7:29 Plan derived from stitched satellite images of Bust (Thomas & Zipfel 2008; see Figs A10:1-10 for further details)

Study Area	Area (km^2)	Number of placemarks	Number of catalogued sites	Site density	ASAGE 'surveyor'
SA1	312.5	163	55	0.18	Nikolovski
SA2	273.5	579	118	0.43	Thomas
SA3	240.5	599	171	0.71	Kidd
SA4	267.5	382	91	0.34	Kidd
SA5	273.0	107	16	0.06	Nikolovski
SA6	225.0	123	20	0.09	Nikolovski
SA7	263.7	41	17	0.06	Thomas
SA8	265.5	143	24	0.09	Thomas
SA9	299.0	285	81	0.27	Smith
SA10	260.0	257	86	0.33	Smith
Total	2680.2	2679	679	0.25	

Table 7:4 ASAGE Study Areas

of high resolution images in several of the largely unsurveyed areas of Afghanistan (see Fig. 7:27; Tables 3:1, 7:4).[64] The Study Areas target a range of environmental zones which are close to major medieval urban settlements (Bust / Lashkar-i Bāzār, Djām / Fīrūzkūh and Harāt) and which are likely to have been exploited by the semi-nomadic Ghūrids. As I discussed in Chapter 2.2, desert areas and their nomadic inhabitants tended to be marginalized in the historical sources, and have since largely been overlooked by archaeologists.[65] Kenneth Brophy (2005: 38), however, stresses the importance of developing survey strategies to cover the whole landscape and not just 'cherry picking' what are likely to be the most productive areas. Selecting strips which incorporate a range of environmental zones increases the likelihood of locating a variety of archaeological site types. It is also a means of testing whether the research methodology is applicable in different parts of Afghanistan.

Each high resolution image, or Study Area, is roughly 17 km square (275 km^2 in area). It was divided into strips 0.79 km wide, each of which was 'surveyed' by ASAGE team members at the 200 m scale on the computer screen from north to south.[66] Each potential archaeological site (usually a discernibly unnatural, anomalous looking feature) was

[64] See Chapter 3.6 for detailed geographical discussions of these Study Areas and the rationale behind their selection.

[65] Notable exceptions include the work of Cribb (2004) and Hole (1978; 2004; 2009; *inter alia*) and the volumes edited by Barnard and Wendrich (2007), and Szuchman (2009). Few of these studies, however, consider Early Islamic nomads.

[66] This strip width was selected as the most pragmatic balance between speed and area of coverage, and image pixellation. On average, it took a total of ten hours over several sessions to 'survey' each Study Area.

marked using Google Earth's Placemark tool. The more experienced 'virtual surveyors' (Kidd and Thomas) found it relatively easy to identify potential sites, based on years of fieldwork in the region. This knowledge was shared with less experienced team members, who quite quickly 'got their eye in' during training – part of the more general archaeological process of acquiring knowledge through practice (Bradley 2003: 154-5). The resultant Placemark data were exported as a .kml file and then imported into Microsoft Excel, where they can be sorted and checked more readily.

After each Study Area had been surveyed, I revisited and catalogued each of the Placemarks or potential sites, occasionally adding sites which had been overlooked. Having one person catalogue all the sites helped to standardize the site recognition and documentation processes. Fourteen major site types were defined and locational information recorded, to facilitate the identification of typological and spatial patterning (Tables 7:5-6). An attempt was also made to estimate each site's relative date, based on its type, state of preservation and proximity to modern features (Table 7:7). Once catalogued, the data for the Placemarks categorized as 'sites' was cross-checked by Fiona Kidd, in an attempt to minimise errors, reduce subjectivity and maximise standardization, as advocated by David Wilson (2005: 64, 72).

The cataloguing process resulted in 679 of 2,697 Placemarks (25.3%) from the ten Study Areas being designated as probable or possible archaeological sites. This significant reduction in the number of sites was largely due to the omission of the majority of isolated structures, corrals, ephemeral outlines and lines of underground water channels (*kārīz*), which were deemed to be of too uncertain function or date to qualify as likely archaeological sites.

