XCEPT

CROSS-BORDER CONFLICT
EVIDENCE / POLICY / TRENDS

Policy brief

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Digging an ever-deeper hole: the response to climate change in the Helmand River Basin

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Purpose

This policy brief shares key findings and implications for policy arising from the management of water resources along the Iran-Afghanistan border. It summarises results from a forthcoming XCEPT study on the escalation in violence along the Afghanistan-Iran border on 27 May 2023, led by Dr David Mansfield and supported by Alcis. The study challenges assumptions that the surge in violence in 2023 revolved around water distribution along the Helmand River and the rising tensions over Afghanistan's upstream water diversion. It indicates that the fighting more likely reflected bilateral tensions over border management, which increased after the 2021 Taliban takeover of Afghanistan.

However, ongoing efforts by Kabul and Tehran to retain and divert water flows in the Helmand River Basin and increased groundwater exploitation on both sides of the border are causing a rapid decline in water tables, jeopardising the livelihoods of approximately 3.65 million people. These trends are further compounded by climate change impacts reflected in rising temperatures and decreasing rainfall and snow cover in the Hindu Kush mountains. This brief summarises an analysis of water management along the Iran-Afghanistan border, highlighting potential cross-border risks and implications for policy. It encapsulates findings from the second of two reports arising from this research and should be read in conjunction with an XCEPT policy brief entitled 'Missing the Target'.

Context

This paper draws on the second of the reports from this study, which conducted a detailed assessment of the Helmand River Basin, the impact of climate change, and Tehran and Kabul's repeated efforts over the decades to redirect water flows, sometimes to the detriment of their own border populations. Recognising the limits of the literature, this work draws on significant imagery analysis to chart the sequencing of the various infrastructural projects implemented on both sides of the border and assess their downstream effects. However, this analysis goes further and examines the effects of increased groundwater extraction. The current disputes over surface water and transboundary water rights between Tehran and Kabul distract from a far more serious problem: the dramatic annual falls in the water table in southwestern Afghanistan, which puts the livelihoods of around 3.65 million people at risk.

Key findings

The events that led to the conflict in May 2023 relate directly to how the border is managed and to the challenges of recalibrating cross-border relations following the collapse of the Afghan Republic and the subsequent Taliban takeover. The rhetoric from Tehran and Kabul over the long-standing dispute over water flows from the Helmand River heightened the tension between the two countries but was not the cause of the out-break of violence. This was primarily a local conflict between those deployed on Iran and Afghanistan's borders in Nimroz, not between the governments in Kabul and Tehran.

Despite the evidence that the direct cause of the fighting lay with differences over how the border was managed and a breakdown in cross-border relations following the Taliban takeover, it is important not to completely dismiss underlying friction between the two governments over the flow of water from the Helmand River, and how this increases the potential for an outbreak of violence. There is growing tension between Tehran and Kabul as they jostle to divert and store more sig-nificant amounts of water in a river basin impacted by climate change and reduced water flows. Some of the investments in infrastructural works made by Afghanistan and Iran have dramatically affected water flows to downstream populations on the other side of their respective borders, fuelling tensions between the two states and influencing the war of words that erupted in the days before the fighting in May 2023.

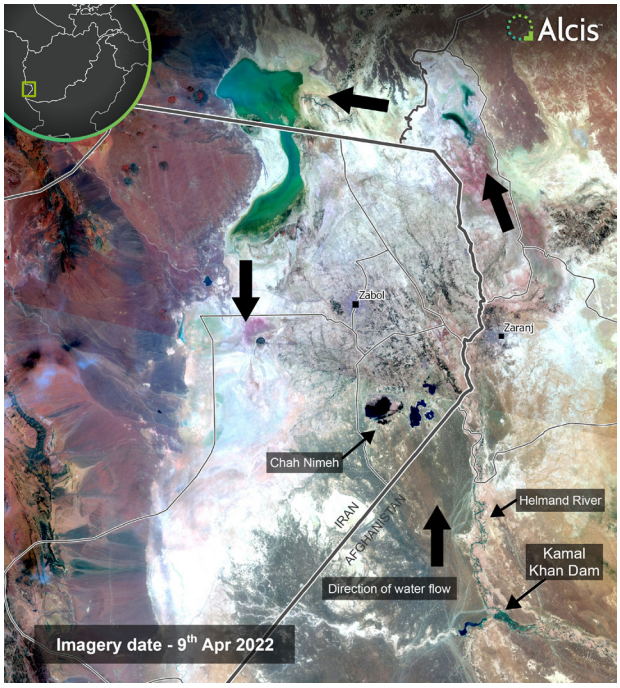

Figure 1. The location of Kamal Khan Dam relative to the Hamouns and Chah Nimeh reservoirs.

