrates that the takeover of the oil sites and increased attacks have resulted in a dramatic increase in civilian operated makeshift oil refineries, which will have grave and far-reaching health consequences for civilians operating these sites, in particular children, and the communities in which they live. PAX has analysed selected sites northwest of Deir ez-Zor, and witnessed a vast increase in so-called makeshift oil refineries. Of particular concern is the number of children involved in refining crude oil. Children are acutely sensitive to toxin exposure because of the profound long-term effects this has on physical and mental development. This report will first outline the background to the Syrian oil industry, as well as how it relates to the targeting of the oil industry by Operation Inherent Resolve and Russia. Next, the report will provide background on the acute and chronic health and environmental impacts in these selected areas based on reports from the sites in Deir ez-Zor and Al-Hasakah province before providing satellite analysis of selected sites in Deir ez-Zor. Finally, based on the findings, it will provide recommendations to the humanitarian community, international organisations and States on dealing with these public health and environmental challenges as a result of armed conflict.

Syria's oil economy

Much of life in Syria, a fully demographically and economically transitioned country, still depends on oil services, ranging from motorcycles, cars and trucks to generators, household and industries -all use a variety of oil derivatives. Households also need oil for heating in the winter. Many hospital generators, pumping stations, water purification sites and power plants are dependent upon refined oil for electricity production. As in most industrialised countries, oil has become the blood in the economic veins of Syria. This dependence on oil and the revenues generated from its sale have made this commodity a vital tactical resource for ISIS, oil smugglers and the local population.

Since the onset of the Syrian onflict in 2011, access to oil-rich areas has been strategically important to many of the armed groups that have been part of the conflict, including the Syrian army. The Syrian Economic Forum claims that the regime lost more than 97.5% of its registered volume of oil production between 2010 and 2014.[3] Opponents of the Syrian government have benefited from the situation, in particular ISIS, which now controls around 60% of Syria's oil production.[4]

Prior to the war, Syria's production capacity was around 383.000 barrels of crude oil a day, and 316 million cubic feet of natural gas per day.[5] Oil production has since dropped to 25.000 barrels a day in government-controlled areas. The production capacity in rebel and ISIS-held areas is unknown, but ISIS does control Syria's biggest oil asset, the Omar oil field. In 2014, experts estimated ISIS's produced 40.000-80.000 barrels of crude oil a day[6], though recently experts warned not to overestimate ISIS's reliance on oil incomes, estimating the production to be much lower, namely around 20.000-30.000 barrels a day.[7]

Shifting oil production

Since the beginning of the conflict, the production and refining of crude oil witnessed a sharp drop due to loss of skilled staff, lack of equipment or damages due to fighting. Yet the need for oil was still high. Desperate residents in some regions have taken advantage of oil leaks to acquire fuel for heating purposes, only to find that unrefined crude oil exposure was causing a range of health problems such as irritation to the eyes, skin, and lungs, as well as dizziness, rapid heart rate, and headaches. It is estimated that in the Jazira area alone (part of the Kurdish-dominated enclave in Al-Hasakah province) there are already over 3.000 makeshift oil refineries. Local reports indicate that civilians are turning to makeshift oil refineries for income, selling refined products on the roadside, gas stations or directly delivering them to remote communities that have no other source for energy products as a result of a collapsed energy infrastructure.[8]

Similar changes also occurred in and around Deir ez-Zor, Syria's oil capital. The governorate hosts the majority of Syria's professional oil pumping stations, refineries and storage sites, that before the conflict produced 27.000 barrels a day. Very early on in the conflict, intense fighting took place over access to these sites, resulting in oil spills, collapse of management of these sites and other kinds of damage to these facilities, according to a journalist who visited these sites in 2014.[9] Reports suggest that the makeshift oil refineries used by ISIS and other armed groups or criminal gangs have caused significant local environmental damage,[10] with locals living near an ad-hoc refinery claiming birds were "turning black" because of the smoke.[11] In sum, the continued conflict and attacks on oil sites have dealt a significant blow

to the professional oil industry, and have driven many civilians to alternative means of income generation. This shift from professional to amateur-operated artisanal oil production has resulted in tens of thousands of makeshift oil makeshift oil refineries.

The presence of makeshift oil refineries rapidly increased in 2012 and they were soon seen all over northern and western Syria in the vicinity of oil wells, providing local communities with means to earn an income. These practices are gaining ground in Iraq as well, as shown by the U.S.-based company Stratfor, which published a short analysis of satellite imagery, demonstrating an increase of these sites at Mosul, Iraq in July 2016, noting the change in oil production by ISIS in order to boost their oil revenues.[12]

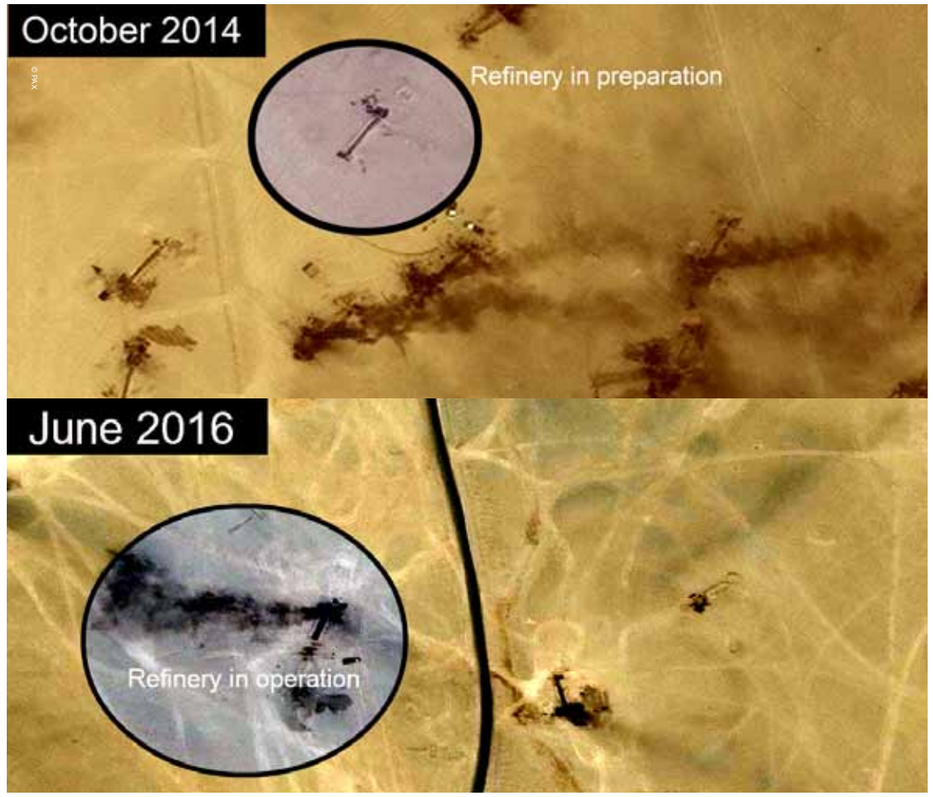
The various news reports and documentaries shot in multiple locations in northern Syria provide useful insight into how these makeshift oil refineries are constructed.[13] The process is very rudimentary: a tank or furnace is filled with crude oil and a fire under the tank heats the oil. The oil evaporates in the form of hydrocarbons, and these ascend, and are directed through a pipeline that flows through a basin of water, and condense out. This will come out at the other end of the ditch in various forms, depending on the heat underneath the tank. The initial product, when the crude oil is heated to 110 degrees Celsius, is benzene, then followed at 180 Celsius by kerosene and lastly, at 280 Celsius, by diesel. The leftover products in the tanks include paraffin wax, lubricating oil and tar, which are commonly used as fuel for the tank. During the refining process, sulphur, ethane and methane gasses are produced as by-products, but are usually not captured by amateur oil refiners, thus are released to the atmosphere during the burning of the crude oil. A graphic representation of this process can be found in the image at the bottom of page 11.

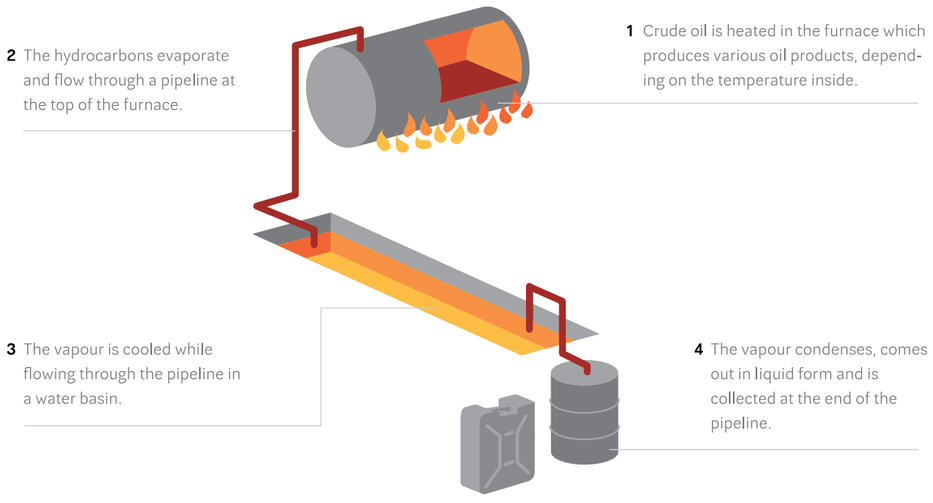
As shown in the imagery on page 11, these makeshift sites often have a T-shaped structure and can be recognized on satellite imagery as such. These images on page eleven show clear examples of a used and an unused makeshift refinery.

Health effects of makeshift oil refining

Past conflicts over oil-rich areas such as the Ogoniland in Nigeria[14] or oil production areas in South Sudan,[15] or attacks on oil facilities in the Balkans[16] and Iraq[17] that led to severe localised pollution have demonstrated how important it is to properly identify and assess health and environmental impacts of oil-related conflict damage.