Archaeologists conducting surveys often face the apparently simple, but pertinent question *How old is "old"*? (Waechter *et al*. 2006). For the purposes of the ASAGE project, I have adopted the rolling fifty-year date used by some heritage agencies as the arbitrary division between 'archaeological' sites and 'modern' sites (Lawrence & Davies 2011: 3).[67] This relatively recent cut-off point differs from that adopted by Ball (1982 I: 14) who argues that if post-Tīmūrid remains were included in his gazetteer "virtually every modern town and even many villages would qualify as a "site"". While Ball's reasoning is understandable given the practical challenges of producing a gazetteer for an archaeologically rich country such as Afghanistan, it is less valid for the remote Study Areas selected for this study. The relatively recent cultural heritage of Afghanistan is also just as worthy of recognition,

[67] Similarly, Waechter and her colleagues propose 1960, although it should be noted that in New Zealand, for example, 1900 is the cut-off date.

No.	Site Type	Description
1	camp site	short-term occupation site; can be re-used, but in a random fashion with little evidence of permanent occupation and/or planning
2	cemetery	a collection of graves / small tumuli mounds; some graves may be within small enclosures
3	corral	an animal pen, often sub-circular
4	dam	a linear structure across a wadi (dry river bed)
5	enclosure	large area surrounded by a wall or bank
6	field system	the remains of a field system with regularly laid-out walls / banks / irrigation channels, sub-dividing the landscape
7	fort	a fortified structure, with distinct outer walls and possibly towers, and internal sub-divisions
8	dwelling	single family dwelling unit; may include a multi-room structure often associated with corral(s)
9	hamlet	a cluster of dwellings and corrals - more permanent / organised than a camp site
10	*kārīz*	underground canals identified by lines of 'doughnut'-shaped spoil heaps; preservation of spoil heaps may indicate age / phasing
11	kite	a linear feature designed to channel wild animals into an enclosed space
12	other	other archaeological sites
13	*tepe*	an occupation mound, usually with a flat top; sometimes conical in shape; a citadel and 'lower' town may be visible
14	reservoir	generally oval water collection feature; some of the more regular / distinct ones have probably been bulldozed
15	natural	probably a natural feature
16	ephemeral	too ephemeral to merit cataloguing
17	merged	site merged with another, already numbered site

Table 7:5 ASAGE site types

No.	Location	Description
1	mud flat	mud flat in desert (*playa* / *takyr* / *sebkha*); tends to be lighter coloured than surrounding landscape – silty, light grey-brown
2	stony desert	stony desert (*dasht*), distinct from more sandy areas like (1) and (4)
3	wadi	dry water course, or edge thereof; varies from very shallow to clearly incised
4	plain	sandy / stony, generally flat plain with some expanses of dunes; in true desert, ranges in colour from yellowy buff to reddy brown, although this is partly a factor of the satellite image and when it was taken
5	elevated	hill top, ridge or other elevated location
6	dunes	red sand dunes found in swathes across the Rīgistān

Table 7:6 ASAGE site location categories

No.	Category	Definition
1	Prob. modern	Well preserved, may be near modern features
2	Poss. modern	Poorly preserved, but near modern features; or well preserved but in an isolated location
3	Poss. pre-modern	Relatively well preserved, but not near modern features
4	Prob. pre-modern	Poorly preserved, far from modern features
5	?	No indication

Table 7:7 ASAGE dating categories

preservation and protection as its older sites, as it is elsewhere in the world.[68]

7.6.2 The analysis of known Ghūrid sites using Google Earth

Detailed inspection of the high resolution satellite images available through Google Earth reveals a wealth of additional information for several of the known sites with Ghūrid period remains. This is unsurprising – Terry Allen (1988: 58) estimates that nearly one hundred Ghaznawid / Ghūrid buildings, some standing two storeys high, survive at Bust; most have never been documented (Crane 1979: 241). The outlines of many of these structures, which are not marked on Schlumberger's plans, have been identified, while additional detail can be collated for several of the other structures which the French mission merely outlined.