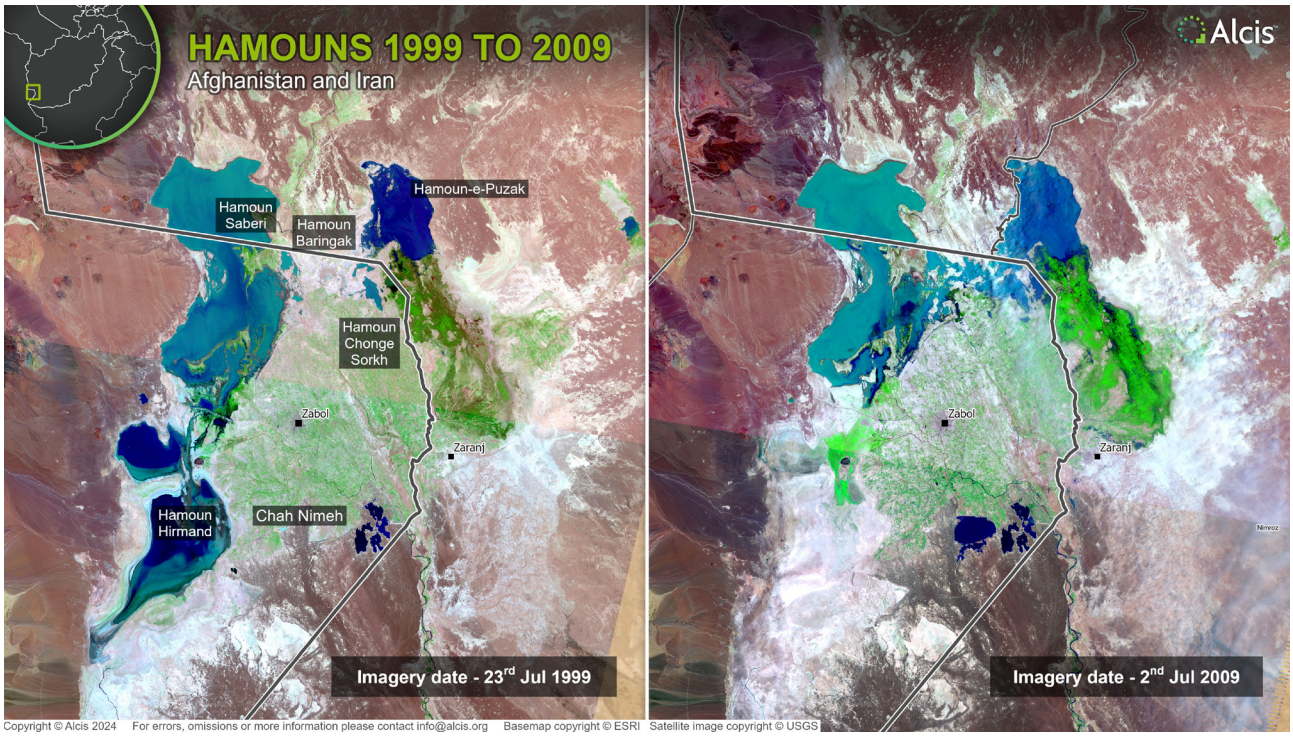

Figure 2. The reduction in the Hamouns following the construction of the Chah Nimeh Reservoirs.

