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# The Role of Science Diplomacy in International Crises: Syria as a Case Study

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The Syrian refugee crisis, which began amidst the country's civil war starting in 2011, is recognized as one of the worst humanitarian disasters since World War II. Although the crisis has not typically been framed in the context of science and technology (S&T), it encompasses many complex issues with scientific components, including combating weapons of mass destruction, the exacerbating effects of climate change, public health issues, cultural heritage destruction, and human migration, including as it relates to scientific diasporas.

On June 1, 2016, we organized a symposium titled "The Role of Science Diplomacy in International Crises: Syria as a Case Study" in Washington, D.C., at the headquarters of AAAS, publisher of Science & Diplomacy.NOTE During this event, invited speakers and participants explored how science diplomacy can shape international crisis response and eventual recovery by mitigating the factors that fuel conflict, displace people, and cause subsequent challenges. Using the Syrian crisis as a case study, we discussed how science and technology (S&T) and science diplomacy can inform responses to future international security, environmental, and humanitarian crises. We sought to identify how lessons learned from Syria can

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be applied to other current and future emergencies, and to explore the pathways by which scientists and engineers can engage in crisis response and recovery.

We define science diplomacy broadly as ranging from the formal (e.g., government-to-government) to the informal (e.g., scientist-to-scientist) ways in which S&T knowledge can inform diplomatic efforts and the diplomatic benefits that international S&T collaboration can generate. As the examples in this article show, science diplomacy can operate multilaterally a multilateral scale and through diverse scientific disciplines. Recognizing the contributions of S&T cooperation in mitigating the crisis in Syria can yield an expanded set of tools available to diplomats when addressing global crises. The concept of science diplomacy also broadens the roles scientists can play in Syria and beyond, and increases the scope of diplomatic relationships between countries and between citizens.

This article summarizes the lessons learned thus far from Syria regarding how S&T can contribute to mitigating, responding to, and eventually recovering from international crises. The ideas presented herein are drawn from the remarks of our symposium speakers and from comments shared by symposium participants during an interactive session. The lessons are organized around the symposium's four session themes: countering weapons of mass destruction (WMDs), addressing the effects of climate change in conflict zones, combating cultural heritage destruction, and assisting refugees and others affected by conflict.

## Countering Weapons of Mass Destruction

Although the Syrian chemical weapons program is believed to date to the 1970s, the Syrian government did not publicly acknowledge its significant stockpile until 2013. In March and August of that year, particularly deadly attacks in Khan al-Asal and Ghouta, respectively, brought international attention to the issue. Following Russian intervention, in September, Syria agreed to relinquish its chemical weapons stockpile to a joint United Nations–Organisation for the Prohibition of Chemical Weapons mission, thereby averting U.S. airstrikes. The destruction of those chemical weapons was a major feat of multilateral science diplomacy. However, since the completion of that mission, chemical weapons attacks in Syria continue to occur, reportedly perpetrated by multiple parties in the civil war. Although science diplomacy has made inroads in the fight against WMDs in Syria, this work remains urgent. The following are some key principles guiding the approach:

**Build on experience with other countries**: Many of the officials faced with handling Syria's chemical weapons stockpile, from both the U.S. and the international community, had experience working together on the Nunn-Lugar Cooperative Threat Reduction Program. Named for its cosponsors, Sen. Sam Nunn (D-GA) and Sen. Richard Lugar (R-IN), the program was established in 1991 with the aim of confronting the potential challenge posed by WMDs as the Soviet Union collapsed. The efforts of Nunn-Lugar focused on the custodians of WMDs.

In particular, the former Soviet states contained a large number of scientists whose expertise could potentially be exploited by rogue states or terrorist groups. The program created the International Science and Technology Center which employed these scientists and helped shift their research programs to focus on increased security and peaceful pursuits. U.S. officials with experience in the Nunn-Lugar program recognized that similar tools could be used in Syria and built a successful collaboration with Russia, described as follows.