Four of the five structures at Bust planned by ASAGE are courtyard buildings, generally 30-40 m square (Appendix Ten: ASAGE NP1-3 and NP5). They consist of an array of internal rooms around a large central courtyard. The external walls of ASAGE NP1-2 appear fortified – towers and bastions are evident in places. The structures are comparable to several of the nearby *résidences* recorded by the French Mission.

Inevitably, the dating of these structures is problematic, given the multi-period nature of the site. As I discussed in Chapter 5.4.1, archaeological fieldwork at Bust / Lashkar-i Bāzār has primarily focussed on the Ghaznawid period remains. Parts of the Southern Palace were rebuilt following the destruction of the site in 545 / 1150-1, but the monumental arch at Bust provides the only evidence of a Ghūrid building program. Consequently, it is likely that most of the standing structures that are visible in the satellite images available through Google Earth were built during the Ghaznawid period, although they may later have been

[68] Heritage Victoria, for example, has "no set age at which places become old enough to be 'heritage'" arguing that if "we lose the heritage fabric of the second half of the twentieth century, we are in danger of losing the understanding of this time for future generations." (http://www.dpcd.vic.gov.au/heritage/heritage-places-and-objects/Twentieth-century-heritage [accessed 10/8/2011]).

7:30 Siyāh Čar icehouse (top of satellite image available through Google Earth, to the north of Schlumberger's Résidence XIII)

renovated and re-used by the Ghūrids.

Several domed structures, such as the Siyāh Čar icehouse,[69] are visible (Fig. 7:30). The only other identifiable structure, however, which was not planned by the French mission is the Shāhzāda Sarbaz mausoleum (Appendix Ten: ASAGE NP4; Figs 7:31-2, A10: 7; Dupree 1977: 311; Hill & Grabar 1964: Figs 155-60).[70] The wealthy patron of this large domed structure is unknown – some locals refer to it as Ghiyāth al-Dīn's mausoleum (Hill & Grabar 1964: 57), but this is unlikely to be the principal Ghūrid ruler, since it is well established that Ghiyāth al-Dīn Muḥammad was buried in Harāt.[71] Although unique in plan and elevation, the tomb's decorative features suggest that it dates to the sixth / twelfth

[69] Unfortunately, just one internal photograph is archived in Archnet (https://archnet.org/library/sites/one-site.jsp?site_id=12486 [accessed 24/3/2011]), although the building type is well known in Ṣafawid Iran (Beazley 1977: 90-3; Beazley *et al*. 1982: 49-56); and Tīmūrid (?) Marw (Herrmann 1999: 56-7, 96, 105-8, 226-9, Figs 49, 114, 124-7, 293-304).

[70] See further images archived in ArchNet: http://archnet.org/library/sites/one-site.jsp?site_id=11347 [accessed 21/3/2011].

[71] Another name for the building is the mausoleum of Shāhzāda Shaykh Ḥusayn ibn Shaykh Ibrāhīm (Crane 1979: 241).

7:31 Shāhzāda Sarbaz mausoleum (photo: Blair / Bloom, ca 1970, source ArchNet)

7:32 Shāhzāda Sarbaz mausoleum in satellite image available through Google Earth (see also Fig. A10:7)

century or early seventh / thirteenth century (Crane 1979: 245-6). Howard Crane notes that eight other large but less well-preserved tombs are located close by; several of these are also visible in the satellite image available through Google Earth. Another major domed structure, the

The mausoleum and icehouse, like the monumental arch at the foot of the citadel, illustrate the benefits of being able to integrate the analysis of satellite images available through Google Earth, photographic archives and published studies. Although an array of *résidences*, courtyard buildings (caravanserais?), walled enclosures (probably gardens), canals and other less identifiable structures are also visible in the satellite images available through Google Earth, none can be attributed to the Ghūrid period on the basis of the satellite images available through Google Earth alone.

The primary value of the detailed sketch plans we have produced based on the satellite images available through Google Earth, therefore, is as a basis for future fieldwork (see Figs 7:29, A10:4; Thomas & Zipfel 2008).[72] The detailed sketch plan could also be used by NAIA and the Department of Historic Monuments to develop a site management plan for the site. The management plan needs to address the problem of the encroachment of modern cultivation on the archaeological and architectural remains – the satellite images available through Google Earth reveal that farmers have ploughed and irrigated inside some of the Early Islamic walled compounds, damaging the remains both above and below ground.