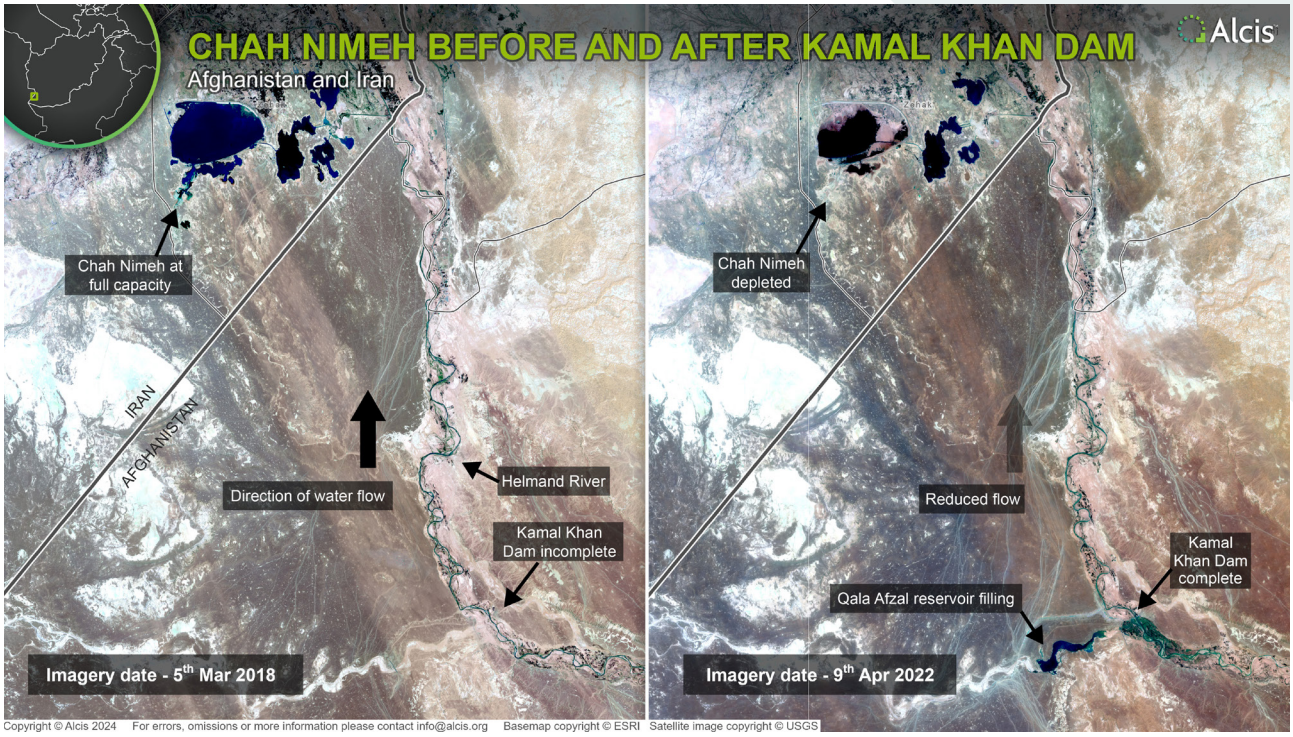

Figure 3. Reduction in the Chah Nimeh following the commissioning of the Kamal Khan Dam.

Over the last twenty years, both Kabul and Tehran have built dams and reservoirs to divert surface water from the Helmand River Basin to the detriment of their neighbour, the downstream population, and the ecological balance of the river basin. The current media focus is on Afghanistan and the completion of the Kamal Khan Dam, which is only 80 kilometres upstream from the fork in the Helmand River and the intake to Iran. Completed in 2021 and now under the authority of a single administration, this dam gives Kabul significant leverage, allowing it to control the volume of water, when it is released, and the ability to divert it away from the Sistan River, from where Iran takes most of its water, via canal to the Afghan border districts of Kang and Zaranj. High-resolution imagery shows that this has led to an increased area under agriculture, improved yields in 2024, and the construction of additional canals to divert water from Kamal Khan to other parts of Charburjak and Zaranj districts in Nimroz Province. Imagery shows that this has been to the detriment of Iran, and has led to a reduction in the size of the large reservoirs, the Chah Nimeh, that Tehran had constructed to provide potable water to the urban populations of Zabol and Zahedan in Sistan and Baluchestan Province (see Figure 1). However, imagery shows that following Tehran's construction of the fourth, and by far the largest, of the Chah Nimeh reservoirs in 2008, the surface area of the natural wetlands in Kang District in Afghanistan contracted considerably (see Figure 2). Consequently, while Tehran may complain about the diversion of water from the Kamal Khan dam, its construction of the Chah Nimeh some years earlier, as well as the two dams it built on the Sar e Shelah, played a key role in denying water to the wetlands in Afghanistan further downstream.