Under peacetime circumstances, the oil industry is (ideally) heavily regulated because workers can be exposed to numerous hazardous chemicals and by-products of oil and gas drilling, which present both a health and an environmental threat if not handled properly.[18] [19] These can range from chemical burns to inhalation of toxic vapours, hydrogen sulphide, silica and diesel particulate matter. Oil fires release harmful substances into the air – sulphur dioxide, nitrogen dioxide, carbon monoxide, polycyclic aromatic hydrocarbons, and lead. These can be transported over a wide area before deposition in soils and can cause severe long-term health effects for people and wildlife, especially people with pre-existing respiratory problems. Long-term exposure to oil-related substances may lead to respiratory disorders, liver problems, kidney disorders, anaemia, teratogenesis (prenatal toxicity), developmental disorders and cancer.[20] An overview of the adverse health effects of oil products can be found in Table 1. Moreover, the environmental health effects of targeting oil infrastructure can be multi-faceted.





A rudimentary overview of makeshift oil refining

Table 1:
Health effects of hazardous chemicals derived from oil refining.

Hazardous Chemicals	Adverse Health Effects
Benzene (crude oils high in BTEX, benzene, toluene, ethylbenzene, and xylene)	Irritation to eyes, skin, and respiratory system; dizziness; rapid heart rate; headaches; tremors; confusion; unconsciousness; anemia; cancer
Benzo(a)pyrene (a polycyclic aromatic hydrocarbon reproductive [see below], formed when oil or gasoline burns)	Irritation to eyes and skin, cancer, possible effects
Carbon dioxide (inerting atmosphere, byproduct of combustion)	Dizziness, headaches, elevated blood pressure, rapid heart rate, loss of consciousness asphyxiation, coma
Carbon monoxide (byproduct of combustion) Irritation to eyes, skin, and respiratory	Dizziness, confusion, headaches, nausea, weakness, loss of consciousness, asphyxiation, coma
Ethyl benzene (high in gasoline)	Irritation to eyes, skin, and respiratory system; loss of consciousness; asphyxiation; nervous system effects
Hydrogen sulfide (oils high in sulfur, decaying plants and animals)	Irritation to eyes, skin, and respiratory system; dizziness; drowsiness; cough; headaches; nervous system effects
Methyl tert-butyl ether (MTBE) (octane booster and clean air additive for gasoline, or pure MTBE)	Irritation to eyes, skin, and respiratory system; headaches; nausea; dizziness; confusion; fatigue; weakness; nervous system, liver, and kidney
Polycyclic aromatic hydrocarbons (PAHs) (occur in crude oil, and formed during burning of oil)	Irritation to eyes and skin, cancer, possible reproductive effects, immune system effects
Sulfuric acid (byproduct of combustion of sour petroleum product)	Irritation to eyes, skin, teeth, and upper respiratory system; severe tissue burns; cancer
Toluene (high BTEX crude oils)	Irritation to eyes, skin, respiratory system; fatigue; confusion; dizziness; headaches; memory loss; nausea; nervous system, liver, and kidney effects
Xylenes (high BTEX crude oils)	Irritation to eyes, skin, respiratory system; dizziness; confusion; change in sense of balance; nervous system gastrointestinal system, liver, kidney, and blood effects

Source: United States Department of Labour. OSHA 3172. [21]

Oil fires release harmful substances into the air – sulphur dioxide, nitrogen dioxide, carbon monoxide, polycyclic aromatic hydrocarbons, and lead. Damage to oil storage sites and processing facilities can lead to the release of a range of dangerous substances, risking civilian exposure and environmental pollution. Groundwater contamination threatens agricultural land and the people who rely on ground and surface water for irrigation, drinking, and domestic purposes.

Targeting Syria's oil infrastructure

Makeshift oil refining was already common practice in 2013, as Google Earth images show numerous sites in various sizes around Deir ez-Zor and south-west of Raqqa in this year.[22] These refineries were operated by civilians, who bought the crude oil from armed groups controlling the oil wells. Soon after the rise of ISIS, the production levels changed. Syria's oil-rich areas have been substantial sources of income to ISIS, who continued to operate professional oil refineries and smuggle out crude and refined oil. Therefore, the US-led OIR started targeting some of the major oil producing sites in 2014, focussing on secondary oil infrastructure and oil transportation means. Interestingly enough, the U.S. Pentagon's spokesperson stated that environmental concerns were one of the main reasons not to target the larger oil refineries and oil wells directly.[23] These considerations were less of an issue for the Russian Air Force (RuAF), when it started to attack ISIS in October 2015. The RuAF carpet-bombed oil refineries, oil wells and storage facilities. The increase of attacks by both the RuAF and the U.S.-led OIR took out some of the major oil producing sites, like the Omar oil field, the Tayyem oil field, and various sites near Abu Kamal, south of Deir ez-Zor.
The OIR information centre currently claims to have taken out 1.620 oil infrastructures[24] whereas the Russian Ministry of Defence stated they have damaged 32 oil refining complexes, 11 oil refineries, and 23 oil pumping stations, while destroying 1.080 oil tankers.[25] Recent images from the Russian Ministry of Defence also demonstrated attacks against makeshift oil refineries in Hama province, although these locations have not been independtly verified.[26]

Wider impact of targeting oil infrastructure

Although the rationale used by Russian and U.S.-led coalition forces is that the oil industry is a legitimate target as a "war-sustaining activity,"[27] it is questionable how viable a strategy it is if the objective is to defeat ISIS, and what the long-term consequences of these tactics are. There is huge demand for oil – by the Assad regime,[28] Kurdish groups, even the Turkish government[29] – and so oil refinement and smuggling will continue, calling into question whether this strategy is actually degrading ISIS' operations in any way.[30] The overarching question in Syria then is whether targeting oil infrastructure is a sound long-term strategy. This issue is also under consideration by the British armed forces in the their operation planning against ISIS, which noted that:

“Military strikes against ISIL must always be balanced against the risk of undermining the ultimate capacity for post–war reconstruction in the areas now controlled by ISIL, and the danger of worsening the conditions of the populations who now live under the group’s occupation. The targeting of ISIL’s oil industry must also consider the environmental impact, as well as the risk to civilians who are not necessarily adherents of ISIL but who nevertheless work in the oil supply chain controlled by the group.” [31]

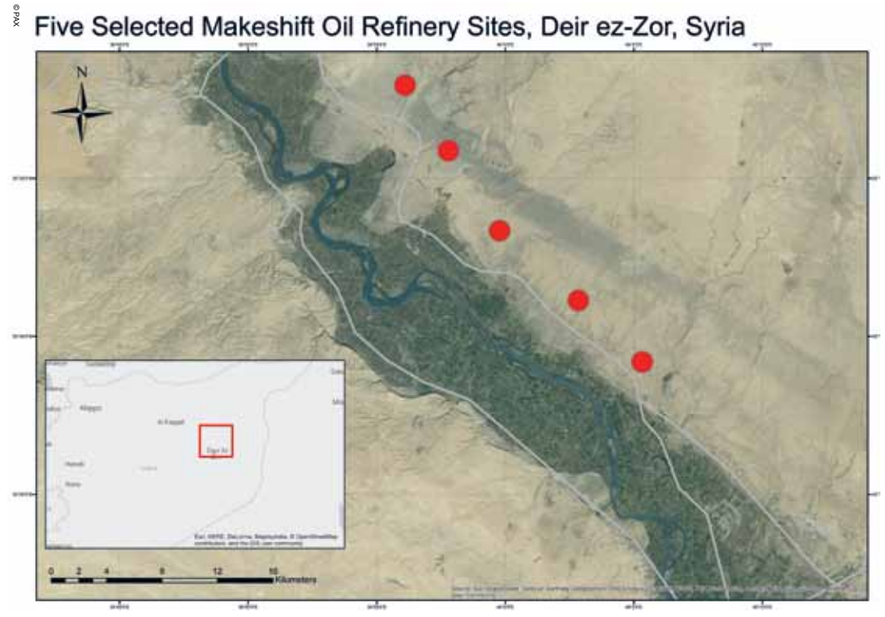
As long as there is a need for oil, refining and smuggling will continue, and there certainly lies a responsibility for the regimes claiming to oppose ISIS to stop the smuggling. However, they are allowing oil smuggling to continue and profiting from the lucrative business.[32]
Disrupting smuggling activities and enforcing stricter border controls will likely have a greater effect on ISIS’s finances than air strikes on infrastructure – with the added benefits of preventing long-term damage to the environment, socio-economic development, and public health.[33] ♦

Footage released by the Russian Ministry of Defense of attacks on various oil installations, November 2015.

Footage released by the Russian Ministry of Defense of attacks on various oil installations, November 2015.

Footage released by Operation Inherent Resolve of the targeting of an oil well head near Abu Kamal, Syria, May 2016.

3. Capturing the growth of Syria's makeshift oil refineries



Assessing the impact of conflict on human health and the environment is fraught with access and technical challenges. However, new technological approaches have greatly contributed to obtaining information from conflict areas that can help identify a range of conflict-related issues such as damage assessment, tracking flows of arms and ammunitions, as well as weapons identification and locations of hostilities. Remote sensing utilising satellite imagery has been increasingly used as an important tool among humanitarian and human rights organisations to critically monitor such activities.[34]

Methodology

PAX obtained satellite imagery from Digital Globe through United Nations Operational Satellite Applications Program (UNOSAT), of selected sites in Syria and made a comparison of the number of makeshift oil refineries at these locations on different dates. The sites are selected on the basis of availability of imagery and function merely as examples to demonstrate the growth and impact of this industry, not as a systematic comprehensive country assessment. Many more locations are to be found all over the country, with noted examples of sites near Aleppo, Idlib, Raqqa and in Al-Hasakah governorates, based on journalists' reports at these sites. Other reporting indicates that there is also a growing illegal refining industry in Iraqi Kurdistan, especially near sites in Kirkuk, where the Kurdish Regional Government had already shut down 170 illegal oil refineries in 2015.[35]

PAX obtained imagery for five main sites from different years (2013, 2014 and 2016). In addition, images were taken from Google Earth for sites from where PAX was not able to get

Table 2:
Locations of makeshift oil refineries

Location	Coordinates
Site 1	35.478204, 40.090012
Site 2	35.511211, 40.051203
Site 3	35.547902, 40.000047
Site 4	35.590576, 39.966378
Site 5	35.624155, 39.935523

Close-up view of makeshift oil site, Deir ez-Zor, Syria, 2016

images from Digital Globe. At every selected site, the makeshift structures were counted by assigning a symbol to each makeshift oil structure, either in preparation or in production. A 5 % margin of error should be applied to the data, as it was not always clear if the site was taken in production or the workers dug a water basin, but did not take the site into production at a later stage, as only the basins were visible. Note that PAX has not been able to verify this research on the ground and this is overview is merely a prelimenary analysis.