The example of Bust / Lashkar-i Bāzār demonstrates both the potential and the limitations of attempting to use satellite images available through Google Earth in period-specific research. The site, like five of the other nine sites with Ghūrid period remains in the high resolution strips, was occupied during earlier periods. Consequently, it is largely impossible to discern which structures date to the Ghūrid period and which to other periods.[73]

[72] See Di Giacomo *et al*. 2011 for broader uses of georeferenced high resolution IKONOS images.

[73] Of the other single-period sites we studied, a small fortress of unknown date is clearly visible on top of the mound at Dūst Mohammad (Ball [1982 I: 96, site 311] merely describes the site as a "small mound and some ruins"), but several of the possible fortifications around Shīniya require ground-truthing before they can be identified with certainty. A fortress / modern military camp has been constructed on top of the mound at Tepe Buland, while poor image quality limits the usefulness of the satellite image of Qūri available through Google Earth.

7.6.3 Other Ghūrid period sites identifiable in Google Earth

Although the 2009 upgrade to SPOT imagery provides a greatly improved coverage of Afghanistan as a whole, the new imagery is of limited use to archaeologists (Thomas 2010b / in press). Detailed study of the satellite images available through Google Earth has yielded spatial data for thirteen of the thirty-eight most promising Ghūrid period sites (Appendix Eleven). These data are useful, especially considering the dearth of quantitative data in the published sources, but they cannot be used in a statistical analysis of Ghūrid sites due to the biases within the dataset – the spatial extent of Ghūrid period remains at large sites such as Ghazna and Harāt, for example, is unquantifiable, while small sites and fortifications are often impossible to identify.

Isolated fortified sites, therefore, particularly those located in the semi-desert areas of Sīstān (see, for example, Khwāja Sultān – Ball 1982 I: 162, Site 608) or the mountains of central Afghanistan, are best suited to this form of analysis. The Ghūrid fortress of Sarkhushak (Ball 1982 I: 236, Site 1004), however, highlights the limitations of the current imagery available through Google Earth – this large fortified site is difficult to distinguish from the surrounding rugged topography, other than the faintly discernible Structure A and the satellite image available through Google Earth is much less informative than the existing site plan (Figs 5:18, 7:33; Baker & Allchin 1991: 164, Fig. 5.6). Elsewhere, it is difficult to identify the known sites with certainty due to the imprecise coordinates, local

7:33 Ghūrid fortress of Sarkhushak, with Structure A circled, in satellite image available through Google Earth

	Total no. of sites	Camp sites	Dams	Enclosures	Dwellings	Hamlets	Reservoirs	Sub-total
SA 2	121	20	4	5	7	23	3	62
SA 3	174	22	9	24	11	51	47	164
SA 4	94	16	6	13	2		48	85
SA 5	16	2	2	3			9	16
SA 1	58	3	9		7		21	40
Total	463	63	30	45	27	74	128	367