**Planning is the key to success**: A year before the 2013 U.S.-Russia agreement on the destruction of Syria's chemical weapons stockpile, planning had already begun between Washington and Moscow on how to approach the problem. In 2011, civil disturbances in Syria raised concern in the international community that the Syrian government might use chemical weapons against its neighbors or its own people, or that its stockpile could fall into the hands of nonstate actors. At that time, U.S. officials recognized that should the opportunity arise, they lacked the technical capability to destroy Syria's stockpile. Although Russian and U.S. officials held significantly different political views regarding Syria, both recognized the potential threat posed by Syria's weapons as well as the value of working together. In September 2012, a confidential U.S.-Russia channel on Syria's chemical weapons stockpile was established. A group of experts convened six times over the next year to develop an actionable plan to destroy Syria's stockpile of upwards of 1,300 tons of chemical weapons. In the end, more than thirty countries contributed f¬unding, expertise, personnel, or other resources to aid in the successful destruction of the stockpile—a major achievement for multilateral science diplomacy.

**Innovate with existing technologies**: In the past, large, expensive facilities have been used to destroy chemical weapons. The Syrian civil war made construction of this type of facility within the country impractical; however, the alternative of transporting chemical weapons to another country for destruction had never been attempted. When the planning process for destroying Syria's chemical weapons began in 2012, portable technology for the destruction of large quantities of liquid chemical weapons agents did notexist. In January 2013, scientists and engineers at the U.S. Department of Defense began developing the Field Deployable Hydrolysis System (FHDS), which converts chemical weapons into benign compounds. The system, largely an adaptation of commercially available products and proven technologies, was operational within six months, thanks to the extensive expertise of the scientists, engineers, and managers involved and their ability to rapidly modify existing technologies to suit new challenges. When no country was willing to host the destruction within its borders, the FHDS units were mounted on the U.S. ship MV Cape Ray in international waters of the Mediterranean Sea.

**Focus on the people**: Unfortunately, as noted, chemical weapons attacks continue to occur in Syria. Although Syria's declared production capability has been eliminated, reports of the use of makeshift chemical weapons by the regime persist. In addition to theories that the regime withheld a portion of its stockpile,

stocks of chlorine, which has uses both as a weapon and in peaceful endeavors, were not destroyed because of chlorine's many legal applications. Unlike in the Nunn-Lugar program countries, many of the experts at the Syrian Scientific Studies and Research Center who were involved in developing Syria's chemical weapons programs are loyalists and maintained their positions at the agency. It is important to continually seek opportunities for engagement with these scientists and engineers.

International scientific engagement can also help track and reduce the use of WMDs by terrorists groups. WMD terrorism is a new challenge, as demonstrated by the Islamic State's reported use of mustard gas in Iraq and Syria. t is essential to map the supply chain of WMDs in order to identify key players and their roles. Building relationships around the world through scientific exchanges and science diplomacy will help provide the information and networks needed to prevent these technologies from being misused.

**Addressing the Effects of Climate Change in Conflict Zones**

From 2006 to 2009, the Fertile Crescent, as the agricultural region encompassing much of Syria, Iraq, Lebanon, Jordan, and other nearby countries is known, experienced the most extensive and prolonged drought in recent history. In Syria especially, ineffective water management practices, crop failure, and weak government response combined to exacerbate the societal consequences of the drought. Remote sensing data show that agricultural productivity dropped by 15–30 percent between 2000 and 2013. By 2011, these factors led possibly as many as 1.5 million people to migrate from historically agriculturally-rich rural areas of Syria to urban areas, where economic opportunities were limited. This mass migration resulted in overcrowding, strained infrastructure, and increased competition for resources, leading some scholars to argue that water shortages contributed to the causes of the Syrian civil war.