The sites for analysis were geo-located through Google Maps on the basis of news reports on the subject sourced from various online articles between January and August 2016. The main makeshift sites are adjacent to the road north of the river between Deir ez-Zor and Raqqa (see Table 2). The sites were defined based on a substantial spatial separation from other sites.

On all sites, no makeshift refineries were visible on Google Earth Satellite imagery from 2011. Other makeshift sites have been located in other areas near Deir ez-Zor, in particular, northeast of Deir ez-Zor city, south of the Jafra oil field. As a constant flow of crude oil from wells is needed to operate the sites, it is likely that new sites can be located in the vicinity of the wells and major oil fields in this region. However, no high-resolution imagery of these sites was available for this research.

Analysis of makeshift sites

In the following section, satellite analysis will be provided, which demonstrates the increase of makeshift refineries at each location. For all locations, Google Earth imagery has been used as a background in the maps, instead of the real satellite imagery at the time of the location, for aesthetic purposes. At some locations, an inset image is provided from the actual satellite imagery. Each map shows an overview of the makeshift refineries present at the site at the designated date.

Site 1:

At all sites, as shown on the satellite imagery, there were no structures visible prior to the conflict. Site 1, which is north of the village Abu Ghanimah, is one of the smaller sites. İn 2013, the visible used and unused structures were counted at a minimum of 162, including a smaller site 1,5 km to the south. This number almost tripled in 2014, where at least 518 structures were counted. İn the imagery from June 2016, the total number grew to 690.

Makeshift Structures 2013

Makeshift Structures 2014

Coordinate System: GCS WGS 1984

Datum: WGS 1984

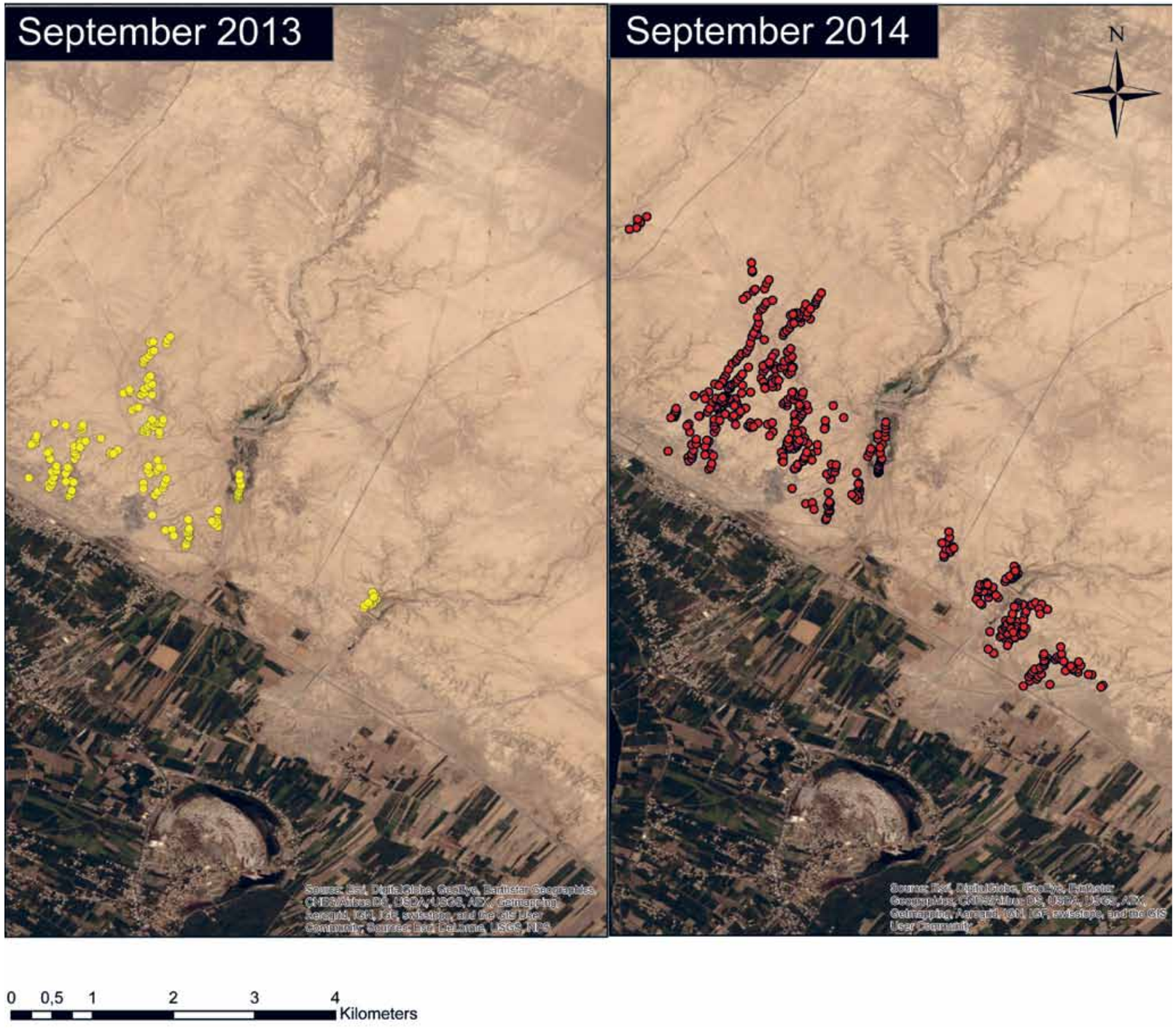
Units: Degree

Author: PAX

Copyright: DigitalGlobe Inc.

Source: US Department of State, Humanitarian Information Unit, NextView License.

Produced by UNITAR-UNOSAT



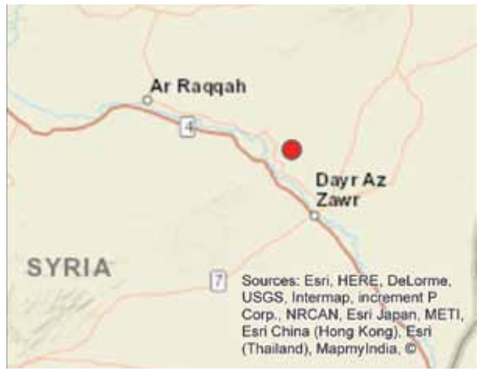
Site 2

The next location is a site that is 5km by road north of Site 1 and adjacent to the town of Zughayr. At this location, major developments took place over the reporting years. In 2011, there were also no makeshift refineries present. However, in 2013, an enormous field of makeshift refineries can be seen, with over 437 counted structures.

In October 2014, this number dramatically increased to 1.306 makeshift structures. Even more appeared by 2016, with the number at this specific site having risen to 1.751, as visible on the imagery below.

Makeshift Structures 2013

Makeshift Structures 2014



Coordinate System: GCS WGS 1984 Datum: WGS 1984

Units: Degree

Author: PAX

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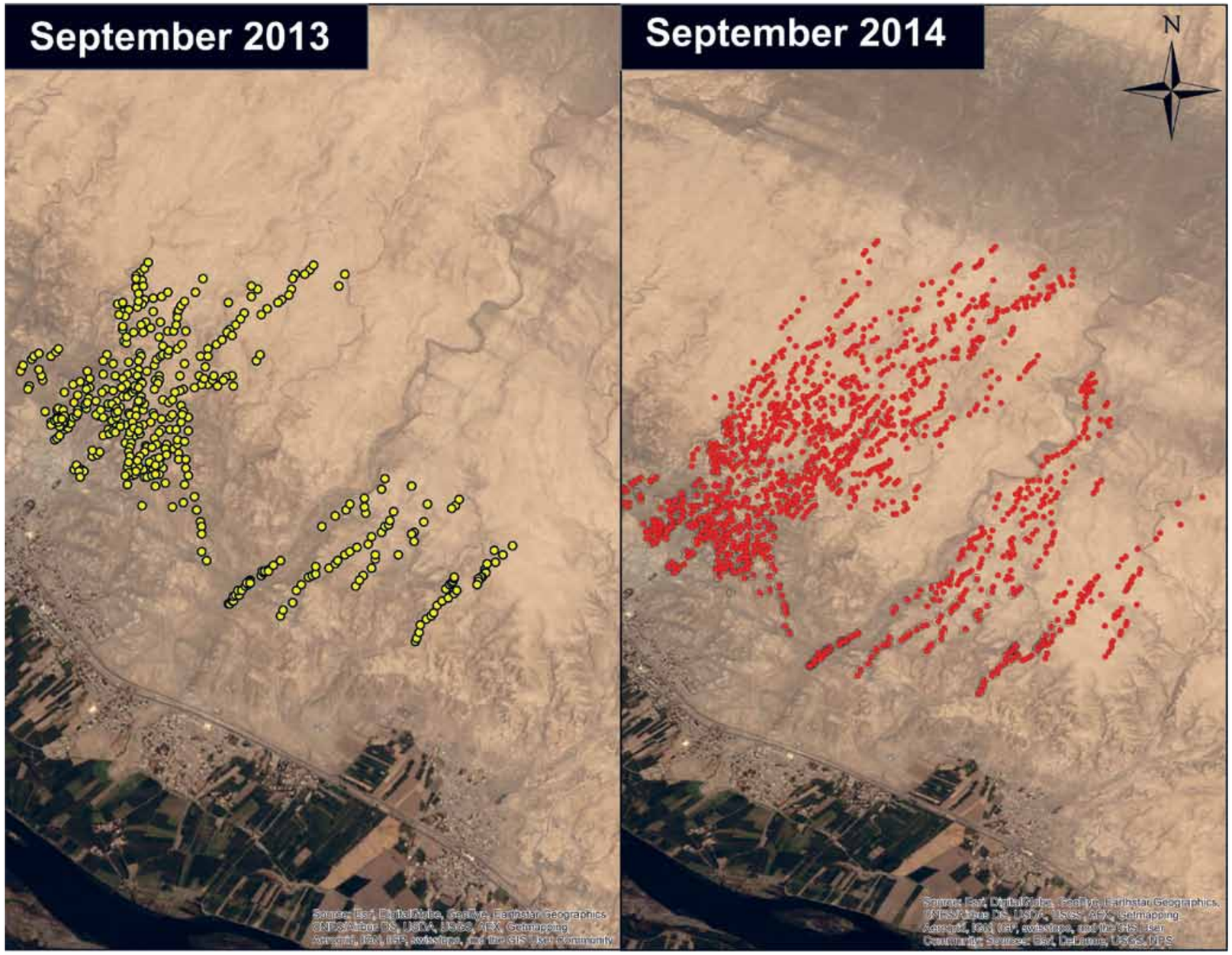
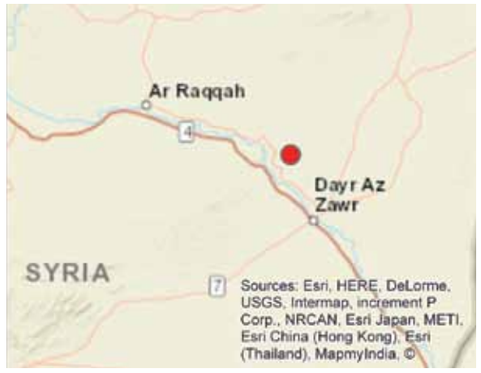