The tit-for-tat water diversions by both the Iranian and Afghan authorities reflect increased concerns over dwindling water flows in the Helmand River Basin and the impacts of climate change. Meteorological data between 1990 and 2024 starkly illustrates the climate trends. Temperatures in the Helmand River Basin have risen by 10 degrees centigrade, annual precipitation has declined from 225 mm to 200 mm, and there has been a marginal decline in the amount of snow accumulating in the mountains. The cumulative effect has been lower runoff in the Helmand River Basin, less surface water in the river channels, and increased drought frequency. It is no coincidence that much of the rhetoric and sabre-rattling by Tehran and Kabul typically occurs during drought years and that soon after, their investments in water diversion and storage infrastructure projects are implemented.

Since 2019, there has been a dramatic increase in groundwater extraction in Afghanistan and Iran as a direct response to reduced surface water in the Helmand River Basin caused by climate change and the construction of reservoirs and dams. In Afghanistan, individual households have sunk groundwater wells in the Helmand River Basin, some of them up to 110 metres deep. Initially found mainly in former desert areas and using solar-powered

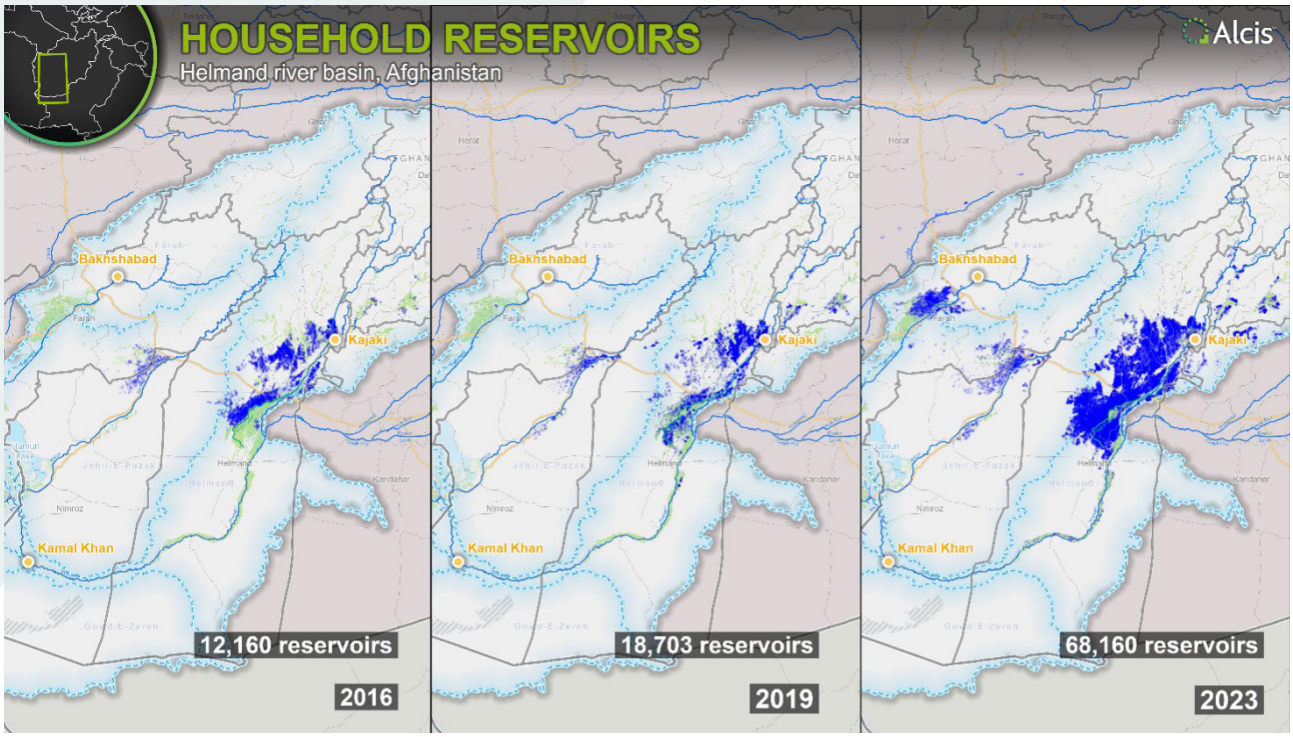

Figure 4. The rapid increase in solar-powered groundwater wells from 2016 to 2023, shown here with the reservoirs associated with wells shown in blue.

water pumps, these groundwater wells have been increasingly sunk in surface irrigated areas in the middle and upper basin due to inadequate surface water in the summer and now number almost 70,000 (see Figure 3). This shift to groundwater extraction has allowed Afghan farmers to increase the amount of land under agriculture and the quality of the land despite declining levels of precipitation, increased temperatures, and reduced water flows (see Figure 4). In Iran, the state has led groundwater exploitation, sinking three wells between 1,000 and 3,000 metres in depth.