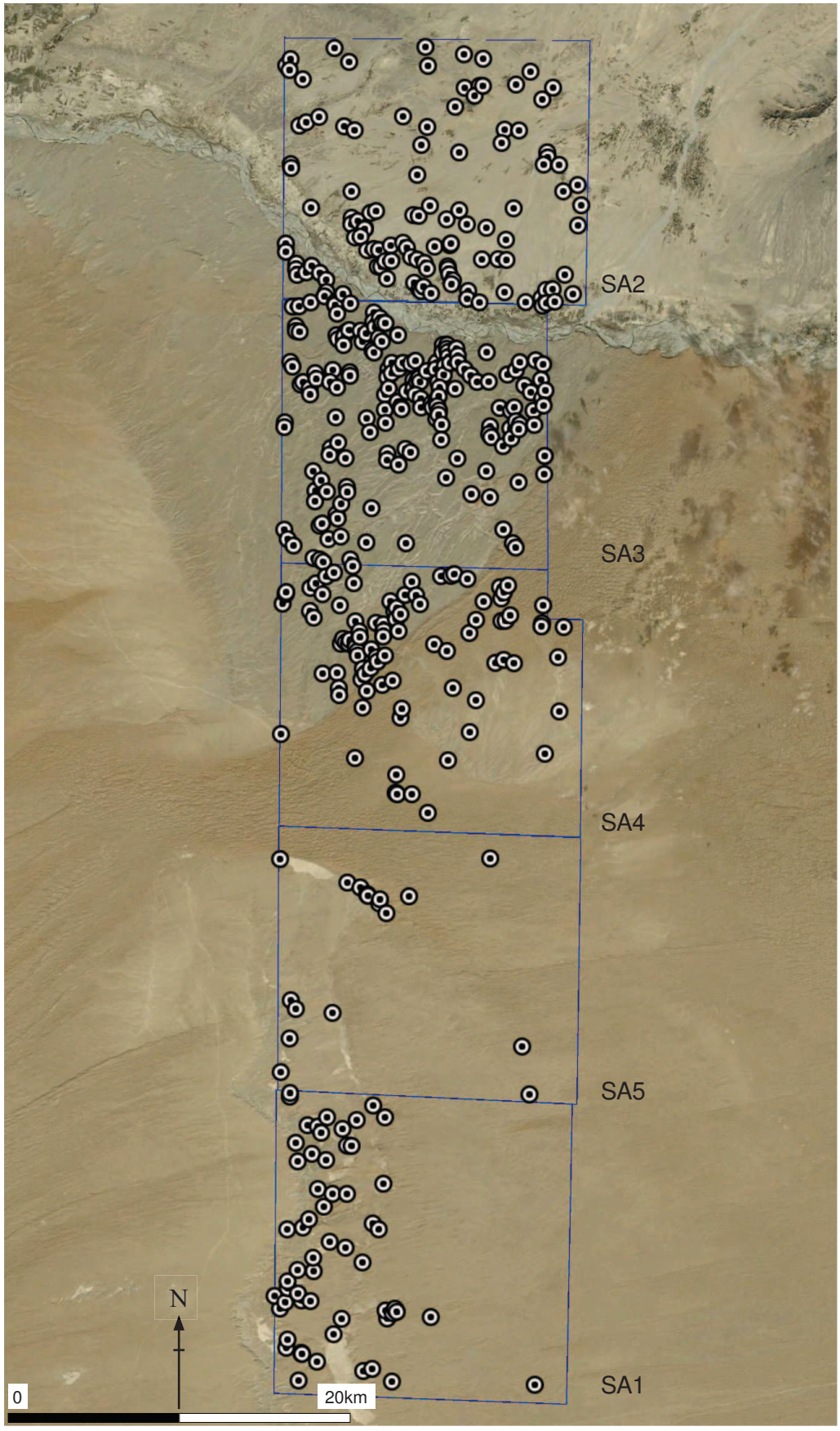
Table 7:8 Total number of sites and site types with more than 25 occurrences, by Rīgistān Study Areas (SA2 in the north to SA1 in the south)

geomorphology, the size and type of sites, and the limited descriptions.