Site 2 - 2016 North

İn the same imagery, from June 2016 a production move is also visible to north of the location, where the operators have direct access to the oil wells. At this new site, 1.098 makeshift structures were counted and are visible in the image below. All of these appear to be in full production, where dozens of oil trucks are visible shipping the oil out.

Makeshift Structures 2016



Coordinate System: GCS WGS 1984 Datum: WGS 1984

Units: Degree

Author: PAX

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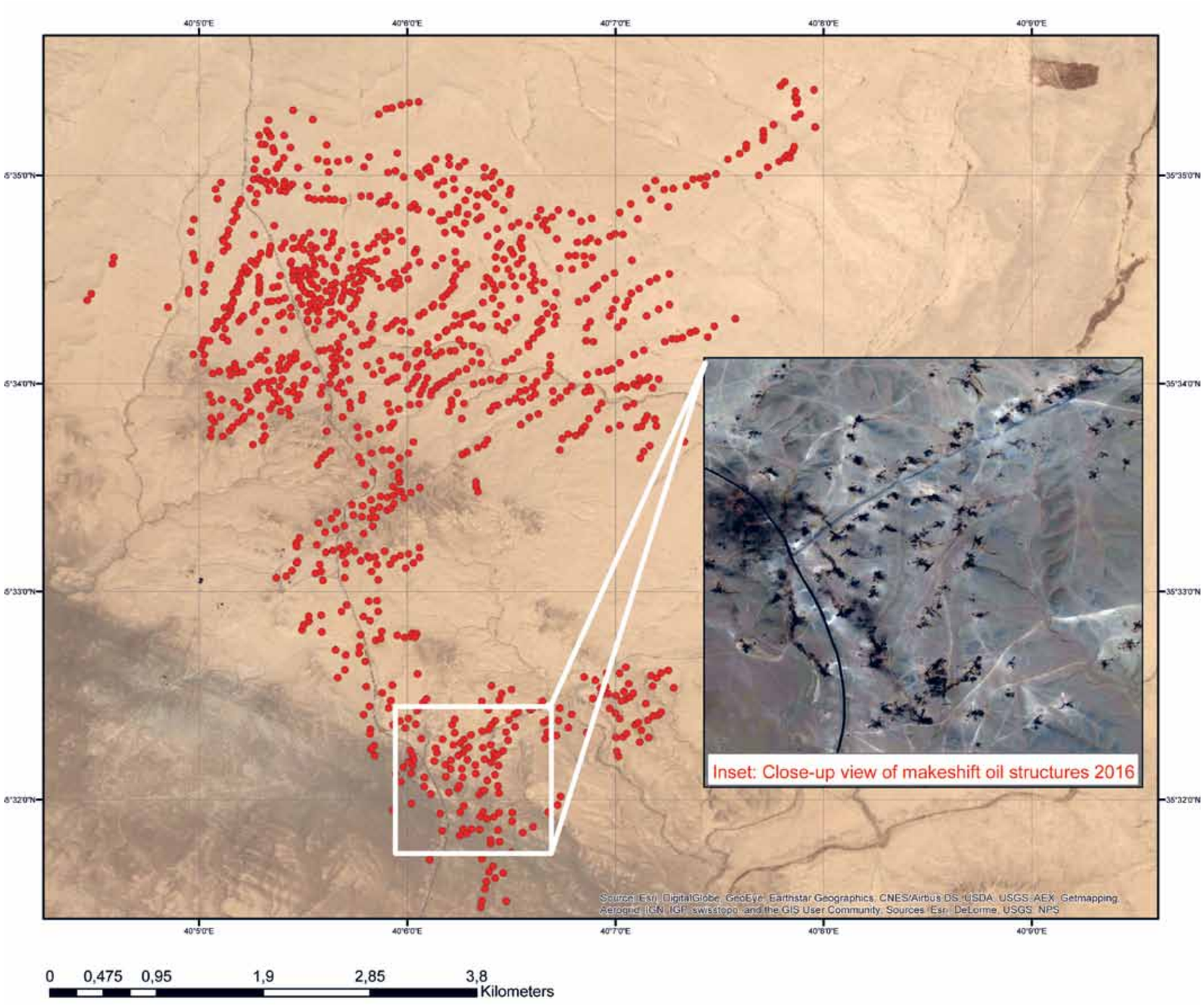
Produced by UNITAR-UNOSAT



Site 1,2 & 3

Farther north, about 2,5 km up the road from Site 2, is the third location. As was true with the other locations, there was no presence of makeshift refineries at Site 3 in 2011, and the amount of makeshifts boomed, in this case to 381 refineries in 2014, and further developed to 592 in 2016. Here it must be noted that this number includes a number of sites out of operation that could potentially be counted in this area, and which are part of this site, but were not available in the 2014 satellite imagery provided. As with Site 2, there has also been a shift in the area of operation to the north, where a new location could be identified in June 2016, with 124 makeshift structures; the majority of those appear to be fully operational. This renders the total at this location as 716 makeshift structures. The map below will show the increase that occurred at sites 1, 2 and 3 compared between 2014 and 2016.

Makeshift Structures 2014

Makeshift Structures 2016

Coordinate System: GCS WGS 1984

Datum: WGS 1984

Units: Degree

Author: PAX

Inset image:

Copyright: DigitalGlobe Inc.,

Source: US Department of State, Humanitarian Information Unit,

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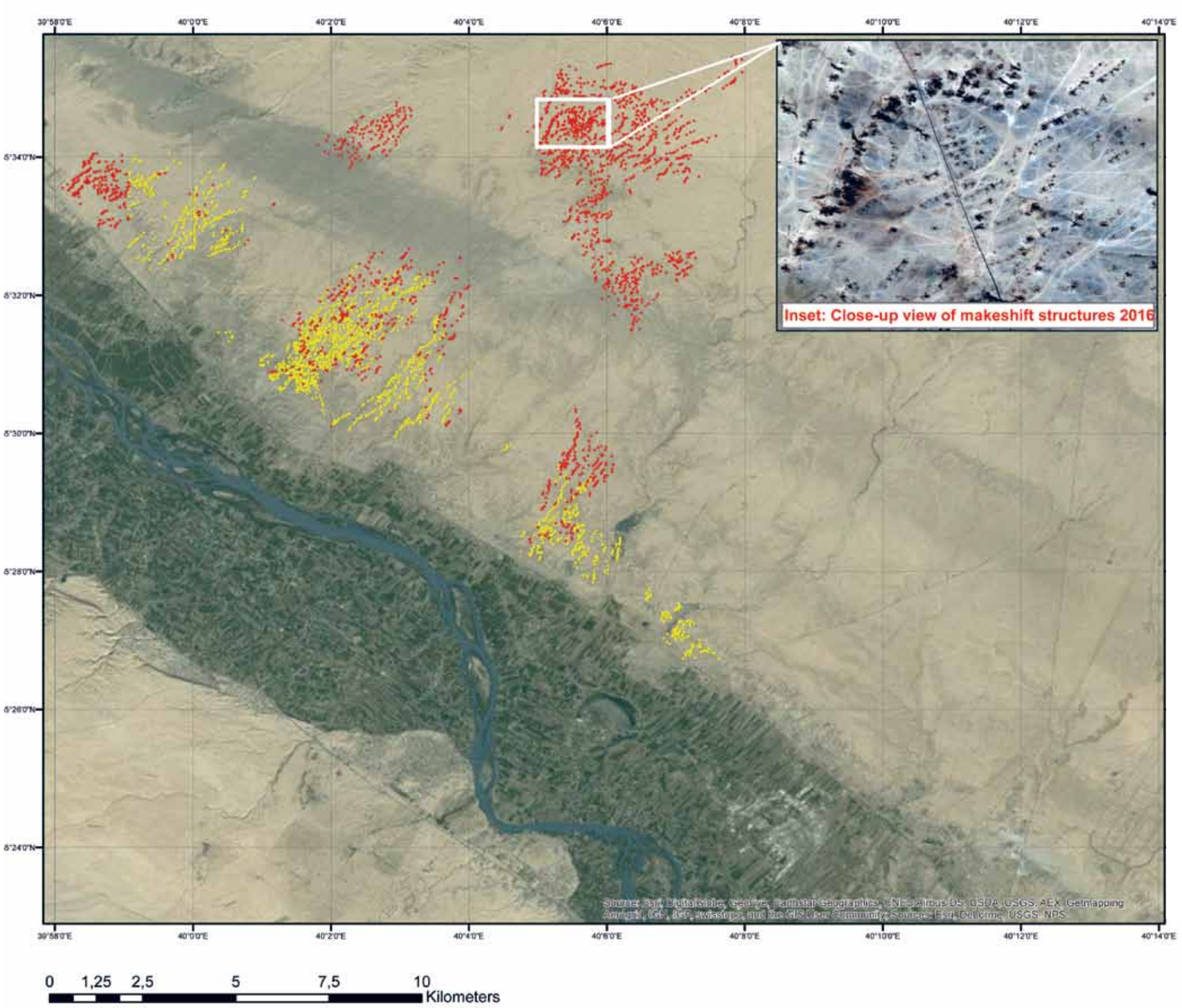


Sites 4 & 5

The last two locations identified and analysed are close to each other, 3,5 kilometres north-west of Site 3. Whereas in 2011 no sites were visible on satellite imagery, in 2016 the number of refineries counted were at least 1.610 visible, including a small site of 45 makeshift refineries located to the north in the surrounding hills.