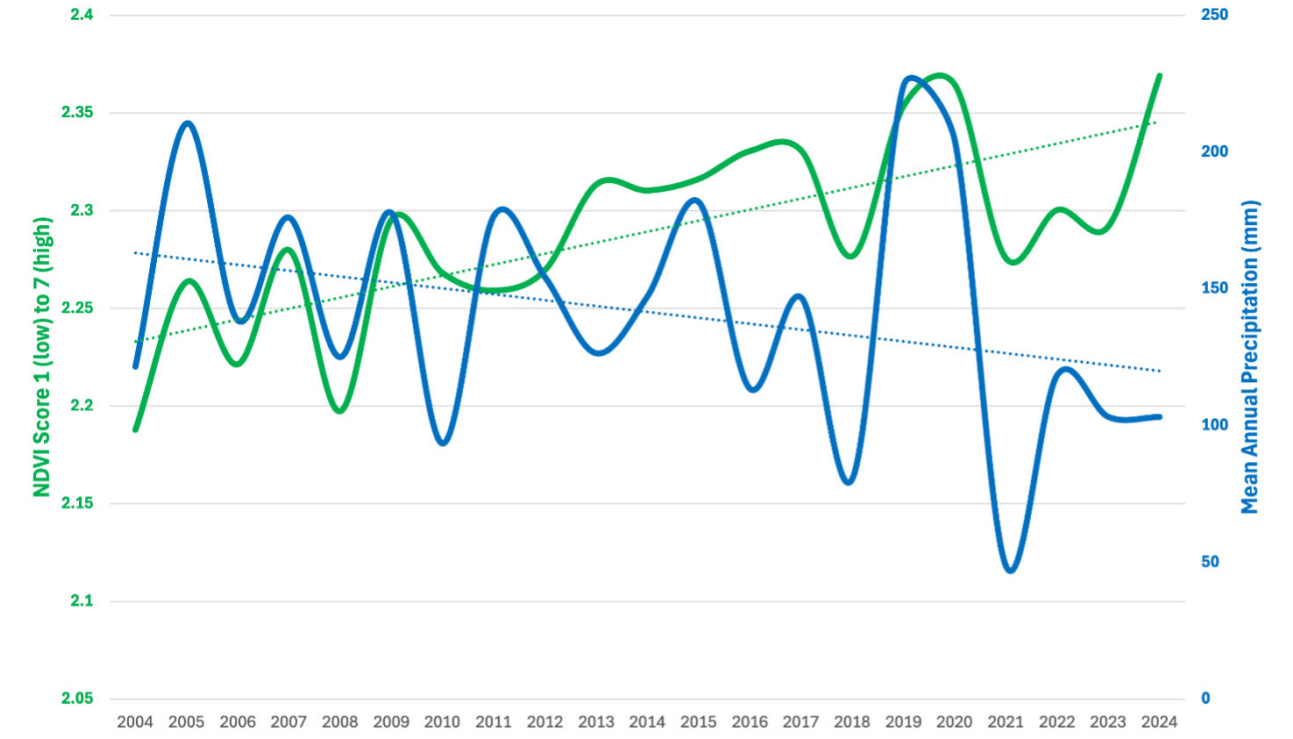

Figure 5. The changing relationship between precipitation and vegetation performance from 2004 to 2024.

Groundwater in the Helmand River Basin in Afghanistan is falling at an alarming rate, putting the livelihoods of 365,371 households – the equivalent of 3.65 million people – at risk over the next decade. Solar-powered groundwater pumps are now ubiquitous across the Helmand River Basin in Afghanistan. Even in surface irrigated areas, farmers are increasingly dependent on their wells to get sufficient water for a summer crop. Furthermore, the Taliban poppy ban has made the summer crop an increasingly important part of livelihood portfolios as farmers struggle to maintain a level of agricultural income that is commensurate with basic needs. This further increases the pressure for groundwater extraction and the risk that much deeper wells will be sunk. Currently, farmers in the Helmand River Basin consistently report annual drops in groundwater in their wells of between one and three metres, with rates of more than five metres in areas further from surface irrigated areas. Unchecked, this trend towards further groundwater extraction poses a major risk to the population across the Helmand River Basin in Afghanistan over the next decade.