In its 2016 Global Risks Report, the World Economic Forum ranked the interrelated issues of water crises, failure of climate change mitigation and adaptation, and large-scale involuntary migration high in terms of both likelihood of occurrence and potential global impact. Scientists and water management experts can take important steps rooted in science diplomacy to address these issues that continue to fuel the Syrian conflict and increase the likelihood of new conflicts in the Middle East and elsewhere in the world:

Use research and modeling to identify areas of environmental stress. Climate research and modeling can be used to put observed events such as drought, flooding, heat waves, and storms into a global and historical context. For example, observational analysis and modeling have shown that a drought of the severity and duration of the one recently experienced in the Fertile Crescent is now more than twice as likely to occur as it was historically. Another example is the rise in

climate change attribution studies by groups such as World Weather Attribution, which seeks to rapidly determine the role of climate change in an event shortly after it happens.

Research and modeling can also be used directly by governments and nongovernmental organizations as policy tools to predict areas of likely future water stress and initiate targeted mitigation efforts before a crisis develops. Examples of this include the SERVIR program, a joint initiative of NASA and the U.S. Agency for International Development to use satellite data to manage climate risks and inform land-use decisions.

Improve sharing of water information between countries. The distribution of water information globally is highly inequitable, leading to vast differences in the ability of countries to predict and mitigate water stress. Countries with access to satellite data, computer modeling capabilities, hydrologic monitoring, funds for research, and similar tools can plan and prepare for future water needs. Countries without such access, which tend to be more vulnerable, cannot. Given the extent to which climate research and modeling are carried out on a global scale, information sharing between more- and less-developed countries can result in mutual benefits at no increased cost. Less-developed countries benefit from the ability to make better-informed water management decisions, and more-developed countries benefit from increased resiliency and improved water management by their neighbors. Information sharing across borders may occur more easily through science diplomacy—i.e., data sharing between scientific colleagues—than through traditional diplomatic channels.

Provide data to support water-sharing agreements. About half of the earth's surface falls within a given transboundary river basin and many aquifers also span national boundaries, highlighting the need for water diplomacy and effective water-sharing agreements. While successfully tested frameworks for transboundary water-sharing exist, these require reliable data on available water resources, including estimates of both present and future supplies. Climate change is predicted to alter water availability, demand, and quality in ways that may be incompatible with existing water-sharing agreements. Some water-sharing frameworks, such as the U.S.-Canada International Joint Commission, facilitate research to support water diplomacy and are anticipating the ways in which their water allocations may need to change as climate change influences water resources. However, most water-sharing agreements lack adequate provisions for reallocating water resources whose availability has been altered by climate change. Scientists have a role in improving the resiliency of water-sharing agreements by making models and data available to policy makers and helping prioritize the reallocation of threatened water resources.

Help develop and implement efficient irrigation practices. Two key practices—growing water-intensive crops in areas with low water availability and inefficient irrigation practices—contributed significantly to the Syrian water crisis. Similar

issues have exacerbated water shortages in Yemen. In both countries, highly inefficient flood irrigation methods are widely used, rather than modern techniques such as drip irrigation or sprinklers. Through the development and adaptation of efficient irrigation practices suited to the local context, scientists and engineers can help slow the overuse of strained water resources. However, development and dissemination of better irrigation practices may not be adequate to improve water efficiency. In many cases, the problem lies in the way water is managed and sold by the government. In Syria, most farmers are charged for water based on the irrigated land area rather than the amount of water used, giving them no incentive to conserve water or invest in more efficient irrigation. Thus, a need also exists to work with governments to develop water management policy that encourages conservation while meeting local needs.

**Combating Cultural Heritage Destruction**

In 2015, the Islamic State appalled the international community by razing the ancient ruins of Palmyra in Syria. Although the devastation of Palmyra was the most heavily reported incident, other historic sites and antiquities have been frequently subjected to abasement as well in Syria's civil war. These instances have included collateral damage from military action, systematic destruction, and a trade in antiquities that fuels looting of both museums and ancient sites. The United Nations Educational, Scientific and Cultural Organization (UNESCO) and other international bodies have condemned such abuses. However, stronger international action and more creative strategies are needed to both prevent the massive destruction of irreplaceable historic and cultural artifacts and to allow reconstruction of Syria's cultural heritage. Key roles for science diplomacy in this area include the following:

**Prioritize the protection of cultural heritage during conflict.** The 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict is an international treaty aimed at safeguarding important sites and artifacts during war and other conflicts. Although Syria ratified the Hague Convention in 1958, enforcement has historically been weak, both there and elsewhere in the world. Archaeological sites frequently suffer severe damage during conflicts, in part because they are often positioned at high elevations, making them ideal lookouts during combat. Social scientists and the international community must promote global awareness of the importance of protecting cultural heritage, even during times of crisis. In addition to the value of these irreplaceable artifacts to society, emphasizing cultural heritage protection communicates to the affected population that its culture is internationally valued; this is vital to the success of future peacekeeping and rebuilding efforts. The significance and history of distinct architectural features, including museums, mosques and churches,

libraries, and community centers, should be explicitly recognized in development and reconstruction plans.

**Involve local communities in cultural heritage protection and decision making**. Local communities should be engaged in the monitoring of cultural heritage sites and in reconstruction decisions. Along these lines, the Cultural Heritage Initiatives project, created by the American Schools of Oriental Research, has developed the Cultural Heritage Monitor (CHM), an anonymous online reporting platform to share information about cultural heritage damage or looted and stolen objects. Through the CHM, Syrians, Iraqis, and others can safely report these incidents in Arabic by completing a simple form. In the future, this information will be shared with Syrian and Iraqi cultural heritage experts to assist in postconflict reconstruction, repatriation, and restitution efforts.

To support these efforts on the ground, trainings can be offered to locals in cultural heritage preservation and emergency conservation. The Safeguarding the Heritage of Syria and Iraq Project (SHOSI), a consortium of the Smithsonian and the Penn Cultural Heritage Center at the University of Pennsylvania Museum, AAAS, Shawnee State University, the Day After Association, and the U.S. Institute of Peace, has successfully organized workshops and trainings to protect museum collections in Syria. In 2014, SHOSI organized a workshop for Syrian museum professionals in emergency care for collections. At the workshop, basic supplies for packing and storing museum collections were provided. Curators and conservators who could not typically communicate because of the conflict were brought together to develop and implement effective protection strategies. At the Ma'arra Mosaic Museum, in the northern Syrian town of Maarat al-Numaan, home to one of the most important collections of third- to sixth-century Roman and Byzantine mosaics in the Middle East, trained Syrian teams protected some 1,600 feet2 of mosaics. The team's work was later tested when a barrel bomb severely damaged the museum in June 2015; the sandbag barriers and coverings they installed protected the mosaics and prevented the walls from collapsing.

**Empower scientists and citizen-scientists to make their research available for decision making**. Geospatial tools can be leveraged to gather information and target interventions in conflict zones, but the most effective interventions do not always require sophisticated technology: low-tech and on-the-ground efforts can also prove extremely effective. For example, emergency conservation interventions to quickly repair the walls of the ruins at the ancient Syrian city of Ebla employed World War II–era techniques. Geographers can use methods such as satellite image analysis coupled with "ground truthing" to understand the extent and types of damage. For example, the AAAS Geospatial Technologies Project has mapped roadblocks, opposition-held areas, and damage at UNESCO World Heritage Sites

in Aleppo using relatively inexpensive, moderate-resolution satellite imagery. This type of image analysis provides ample opportunities for crowd-sourcing and citizen science, as well as opportunities to involve students from different countries in a form of multilateral science diplomacy.

**Enlist the refugee and global diaspora communities to help preserve intangible cultural heritage**. Refugee and diaspora communities can be involved in ethnographic and anthropological research, and in the preservation of recipes, dances, stories, and songs—all components of intangible cultural heritage. Displaced artists can raise awareness about the conflict while helping preserve the memories of destroyed and damaged sites. For example, the Washington, D.C.-based nonprofit Art in Exile showcases the work of artists displaced by conflict, helping humanize those affected and raise awareness among nontraditional audiences. Although more resources are often focused on the preservation of tangible aspects of cultural heritage such as archaeological sites, intangible cultural heritage is also vulnerable as populations become fragmented during conflict. Refugees and diaspora communities are critical to ensuring these important cultural dimensions are not erased.