Makeshift Structures 2016

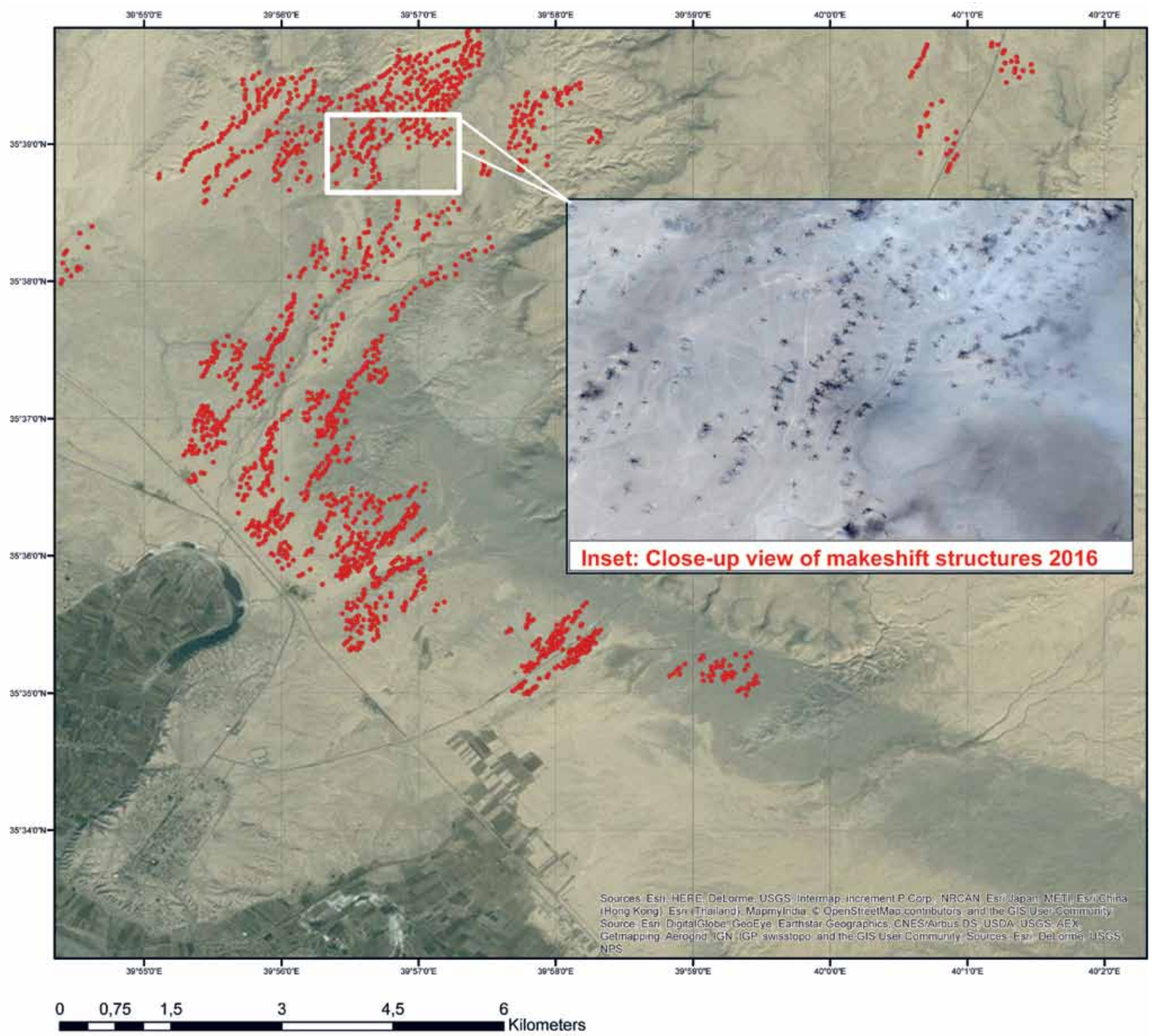


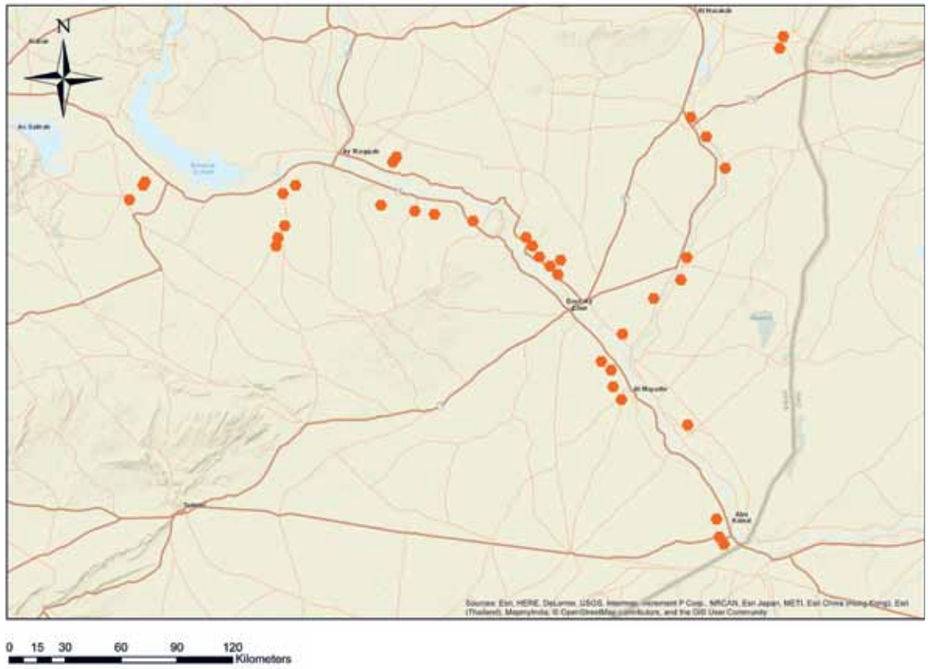
Table 3:
Increase of makeshift oil structured at selected sites

Location	Number of Makeshift Structures			
	2011	2013	2014	2015
Site 1	0	162	518	690
Site 2	0	437	1354	2766
Site 3	0	<no data>	381	716
Site 4	0	<no data>	<no data>	187
Site 5	0	<no data>	<no data>	1432
Total	0	599	2253	5791

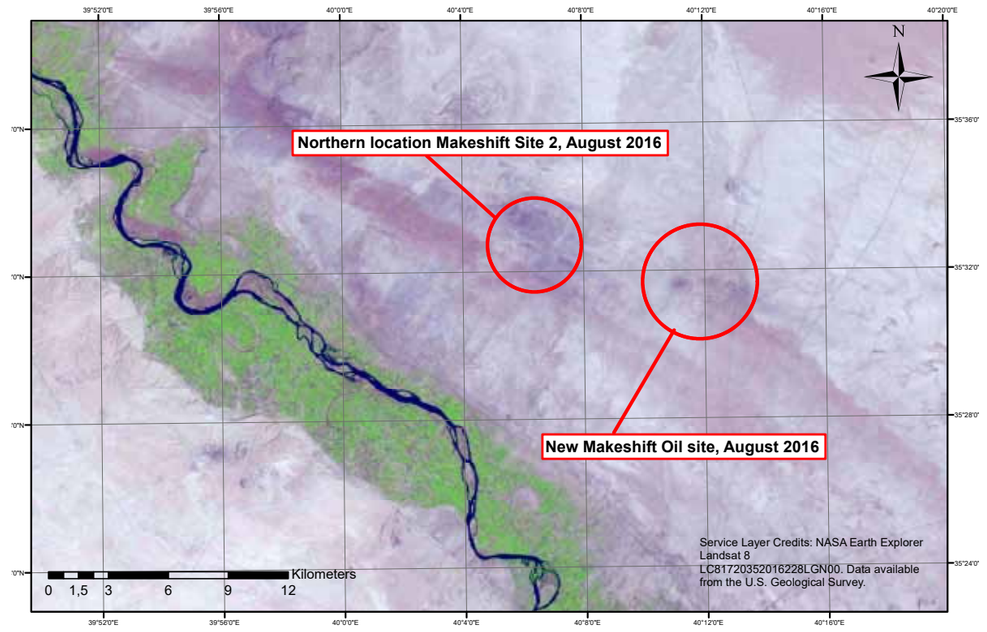
Conclusion

In summary, at these selected five sites, at least 5.791 makeshift oil refineries have become operational since 2011. Other makeshift sites have been located in areas near Deir ez-Zor, in particular, northeast of Deir ez-Zor city, south of the Jafra oil field. As a constant flow of crude oil from wells is needed to operate the sites, it is likely that new sites will be located in the vicinity of the wells and major oil fields in this region. More makeshift sites are also visible on the road going south from this site. Another huge site can be identified east of Site 2, as visible on LANDSAT 8 as seen at the bottom of page 33. Yet this site fell outside the high-resolution imagery obtained from UNOSAT and is therefore not taken into account in this report.

In total, 36 sites have been located through Google Maps by the researcher @Obretix, shown in the map below. [36] A full overview of the sites including Google Earth imagery for each site can be found in footnote 37.