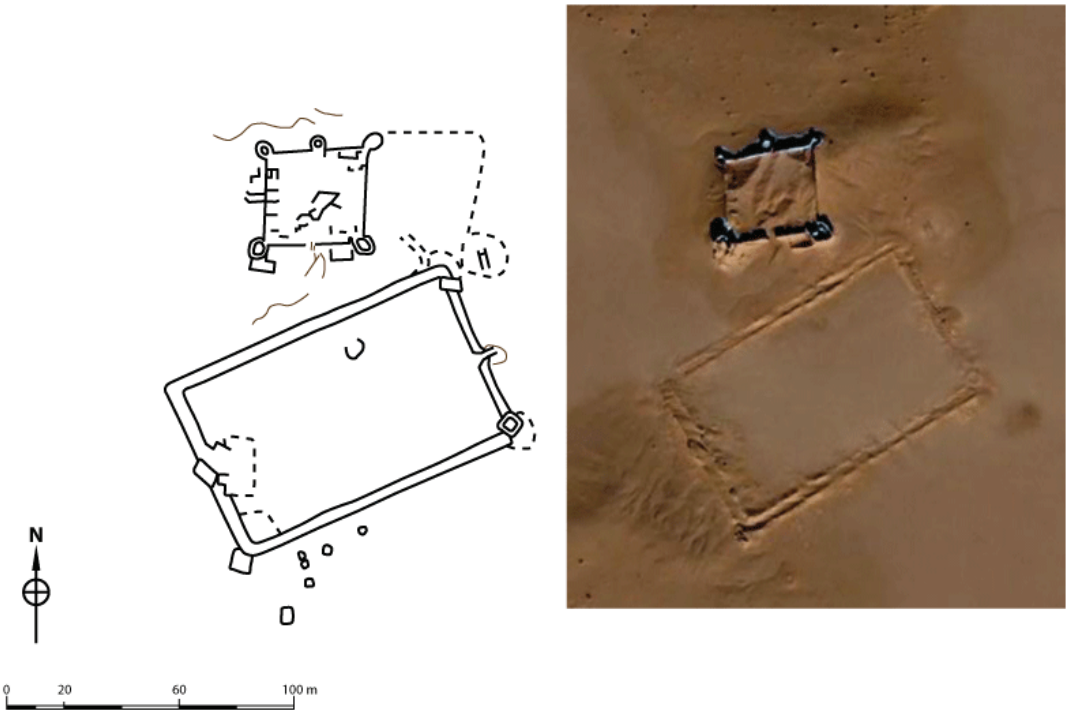
7.6.4 Newly identified sites in high resolution satellite images available through Google Earth

Hundreds of probable or possible archaeological sites have been identified in the ten ASAGE Study Areas, particularly those in the Rīgistān desert, east of Bust / Lashkar-i Bāzār (Fig. 7:34; Table 7:8).[74] The Rīgistān is particularly suited to this form of satellite archaeology – visibility is excellent, while disturbance is minimal due to the current inhospitable environment. The fact that the landscape is flat and relatively low-lying is also advantageous as this reduces the amount of distortion in the satellite images. This has eased the process of checking whether the newly identified sites are visible in the declassified satellite image (see above).

[74] For a comparable aerial archaeological study, see Jutta Häser's (2000) analysis of aerial photographs in the Jebel Marra region of Darfur, Sudan.



7:34 Archaeological sites (n=463) identified in high resolution Google Earth Study Areas SA1-5 in the Rīgistān desert



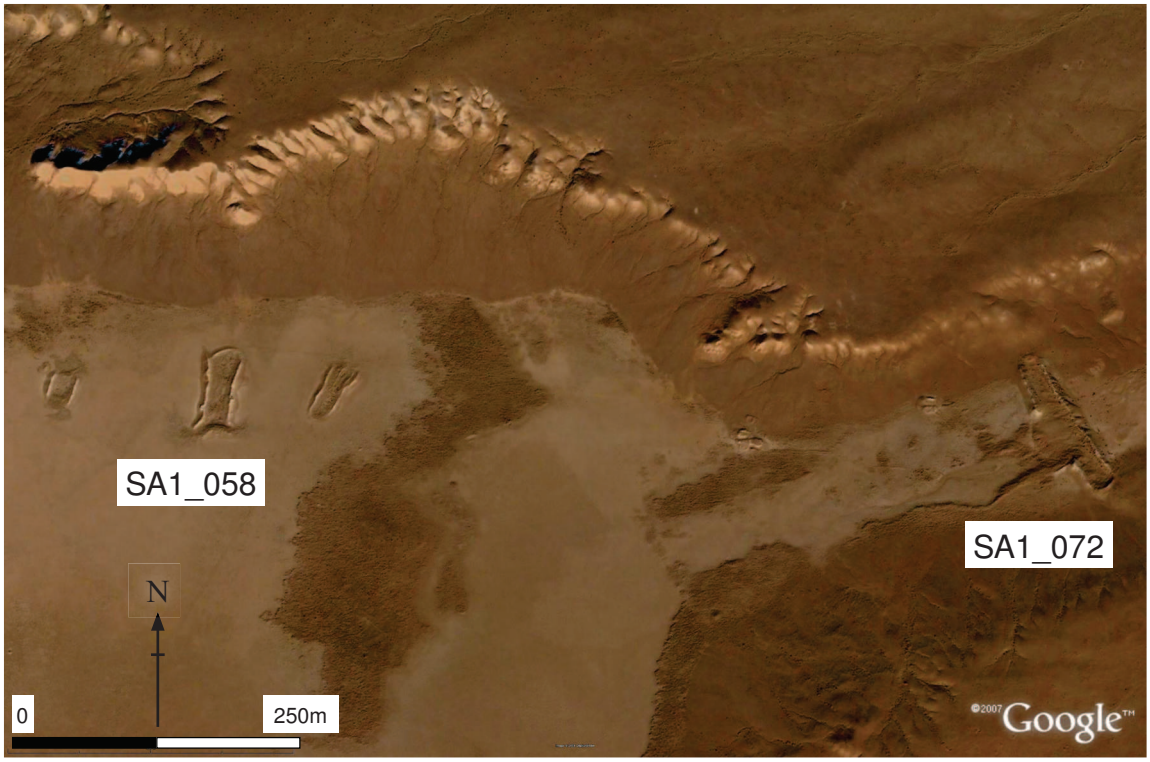
7:35 Sketch plan of the hitherto unplanned Ghaznawid site of Qala-i Hauz, derived from the satellite image available through Google Earth