## Assisting Refugees and Others Affected by Conflict

The world is facing the greatest displacement crisis since World War II, with nearly five million Syrians seeking refuge outside the country and over six million more displaced internally. Inside Syria, healthcare facilities and the remaining healthcare professionals face an increasingly difficult public health situation. To date, an estimated half million people have been killed, two million have been injured, and more than eleven million are in need of healthcare in Syria. Chronic conditions remain untreated and disease outbreaks often associated with natural disasters are emerging, including typhoid and hepatitis A. Most striking, perhaps, is the drop in life expectancy from age seventy to fifty-five. In the midst of these health crises, healthcare facilities, personnel, patients, and means of transport have been and continue to be deliberately targeted. Through July 2016, 400 documented attacks had been made on Syrian health facilities—the vast majority by the Syrian government—and 768 medical personnel had been killed.

In addition to the public health and humanitarian crises, the civil war has created a higher education crisis. As many as 30 percent of Syrian scholars and 100,000 higher education students (a quarter of all youth prior to the war) have been forced to flee the country. Within Syria, the university system has been decimated, with only three out of five public universities left operating at limited capacity. Although the international community is working to assist Syrians who have been displaced abroad as well as those still dealing with the conflict at home, much more must be done. Science diplomacy can help us better understand the

impacts of the crisis on health, education, and livelihoods and enhance our ability to prepare for and respond to the next humanitarian emergency in the following ways:

**Collect data to understand the crisis and drive solutions.** In order to effectively assist in a humanitarian emergency, organizations must make use of data, which can help provide an overview of the crisis, document atrocities, and make a case for action. Scientific processes for gathering data and new technologies (e.g., geospatial technologies) can be especially relevant. In a crisis in which traditional diplomacy has largely failed, science diplomacy has the potential to play a larger role, and indeed has produced some of the few humanitarian successes in Syria, including documentation of the scale of the atrocities and the delivery of telemedicine.

In May 2012, the World Health Assembly adopted a resolution calling on the World Health Organization (WHO) "to provide leadership at the global level in developing methods for systematic collection and dissemination of data on attacks on health facilities, health workers, health transports, and patients in complex humanitarian emergencies." This was an important step for an organization that had not previously been involved in documenting such attacks. Although this mandate was not fully met, in May 2016 WHO released its first report on these attacks, and the World Health Assembly adopted a resolution that supported research, technical cooperation, and "appropriate preventive measures to enhance and promote the safety and protection of medical and health personnel." This support creates a precedent to place data collection and prevention of attacks on medical facilities at the forefront of the international agenda. In order to both mitigate and respond to crises, international organizations must prioritize data collection, and scientists and engineers with relevant data sets and tools should offer their assistance.

**Develop innovative person-to-person solutions**. Despite the magnitude of the crisis in Syria, efforts to address its burgeoning mental health component demonstrate the positive impact that can be made at the person-to-person level, especially when aided by technology. The conflict continues to cause severe psychological distress in local populations, and delivery of mental health care has been severely disrupted as has medical care in general, affecting those with preexisting psychological conditions as well as those experiencing new trauma. Recognizing the urgent importance of psychological assistance in conflicts, WHO, the WarTrauma Foundation, and World Vision International published a guide to psychological first aid for field workers, empowering individuals in the crisis zone to help provide much-needed basic services. Through newer technology, telemedicine has expanded the potential for individuals with needed skills and training, but located far from the conflict zone, to make an impact as well. Through the Syrian Telemental Health Network, psychiatrists from around the world can now remotely provide professional training to local caregivers and patient care

within the country via online platforms. This work has been expanded through the creation of Arabic-language massive open online courses (MOOCs) focused on psychological first aid.