Overview 36 makeshift oil sites Syria



Landsat 8 image indicating growth makeshift oil sites, August 2016

4. Syria's civilian health concerns over makeshift oil refineries

"İt is **death**. **Slow** death."

- Worker at makeshift site in Al-Hasakah.[37]

The health concerns of local residents and workers at makeshift sites in Syria have been documented from early in the conflict when these types of refineries started to appear at various locations over northern Syria. Reporters described the severe health problems among communities working and living in these areas. From early on in the conflict humanitarian organisations have documented the severe impact makeshift oil refineries have had on health and the environment in a more systematic way. İn the 2013 UN led Joint Rapid Assessment of Northern Syria, it was noted how the makeshift oil industry affected the health of communities:

"Self-filtering of crude oil in Deir-ez-Zor is causing respiratory infections and some skin burns have been reported during this assessment. In addition five sub-districts reported cases of cancer in adults and malformations in new-borns. In Ain al Arab in Aleppo, cases of respiratory diseases where mentioned as well, due to inadequate filtering of oil brought from Deir-ez-Zor". [38]

More disturbingly, the report outlines the prominent role of children involved in these hazardous activities, stating that '*most of the children who are not going to school were reported to work in filtering crude oil and operate generators. A small percentage of children in Deir-ez-Zor governorate were reported to work in their homes and are taking short-term jobs. Hazardous child labour was reported to be a high protection concern in LCI areas in Deir-ez-Zor."*[39] These concerns were echoed by UNICEF and Save the Children in their 2015 publication on child labour, that reported the high numbers of children involved in the crude oil filtering and makeshift industry in Deir ez-Zor.[40]

Many of the makeshift sites across Syria were visited by journalists who provided eyewitness accounts of the practices at these sites. These accounts are not confirmed medical facts and there is no reliable baseline study on the pre-conflict health situation in these areas. However, they do provide a valuable insight in people's and communities' health concerns, their medical complaints and their perception of working in these toxic environments. One report and documentary made by VICE in 2013 at sites in Deir ez-Zor, which was controlled by the Free Syrian Army at that time, provided some gruesome details of the effects on workers, in particular children, operating the refineries:

"All day long, Ahmer helps to move barrels, which can weigh more than 200 pounds when full of crude, to and from a converted water tank suspended above a fire. (…) Krahim, Ahmer's ten-year-old brother, has been tasked with perhaps the most hazardous assignment: his job is to throw and coat the inside of the tank with oil to keep its temperature above the necessary boiling point. For two hours I watched him at work, his feet inches from the flames, his head engulfed in crude oil fumes." [41]

A local doctor told the reporter that over 6.000 people are working in these conditions, 2.000 of whom are children, with most of them displaced orphans whose parents were killed in the war. *"I sometimes feel overwhelmed*," the doctor told VICE: "*What I learned in medical school is no longer enough to understand all the pathologies caused by oil and its exploitation in the region*." Early in 2016, reporting from the Deir ez-Zor region added to the concerns. Interviewed by the Arab weekly, Abed Najem El-Obeid, the health care director in Deir ez-Zor, warned of further long-term health impacts:

Young boy working at makeshift oil refinery in Hasakah, Syria, 2014

"Cancers, especially lung and skin cancers, as well as fetal malformations, are being reported in regions outside the government's control in the countryside. The numbers are very high compared to 2011 (when the Syrian revolution started). It is hard to give specific numbers becauseof a lack of statistics and inaccurate registrations."

In 2013, a reporter from The Telegraph visited one of the sites of Mansour, southwest of Raqqa, showing footage of children working at the sites and local civilians describing the tough and hazardous working conditions they face day in and day out, yet having no choice. It's either producing illegal oil or join the army or armed forces.[42]

Similar stories have emerged from the Kurdish controlled Al-Hasakah region where workers are exposed to toxic fumes and chemicals on a daily basis. As one worker bitterly stated: "*We only earn $15 a day but get cancer for free."*[43] During an interview with another worker at one the hundreds of sites in this region, more stories were shared that indicated that many civilians do not have any other alternative to refining oil, as many are the providers for their families:

During his daily work at the makeshift refinery, Abu Abduh has seen many accidents and cases of illness. Three months ago, a co-worker of his had to give up his job because the exanthema on his hands wouldn't stop bleeding. About half a year ago, a friend of his stopped working after tumors appeared on his arms, an alleged case of skin cancer. "We keep telling ourselves that biggest danger of our work is an explosion during the refining process. But inhaling the fumes and being constantly exposed to oil without any protective equipment is just as hazardous in the long run," [44]

Other journalists visited similar sites near the small city of Qamishili, in Kurdish-controlled northern Syria, and interviewed several young boys working in their self-built oil refineries. One of them noted the difficult circumstances under which they have to work, which pose either a direct safety risk or a long-term health risk: *"In terms of side effects, your lungs get clogged. Some people are getting sick, major headaches. It is death, slow death. Sometimes there are explosions. Until now we witnessed 5 explosions. One guy got cut in half. It doesn't usually happen but when you re-cook gasoline it often explodes. Someone did it and died."*[45]

Another person interviewed at this small oil site provided another horrifying account:

"We're not sleeping at night because of the coughing. We were comfortable and happy working at the school. Now we work in oil and it's full of sicknesses. Some guy got cancer working here. God knows what's going to happen to my hand. There's one guy they cut off three of his fingers because of a small scratch that he got oil on it. If they hadn't cut them his whole hand would've been infected and they would've cut it all off".[46]

Local residents complained about the toxic smoke flowing over the villages near Qamishili, affecting the health of children, pregnant women and the elderly, especially causing respiratory problems. These concerns raised by civilians and medical experts from different parts of Syria are likely to be found at every makeshift oil site in Syria, because civilians working at the sites are facing the same exact exposures. At the sites assessed for this research, where thousands of makeshift sites have been in use, the numbers of civilians affected could be as high as 20.000, given that the accounts from earlier in the conflict at these sites, as well as anecdotal evidence coming from Al-Hasakah are a bleak prediction of what can be expected.

Smoke-spewing makeshift refineries dot the desert landscape around Deir ez-Zor.

Man stands in between smoking oil pits, Hasakah Syria, 2014.

Environmental impact

Not only are there direct health impacts, but the use of makeshift refineries will have long-term ramifications, because toxic oil products will contaminate soil and water resources, with long-lasting impacts on the environment of these communities. As with the health concerns, there is no reliable baseline study on the pre-conflict environmental conditions, and therefore it is difficult to make direct correlations (but previous oil-related environmental pollution scenarios like those in Nigeria could be indicative for the situation in Syria).

Facilities that have fallen under the control of ISIS or other rebel groups may be more susceptible to accidents and spills due to a lack of management expertise, particularly where they have been damaged during fighting. These leaks and dumps can lead to substantial localised environmental pollution, affecting agricultural lands and contaminating the groundwater.

The burners in Mansoura and other parts of the southwestern countryside of Raqqa, which were operational for three years, contributed to a major environmental disaster in this region. An agricultural engineer from Tabaqa in the Raqqa governorate said, speaking on condition of anonymity:

"Last year was supposed to be a good harvest season but trees did not give fruit as expected because they were covered with soot from the burners. Even livestock has been blackened." [47]

The uncontrolled burning of crude oil for domestic purposes can release dangerous levels of pollutants, as mentioned earlier in this report, while the crude oil and by-products are likely to be disposed of into the local environment, that can further impact the health and well-being of communities.[48]

Residents are often unaware of the risks, and this reportedly has led to an increase in the number of skin and respiratory diseases in areas were crude oil has been stolen.[49] The products from makeshift oil refineries may be particularly hazardous and the Free Syrian Army and the Asala wa al-Tanmia Front have both warned against, or even prohibited, the setting up of makeshift refineries.[50] Communities living in proximity to the sites are likely to have been affected; however the impact of the refineries on health and the environment have yet to be systematically investigated.[51] Despite this lack of investigation, from various news reports in these areas, one can get a sense of the probability of a huge risk. For example, the area southeast of the city of Qamishli, Al Hasakah province, is now contaminated with a range of toxic breakdown products from these refineries. The presence and intense use of hundreds of makeshift oil refineries is claimed to have had a huge environmental impact on the fertile land around these villages. Another report on an oil site close to the Iraqi border in Kurdish-controlled Al-Hasakah province, on the oil field of Qura Shuk, which has hundreds of oil pumping jacks, though most of them are currently out of order. To ensure that the pump jacks do not start to rust, local operators turn them on once in a while, and pump the oil in natural basins; as a result, oil seeps into the local soil. *"It's either pollution, or millions [of US dollars] go cold,"* the local Minister of Oil stated.[52]

The impact of toxic oil waste products on the water systems was noted by to be a huge problem in a 2013 UN-led humanitarian assessment of Northern Syria:

“Water pollution due to crude oil-filtering in oil-rich areas in Deir-ez-Zor is a problem affecting the whole Governorate. All three districts report that water pollution with oil products is a severe problem. The bi-products of oil-filtering are disposed of in the Euphrates River, which is the main source of water for the area. The pollution of drinking water poses a high health risk for the local population and especially for those that do not have the financial means to buy potable water from water tankers.” [53]

These concerns were also raised early in 2016 by local experts, who noted that water was overused for the burners, leading to salinisation of the soil rendering large parts of agricultural land unfit for cultivation, as well as affecting livestock and natural life in various islands in the Euphrates river.[54]

Considering the scale of makeshift production sites near many villages, it is expected that water and soil pollution will continue to be a widespread problem across oil-rich governorates like Deir ez-Zor, Raqqa and Al-Hasakah, affecting access to clean water and having negative ramifications for agricultural sites. Clean-up operations of oil spills to prevent further environmental damage and minimize human health consequences are costly and require a vast amount of expertise and funding. The recent clean-up project of Ogoniland in Nigeria, which is heavily polluted by oil spills and local oil refineries, is estimated to cost $ 1 billion dollars, which is indicative for the complexity and impact of large scale destruction and pollution in oil rich areas. [55]

No alternatives to oil

The socio-economic necessity is a recurring theme in all interviews given by civilians in the previously mentioned articles and documentaries. The most important reason to start operating a makeshift refinery is to generate income, as there are little to no other job opportunities; essentially, this is the only game in town for those who have to support their family. Or as one Kurdish oil worker told a reporter in 2016 at a site near Qamishili: “*Those who work here say if they don’t die of cancer or lung diseases, they will surely die of hunger,*”.[56] This gives local civilians and governance structures very few options when it comes to making difficult choices between short-term economic survival or long-term health and environmental problems. Rebuilding Syria therefore also demands a focus on providing alternatives for these hazardous labour activities.