Policy implications

The findings from this study highlight several implications for national governments, de facto authorities, regional bodies, and donor programming:

The ready supply of affordable, solar-powered groundwater extraction technology over the last decade has dramatically changed the landscape for rural communities, even in some of the most remote and arid parts of the world, such as the Helmand River Basin. On the one hand, the availability of this technology offers these communities the means to access and even transform land that has been profoundly impacted by climate change and reduced surface water flows. On the other hand, increased groundwater extraction can result in the neglect of collectively managed surface irrigation systems, further increasing community dependence on groundwater extraction and, in the longer term, threatening the aquifers on which these communities rely for their livelihoods. The dramatic increase in the use of this technology in recent years in places like Afghanistan, Iran, and Pakistan suggests the need for increased monitoring of groundwater extraction and resources as part of any study of water security.

Developing a deeper understanding of the impact of this shift to large-scale groundwater extraction on the aquifers in Afghanistan and Iran is a critical first step to establishing the implications of these developments and what it means for the current and future lives and livelihoods of those in the Helmand River Basin. This can only be done with access to time series groundwater data, including groundwater level and water quality monitoring across large areas like the Helmand River Basin. Without such data, policymakers and national authorities do not have the information to assess this critical resource's long-term sustainability.

Tackling the problem of falling groundwater in southwestern Afghanistan should be considered a priority. Ultimately, it puts the livelihoods of an estimated total of 3.65 million people in the Helmand River Basin at risk. This should be of considerable concern to those in the region, as well as those further downstream in Europe. Without the means to sustain themselves in situ, there is every likelihood that many of these people will leave Afghanistan in search of a life in other countries, as many Afghans before them have done over the past few decades.

Methodology

The research project adopted a mixed methods approach combining satellite image analysis, open-source data, qualitative interviews, and agricultural data, including crop mapping and the Normalised Difference Vegetation Index (NDVI), with water data, such as the Normalised Difference Water Index (NDWI), to assess surface water changes and climate impacts. The study incorporates historical data on household reservoirs from 2016, 2019, and 2023, revealing groundwater demand driven by solar-powered pumps.

A comprehensive 34-year climate dataset (1990-2024) from the ESA Copernicus Climate Change Service (C3S) facilitates analysis of temperature, precipitation, evaporation, and drought indices, providing insights into water availability. High-resolution satellite imagery plays a crucial role in mapping the last 34 sites and analysing water use patterns and infrastructure impacts, such as the diversion of water projects by Afghanistan and Iran. Key findings include varying completion dates of the Iranian Chah Nimeh reservoirs and the identification of deep well projects in Iran's Sistan and Baluchestan Province. This integrated data enhances understanding of the region's water dynamics and the implications for the Hamoun wetlands.

About the authors

Dr David Mansfield is the primary author, responsible for designing and managing the research. David has been conducting research on illicit economies in Afghanistan and on its borders since 1997. David has a PhD in development studies, is the author of "A State Built on Sand: How opium undermined Afghanistan" and has produced more than 80 research-based products on rural livelihoods and cross-border economies, many for the Afghanistan Research and Evaluation Unit, working in partnership with Alcis Ltd. This work has included extensive research on irregular migrants travelling from Afghanistan to Europe.

Alcis provide world-class data-driven evidence in fragile and former conflict-affected states to enable better understanding, decisions and outcomes for their clients and beneficiaries. Alcis has worked continuously in Afghanistan since 2004, providing in-depth analysis and GIS to a wide range of donors, including the UK, US, Australian, Danish and Afghan Governments, ADB, UN, academia, think tanks and NGOs. Over this period, they have patiently curated the most comprehensive and sophisticated geospatial database for Afghanistan, building a range of unique web-based geographic data visualisation and analysis platforms for different clients with differing needs that enable the viewing, querying and annotation of bespoke geospatial data.

About XCEPT

The Cross-Border Conflict Evidence, Policy and Trends (XCEPT) research programme brings together world-leading experts and local researchers to examine conflict-affected borderlands, how conflicts connect across borders, and the drivers of violent and peaceful behaviour. Funded by UK International Development, XCEPT offers actionable research to inform policies and programmes that support peace. The views expressed in this material do not necessarily reflect the UK government's official policies.

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