Rīgistān Study Areas

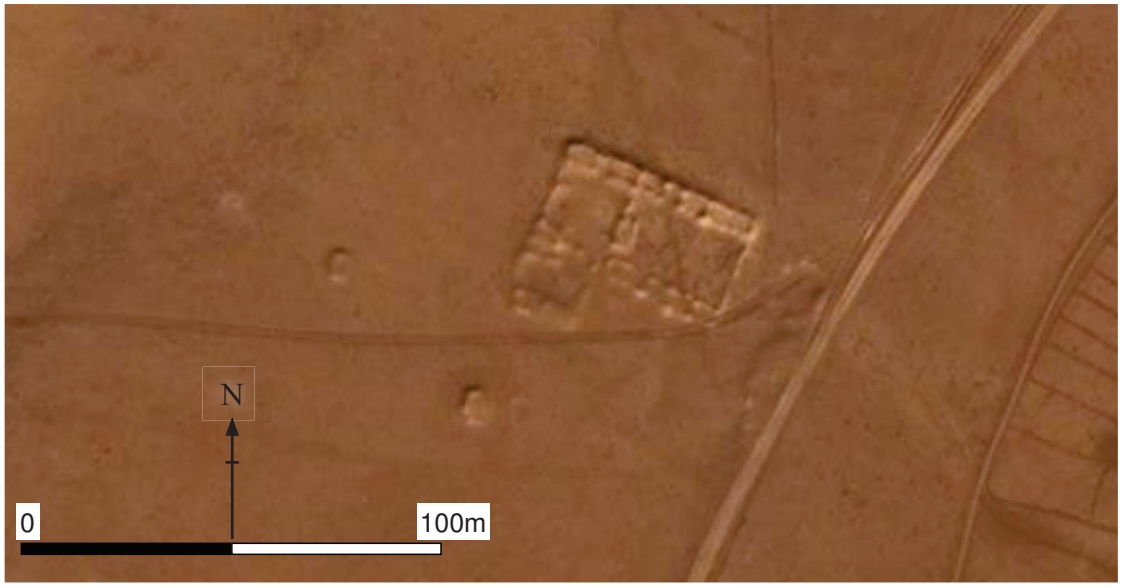
Qal'a-i Hauz (SA1_094) was the only known archaeological site in the Rīgistān Study Areas, prior to our research (Fig. 7:35; Ball 1982 I: 848, Site 207; Balsan 1972a: 170-5). It is broadly dated to the fifth-sixth / eleventh-twelfth centuries, on architectural grounds and Balsan (1972a: 172) speculates that the site was used by Ghaznawid princes on hunting trips, although he provides little more than circumstantial evidence. By studying the satellite image available through Google Earth, we have been able to generate the first measured sketch plan of the site and delineate some of the internal features of the fortress (see the description in Appendix Twelve).