Wider concerns over conflict, environment and public health

The research done for this analysis raises broader questions about the impact of conflict on the environment and the direct and long-term health consequences of conflict related environmental damage. Yet, for too long the environment has been seen as a low priority, something of a luxury to be included in post-conflict reconstruction and development plans. But a growing body of evidence and work done by, among others, the Joint UNEP/OCHA Environmental Unit,[57] United Nations Develop Programme (UNDP) and a range of humanitarian organisations [58]and advocacy groups [59] have highlighted the importance of improved linkages between conflict assessment and environmental impacts.

Protection of civilians in armed conflict is linked with protecting the environment they live in; from the air they breathe, to the water they drink, to the soil they till and the urban environment they live in, these can all be affected by conflict. Wide-scale destruction of built-up areas can leave millions of tons of rubble, often a mixture of cement, asbestos and waste products; damage to heavy industry, oil facilities and power plants can result in the release of toxic chemicals and pollute the soil and drinking water; damaged military material or sites often leave a toxic footprint, or can be a source of exposure to civilians working on military scrap metal or children using them as a playground. Indirectly, the collapse of environmental governance results in piling up of household, industrial and medical waste, and can lead to the spread of communicable diseases. These environmental and related public health hazards are often ignored, or their consequences underestimated, which can result in prolonged exposure of civilians to a range of hazardous substances, in particular vulnerable group like pregnant women, children or the elderly.

PAX believes that the protection of civilians must also include an environmental component. This starts with recognising the toxic environmental consequences of conflict and the need for addressing these within humanitarian action. States and international organisations should call for actions and initiate a process of tackling these concerns through systematic monitoring of conflict related environmental damage and providing support to relevant international organisation to, as was called for during the UN Environmental Assembly in Nairobi, May 2016.[60] Traditionally, environmental concerns are low on the list of priorities and reserved for post-conflict assessment and rebuilding. Yet, greater consideration of the environmental impact of military activities during their planning and execution, as well as increased mainstreaming of the environment in humanitarian operations, could help reduce the environmental footprint and civilian health consequences of conflicts. Humanitarian impacts go beyond the visible consequences of conflict, and require a holistic approach, making relief and response work more effective and efficient, as well as providing the ground work for sustainable recovery and reconstruction.♦

Close-up view of makeshift oil site, Deir ez-Zor, Syria, 2016

5. Conclusions & recommendations

Worker prays at makeshift oil refinery, Hasakah, Syria, 2014

Conclusion

Reports and anecdotal evidence from different oil sites assessed for this research are extremely worrying for civilians and communities at these locations. With an increase of over 5.700 makeshift oil refineries at five selected sites in Deir ez-Zor, there are likely tens of thousands of civilians exposed on a daily basis to hazardous chemicals. Preparing and operating makeshift oil refineries will have severe and long-term consequences for the health and well-being of those involved, as they face acute and chronic health risks from both explosive dangers of the crude oil furnaces, and exposure to toxic vapours and chemical substances that are released during the refining process. In particular vulnerable groups such as orphaned children, who are reportedly heavily involved in the refining process, are likely to suffer from being exposed to these toxins. Understandably, these communities do not have the luxury of a choice, as families need to find a way to earn a living. Yet identifying these kinds of practices at an early stage is crucial for timely intervention as soon as the situation allows, and preventing further acute and chronic civilian health risks and long-term environmental pollution that can affect communities.

The increase in attacks by the US-led Coalition forces and the Russian Air Force on ISIS's professional oil infrastructure drove the group, as well as local civilians, to step up the construction of makeshift oil refineries to keep the flow of revenues up or provide a household income. Though hundreds of oil refineries were already present in Deir ez-Zor before the take-over by ISIS, there has been a steep increase since the start of the aerial bombing campaign in 2014 as these attacks severely damaged professional oil installations and the wider oil infrastructure. Though this is an unintended and unforeseen consequence of the conflict, as the aim of Coalition forces and the Russian Air Force is to deny ISIS from profiting from oil revenues, it can be disputed that successfully blocking oil extraction and refining by aerial bombing these sites would succeed. Even though it will hamper and limit the income, oil refining continues and oil products continue to be exported. A more critical approach should be given to the widespread corruption that results in oil smugglers continuing to find buyers for their oil in Iraq, Turkey, government-controlled Syrian territory and Iraqi Kurdistan.

Addressing the wider consequences of conflict on the environment and related public health risks is no longer a luxury, considering the state of the planet after decades of pollution affecting our living and working environments, and leading to an increase in conflicts over access to natural resources. Moreover, this link should play a larger role in conflict assessment, humanitarian response and peacebuilding activities, if we want to aim for building back a better life for all those who have suffered for years as a result of this protracted conflict.

Recommendations

Tackling the health and environmental impact of conflict requires innovative methods to quickly identify conflict-related environmental damage and the related effects on public health.The rise of makeshift oil refineries is only one type of underreported consequence of conflict that needs full attention in planning early recovery and response, as well as the wider socio-economic development plan for the reconstruction of Syria. It also highlights the need to carefully balance and relate use of military force against targets that can lead to serious unintended consequences. Therefore, the following recommendations are made:

- **Full identification of all makeshift sites across Syria**: This identification exercise undertaken by civil society, governmental health and environmental authorities should collect ground data on the impact of makeshift oil sites and damage to the oil infrastructure. This should lead to the production of an overview of locations and a baseline study that can be incorporated into public health response planning and post-conflict environmental impact assessments.

- **Develop public health interventions and monitoring in villages near these sites**: Dealing with the effects of exposure to oil-related chemicals will require a substantial health program that will assess their health impact. Monitoring programs will need to be set up to ensure civilians have access to medical help when required. There is an urgent need to better understand how to treat and prevent the long-term impact of exposure to toxins from these activities.

- **Provide livelihood support programs for local civilians:** Even after the conflict has ended, civilians are likely to continue to work at makeshift sites in order to provide an income. Raising awareness about the health consequences, as well as providing basic protective equipment is the minimum that could be done to minimize the harm borne from the operation of and proximity to these refineries. Support must be provided for building alternative incomes through socio-economic programs to minimize the number of civilians and in particular children who are involved in makeshift oil refining.

- **Investigate the demand-side of the market for Syrian oil and the smuggling networks:** Tackling the oil-smuggling business and addressing cross-border oil selling can strongly contribute to minimizing oil revenues to terrorist groups. This ought to lead to less targeting of oil infrastructure, thereby preventing further localised pollution and the subsequent health risks.

- **Identify possible environmental recovery interventions:** This includes dealing with contaminated water and soil and developing contingencies for mobilising the required resources once the security situation allows. ♦

Endnotes

1 Zwijnenburg, W. & Te Pas, K. (2015) Amidst the debris. A desktop study on the environmental and public health impact of Syria's conflict. Accessed at http://www.paxforpeace.nl/stay-informed/news/amidst-the-debris-environmental-impact-of-conflict-in-syria-could-be-disastrous

2 Zwijnenburg, W. (2016) Five years on: Lessons learned from the environmental legacy of Syria's war. Accessed at http://www.trwn.org/five-years-on-lessons-learned-from-the-environmental-legacy-of-syrias-war/

3 Syrian Economic Forum (2015) The Islamic State benefits from the regime's loss of 97.5% of Syria's oil production. Accessed at: http://www.syrianef.org/En/?p=4179

4 Ibid

5 US Energy Information Administration (2015) Syria International energy data and analysis. June 2015. Accessed at https://www.eia.gov/beta/international/analysis.cfm?iso=SYR

6 Reuters (2014) Here's How ISIS Keeps Selling So Much Oil Even While Being Bombed And Banned By The West. Accessed at http://www.businessinsider.com/r-islamic-state-keeps-up-syrian-oil-flow-despite-us-led-strikes-2014-10?IR=T

7 The Guardian (2016) Oil revenue collapse means Isis reliant on Gulf funds, inquiry hears. Accessed at https://www.theguardian.com/world/2016/mar/08/oil-revenue-collapse-isis-reliant-gulf-funds-inquiry-hears

8 Bader, M. (2015) Life inside Syria's makeshift oil refineries. Accessed at http://www.middleeasteye.net/in-depth/features/life-inside-syrias-makeshift-oil-refineries-617075533

9 VICE (2013) Black-gold Blues: The hazards and horrors of the makeshift oil industry in rebel-held Syria. Accessed at http://www.vice.com/read/black-gold-blues-0000138-v20n11

10 Johnson, K. (2014, Sep 24) U.S. strikes ISIS oil installations. Foreign Policy. Accessed at: http://www.defense.gov/transcripts/transcript.aspx?transcriptid=5506

11 Daily Star Lebanon (2014, July 26). ISIS grabs oil and gas fields in Syria and Iraq, but challenges remain. Accessed at http://www.dailystar.com.lb/News/Middle-East/2014/Jul-26/265188-isis-grabs-oil-and-gas-fields-in-syria-and-iraq-but-challenges-remain.ashx

12 Warrick, J. (2016) Satellite photos show Islamic State installing hundreds of makeshift oil refineries to offset losses from airstrikes. July 7, 2016. The Washington Post. Accessed at https://www.washingtonpost.com/news/worldviews/wp/2016/07/07/satellite-photos-show-isis-installing-hundreds-of-makeshift-oil-refineries-to-offset-losses-from-air-strikes/

13 See: VICE (2013) Black-gold Blues: The hazards and horrors of the makeshift oil industry in rebel-held Syria. Accessed at http://www.vice.com/video/syria-syrian-oil; Deutsche; Bader, M. (2015) Life inside Syria's makeshift oil refineries. Accessed at http://www.middleeasteye.net/in-depth/features/life-inside-syrias-makeshift-oil-refineries-617075533; Transterra Media (2015) The Makeshift Oil Refineries of Syria's Civil War. Accessed at https://www.transterramedia.com/media/30939; Deutsche Welle (2015) Makeshift oil refineries busy in Syria. Accessed at http://www.dw.com/en/makeshift-oil-refineries-busy-in-syria/g-18924958

14 UNEP (2011) Environmental Assessment of Ogoniland. Report accessible at http://postconflict.unep.ch/publications/OEA/UNEP_OEA.pdf

15 Zwijnenburg, W. (2015) South Sudan's Broken Oil Industry Increasingly Becoming a Hazard. Accessed at https://www.newsecuritybeat.org/2016/05/south-sudans-broken-oil-industry-hazard/

16 UNEP (1999) The Kosovo Conflict : Consequences for the Environment & Human Settlements. Accessed at http://postconflict.unep.ch/publications/finalreport.pdf

17 UNEP (2005) Assessment of Environmental "Hot Spots" in Iraq. Accessed at http://www.unep.org/disastersandconflicts/portals/155/disastersandconflicts/docs/iraq/Iraq_ESA_hotspots_2003.pdf

18 Salako, A, Sholeye,O. & Ayankoya, S. (2012) Oil spills and community health: Implications for resource limited settings. Journal of Toxicology and Environmental Health Sciences Vol. 4(9), pp. 145-150. November, 2012.