**Preserve access to higher education.** Unlike in other large-scale population displacements that resulted from post– World War II conflicts—such as those that occurred in Afghanistan in the 1980s and Rwanda in the 1990s—the higher education system in Syria was highly developed prior to the onset of the war. Yet, the international community has not adapted quickly enough to the influx of refugees, and efforts to integrate refugee higher education students, scholars, and academics within host countries are often inadequate. Redefining the concept of a refugee and adapting it to the Syrian crisis is imperative for appropriately caring for this burgeoning population. Supporting Syrian refugee students and academics is essential to avoid a "lost generation" whose members may otherwise contribute to the rebuilding of the country. To this end, a number of initiatives have been launched, including the Institute of International Education's Scholar Rescue Fund, with the goal of placing Syrian academics and scientists in higher education institutions around the world. Many more scientists, however, have yet to benefit from such programs.

A large majority of university-age Syrian youth, both within and outside the country, do not have access to higher education. Creating virtual universities linking students with professors would help close this gap for students and allow displaced scholars, academics, and scientists to continue to contribute their talents and knowledge to society. Involving the international community in the creation of a more systemic education system for refugees, a goal of the Global Coalition to Protect Education from Attack, would also benefit university-age students and academics.

**Preserve and transfer professional credentials**. One of the key challenges facing Syrian refugees fleeing the crisis is access to a livelihood. For trained professionals, including healthcare professionals and scientists, the lack of adequate credentials—owing to non-transferable or lost certifications and diplomas—can represent a major stumbling block. A number of efforts in the region aim to address this issue. For example, the Turkish Ministry of Health, in conjunction with WHO, has been working to recognize the credentials of Syrian healthcare professionals. In addition, host countries have facilitated the professional integration of refugees by adapting their respective work permit systems. For example, Jordan now waives work permit fees and organizes workshops to familiarize refugees with the kingdom's system. Such efforts could be applied to other countries in the region facing similar situations. A Web-based international database providing a catalog of professional certifications would offer a more long-term, global solution to the issue.

Professional societies may eventually play an instrumental role in the creation and development of such a platform for their respective disciplines. In the meantime, even appropriately tailored social networking sites or other online repositories could greatly assist in the process. Within Syria, relevant actors are seeking to establish a Medical Board to provide Syrian healthcare professionals with the necessary credentials to practice in the country.

**Hold governments and international organizations accountable**. Although efforts by individuals and local organizations have an impact, the sheer magnitude of the conflict cannot be adequately addressed without the support of governments and international organizations. Citizens must continually hold their respective governments accountable to work toward the resolution of the Syrian crisis. Governments and international bodies, in turn, must hold perpetrators of war crimes accountable for their actions.

In the United States, partisan politics have limited the scope of the direct U.S. role in alleviating the refugee crisis. The acceptance of just 10,000 Syrian refugees is an incredibly small step compared with the number received by other host countries such as Turkey, Lebanon, Jordan, and Germany. In addition, U.S. laws in some cases have made assistance difficult; for example, the United States denies refugee status to health workers who have provided impartial medical care to anyone deemed to be part of a designated terrorist organization. The citizens of all countries thus have the responsibility to hold our political leaders accountable and ensure we as individual nations and as a global community are doing as much as we can to address the crisis in Syria.

**Accelerate refugee processing**. The U.S. immigration system has remained largely unchanged since the late 1980s and is ill-adapted to this unprecedented refugee crisis. More particularly, the system lacks sufficient flexibility to deliver an adequate number of visas; the number of refugees admitted into the country—determined in part by foreign policy concerns—is set each year by the president in consultation with Congress. In fiscal year 2016, the United States set and met a target of 85,000 refugee admissions, 10,000 of which were specifically designated for Syrians.

The lengthy nature of refugee processing (eighteen to twenty-four months) is due in large part to extremely thorough background screens. Devising ways to accelerate this process and reduce the backlog of asylum and refugee seekers is the first step in bringing refugees in desperate need of resettlement, including refugee scientists, into the country. One such effort has been carried out through the U.S. Digital Service, an office launched by the Obama White House to streamline information technology, including through digitization of the immigration review process with the goal of reducing background-check processing time.

**Reform immigration systems to assist skilled refugees**. Comprehensive immigration reform in the United States is imperative in the face of an ever-growing refugee population. In addition, extending Temporary Protected Status

to Syrian refugees and creating specific visa categories for skilled refugees (e.g., scientists, academics, and entrepreneurs) would help further increase the country's hosting capacity. This could be achieved through a legislative proposal similar to the Development, Relief, and Education for Alien Minors (DREAM) Act, which sought to provide a path to citizenship for children of illegal immigrants brought up in the United States.