19 Mudu. P, Terracini. B, Martuzzi. M, eds (2014) Human Health in Areas with Industrial Contamination. Copenhagen: WHO Regional Office for Europe. Accessed at http://www.euro.who.int/__data/assets/pdf_file/0006/264813/Human-Health-in-Areas-with-Industrial-Contamination-Eng.pdf

20 Ordinioha, B., & Brisibe, S. (2013). The human health implications of crude oil spills in the Niger delta, Nigeria: An interpretation of published studies. Nigerian Medical Journal : Journal of the Nigeria Medical Association, 54(1), 10–16. Accessed at http://doi.org/10.4103/0300-1652.108887/

21 Full overview can be accessed at https://www.osha.gov/Publications/3172/3172.html

22 Full overview of sites made by @obretix including satellite images can be accessed here: https://sami-r.carto.com/viz/191c7e02-64b7-11e6-9fc1-0ee66e2c9693/public_map

23 The Washington Times (2015) Former CIA chief says environmental concerns prevented bombing of Islamic State oil wells. Accessed at http://www.washingtontimes.com/news/2015/nov/25/michael-morell-former-cia-chief-says-environmental/

24 US Department of Defense (2016) Operation Inherent Resolve: Targeted Operations Against ISIL Terrorist. Accessed at http://www.defense.gov/News/Special-Reports/0814_Inherent-Resolve

25 Russian Ministry of Defense (2016) Выступление начальника Главного оперативного управления Генерального штаба Вооруженных Сил Российской Федерации — заместителя начальника Генерального штаба Вооруженных Сил Российской Федерации генерал-лейтенанта Сергея Рудского Accessed at http://syria.mil.ru/news/more.htm?id=12070708@cmsArticle

26 Russian Ministry of Defense (2016) Elimination of ISIS open oil depots in Hama province. Accessed at http://eng.syria.mil.ru/en/index/syria/video/watch.htm?id=6784@morfVideoAudioFile

27 Watkin, K. (2014) Targeting "Islamic State" Oil Facilities. U.S. Naval War College. Accessed at http://stockton.usnwc.edu/ils/vol90/iss1/16/

28 Business Insider (2015) ISIS is selling oil to the Syrian regime. Accessed at http://uk.businessinsider.com/isis-selling-oil-to-biggest-enemy-2015-11?r=US&IR=T

29 Associated Press (2015) Despite US-led campaign, Islamic State rakes in oil earnings. Accessed at http://bigstory.ap.org/article/061e7a83299644868c920bed0667eb9c/despite-us-led-campaign-islamic-state-rakes-oil-earningshttp:/www.ibtimes.com/turkey-buying-oil-isis-after-downed-plane-putin-slams-islamic-states-black-market-2198214

30 The Financial Times (2015) Inside Isis Inc: The journey of a barrel of oil. Accessed at http://ig.ft.com/sites/2015/isis-oil/

31 House of Commons Foreign Affairs Committee (2016) The UK's role in the economic war against ISIL. First Report of Session 2016–17. Accessed at http://www.publications.parliament.uk/pa/cm201617/cmselect/cmfaff/121/121.pdf

32 International Business Times (2015) Turkey, Russia, Iraq And Syria: The Black Market Oil Trade That's Fuelling ISIS And Dividing The Terrorist Group's Opponents. Accessed at http://www.ibtimes.com/turkey-russia-iraq-syria-black-market-oil-trade-thats-fueling-isis-dividing-terrorist-2217476

33 For more information, see Zwijnenburg, W. & Waleij, A. (2016) Fire and Oil: The Collateral Environmental Damage of Airstrikes on ISIS Oil Facilities. Wilson Centre New Security Bog. Accessed at https://www.newsecuritybeat.org/2016/01/fire-oil-collateral-damage-airstrikes-isis-oil-facilities/

34 Zwijnenburg, W. (2015) Online Identification of conflict-related environmental damage. A beginners guide. Bellingcat. Accessed at https://www.bellingcat.com/resources/how-tos/2015/12/17/online-identification-of-conflict-related-environmental-damage-a-beginners-guide/

35 170 Illegal oil refineries in Iraqi Kurdistan: environmentalist: Accessed at http://ekurd.net/170-illegal-refineries-in-iraqi-kurdistan-environmentalist-2015-05-18

36 Updated maps can be accessed here: https://sami-r.carto.com/viz/191c7e02-64b7-11e6-9fc1-0ee66e2c9693/public_map

37 Transterramedia (2015) Homemade Oil Refinery in Qamishli, Msheirfi. Documentary available at https://www.transterramedia.com/media/30294

38 Assessment Working Group for Northern Syria (2013) Joint Rapid Assessment of Northern Syria II. Final Report. Accessed at http://reliefweb.int/report/syrian-arab-republic/joint-rapid-assessment-northern-syria-ii-final-report

39 ibid

40 UNICEF & Save the Children (2015) Small Hands, Heavy Burden. How the Syria conflict is driving more children into the workforce. Accessed at http://reliefweb.int/sites/reliefweb.int/files/resources/RS102356_CHILD%20LABOUR%20(5)_low.pdf

41 VICE (2013) Black-gold Blues: The hazards and horrors of the makeshift oil industry in rebel-held Syria. Accessed at http://www.vice.com/video/syria-syrian-oil

42 The Telegraph (2013) The Telegraph visits the oil fields of Syria. Accessed http://www.telegraph.co.uk/news/worldnews/middleeast/syria/10051953/The-Telegraph-visits-the-oil-fields-of-Syria.html

43 Life inside Syria's makeshift oil refineries. Accessed at http://www.middleeasteye.net/in-depth/features/life-inside-syrias-makeshift-oil-refineries-617075533

44 ibid

45 Transterramedia (2015) Homemade Oil Refinery in Qamishli, Msheirfi. Documentary available at https://www.transterramedia.com/media/30294

46 Ibid.

47 Hamlo, K. (2016) Syria's war impacts environment. The Arab Weekly. Accessed at http://www.thearabweekly.com/?id=3880

48 United States National Library of Medicine (2016) Tox Town. Crude oil. Accessed at https://toxtown.nlm.nih.gov/text_version/chemicals.php?id=73;

49 Al Monitor (2013). Syria's oil sector suffers major losses. Accessed at: http://www.al-monitor.com/pulse/culture/2013/03/syrian-oil-losses.html##ixzz3PYqPVlnR

50 Daily Star Lebanon (2014, July 26). ISIS grabs oil and gas fields in Syria and Iraq, but challenges remain. Accessed at: http://www.dailystar.com.lb/News/Middle-East/2014/Jul-26/265188-isis-grabs-oil-and-gas-fields-in-syria-and-iraq-but-challenges-remain.ashx

51VICE (2014) Black-Gold Blues: The hazards and horrors of the makeshift oil industry in rebel-held Syria. Accessed at http://www.vice.com/video/syria-syrian-oil

52 Russia Today (2016) ISIS oilfield exclusive footage: Inside refinery captured by Kurdish militia from Daesh. Video accessed at https://www.youtube.com/watch?v=U859Z3Pz6OI

53 Assessment Working Group for Northern Syria (2013) Joint Rapid Assessment of Northern Syria II. Final Report. Accessed at http://reliefweb.int/report/syrian-arab-republic/joint-rapid-assessment-northern-syria-ii-final-report

54 Hamlo, K. (2016) Syria's war impacts environment. The Arab Weekly. Accessed at http://www.thearabweekly.com/?id=3880

55 UNEP (2016) Nigeria Launches $1 Billion Ogoniland Clean-up and Restoration Programme http://www.unep.org/newscentre/default.aspx?DocumentID=27076&ArticleID=36199

56 Kurdistan24 (2016) Handmade oil refineries pose deadly threat to Syria's Rojava. Accessed at http://www.kurdistan24.net/en/news/09b71865-c0ab-4a6e-89f0-13b64efa1666/Handmade-oil-refineries-pose-deadly-threat-to-Syria%E2%80%99s-Rojava--?platform=hootsuite

57 George, M. (2014) Shaping the future of aid effectiveness by mainstreaming environmental sustainability. Accessed at http://odihpn.org/blog/shaping-the-future-of-aid-effectiveness-by-mainstreaming-environmental-sustainability/; For more information, see also the Environmental Emergencies website https://www.humanitarianresponse.info/en/topics/environment

58 Attwood, J., Breda, van A, & Kelly, C. (2016) Further Integrating the Environment and Humanitarian Action. Accessed at http://envirodm.org/post/further-integrating-the-environment-and-humanitarian-action-a-discussion-paper

59 See for example the Toxic Remnants of War Network: https:www.trwn.org

60 Weird, D. (2016) UNEA-2 Passes Most Significant Resolution on Conflict and the Environment since 1992. Accessed at http://www.trwn.org/unea-2-passes-most-significant-resolution-on-conflict-and-the-environment-since-1992/

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