Although immigration reforms are essential, U.S. policies and processes need to be adapted to allow the refugee population to fully contribute to society. Such progress would include public-private partnerships involving federal and local governments, and private companies, businesses, universities, and research institutions, which represent potential hosts and employers for refugee scientists, engineers, entrepreneurs, and innovators.

## Conclusions

After six years, the Syrian crisis rages on despite the best efforts of leaders and diplomats from around the world. Although the death, destruction, and fighting have yet to be halted, the S&T community has found numerous ways to contribute its talents and expertise to aid the global response to the crisis. Under each of the four themes identified in this article, scientists and engineers are actively working or have been active, seeking to limit the spread of WMDs, improve environmental resiliency, protect cultural treasures, and respond to the needs of refugees and internally displaced people. In addition to helping mitigate the effects of the Syrian crisis, these science diplomats have developed tools that can help prevent and respond to other current and future humanitarian emergencies.

The story of the destruction of Syria's chemical weapons stockpile demonstrates the power of scientists, engineers, and diplomats working together across borders to apply lessons learned from previous experiences to a new challenge. This cooperation and foresight need to continue in the interest of preventing future chemical attacks.

The Syrian crisis highlights the increasing need to understand the role of climate change in causing natural resource shortages, environmental destruction, and mass migration. Climate scientists and other natural resource specialists need to use their data collection and modeling tools to prioritize the study of climate vulnerability in the Middle East and other regions under severe water stress. Furthermore, these scientists must cooperate with governments to ensure that feasible solutions are implemented to address these resource shortages before crises occur.

Scientists and citizen-scientists can aid in the protection of cultural heritage during conflict by using geospatial tools to map endangered cultural sites. By sharing this information with decision makers, such actors can help ensure the most vulnerable sites are targeted for intervention. In addition, cultural heritage

experts should continue training local museum staff in emergency preservation techniques for museum collections under siege. Finally, social scientists should engage with refugee and diaspora populations to help preserve vulnerable elements of intangible cultural heritage such as music, dance, stories, and recipes.

Scientists and engineers displaced as a result of conflict not only contribute scientifically to their host country, they also act as ambassadors for their native countries by sharing their culture, knowledge, and experience. Upon their return, these individuals can help strengthen ties between their host and home countries through the establishment of scientific collaborations, thus acting as science diplomats.

For their part, career diplomats from all countries should be trained to understand the importance of S&T and should promote expanded cooperative research efforts by helping identify new potential collaborations. Fostering collaboration does not require extensive technical training, but rather an appreciation for science and closer coordination between diplomats with S&T portfolios. Diplomats must seek to make meaningful connections between scientists, research institutions, centers of technical expertise, and medical centers, both in their home and host countries. Scientists, engineers, and medical professionals and their institutions must also strive to establish bridges with each other and with the diplomatic community. Online platforms such as the European Molecular Biology Organization's "Science Solidarity List" can help foster such connections. This platform connects displaced U.S.-based scientists affected by White House Executive Order 13769, "Protecting the Nation from Foreign Terrorist Entry into the United States," with offers of desk and lab space, equipment access, and even accommodation from scientists around the world. A similar portal designed to facilitate international collaborations between scientists by matching expertise and research-related resources could be promoted and monitored by diplomats. We hope that traditional diplomatic relations between the United States and Syria can eventually be restored, and that these engagements will include environment, science, technology, and health (ESTH) officers on both sides, striving to catalyze new international S&T collaborations.

Common elements gleaned from this examination of science diplomacy in responding to the Syrian crisis can be applied in future humanitarian crises. These include the importance of: local training, decision making, and implementation of solutions; new, creative uses of technology (e.g., for delivering health services, education, and documenting professional credentialing); and collecting and sharing accurate data, even during times of crisis, to support evidence-based decision making.

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**Endnotes**

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