The 462 other archaeological sites have now been identified in the Rīgistān desert Study Areas as a result of ASAGE research. These include isolated nomad campsites and corrals, fortified dwellings and *tepe*s (occupation mounds, probably dating back several millennia), farmsteads, deserted villages, dams and reservoirs, and *kārīz* (Figs 7:35-43; Tables 7:9-10).

The large number of sites we have identified should not come as a surprise, despite the previous dearth of sites in the area. Survey work in the 1960s and 1970s in the nearby deserts of Sīstān (Fischer *et al*. 1974-76 – see Chapter 5.3.2), the anecdotal reports from travellers in the region and fieldwork in other semi-arid regions of the Near East and central



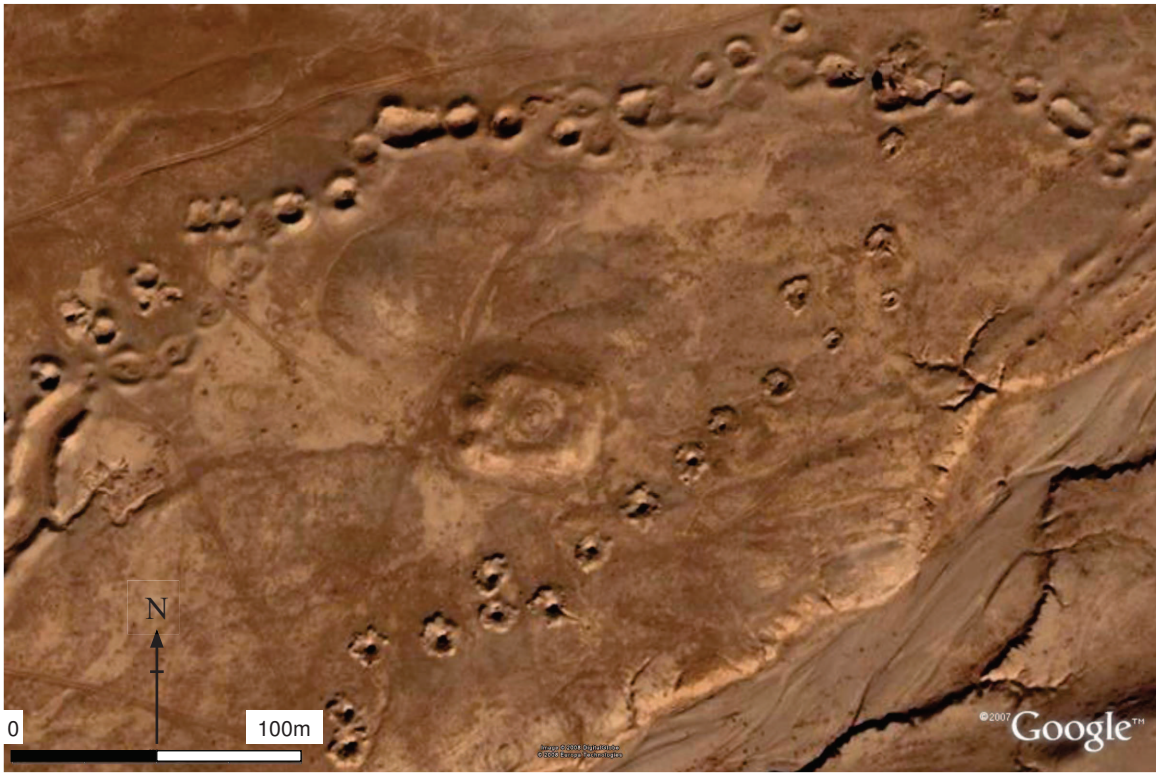
7:36 SA1_058 – enigmatic features: possibly reservoirs or desert kites near Qala-i Hauz and SA1_072 – dam, visible in the satellite image available through Google Earth



7:37 Farmstead SA2_570, with possible corrals to the west and south, visible in the satellite image available through Google Earth

7:38 *Tepe* SA2_512, surrounded by modern fields and ditch leading from a *kārīz* in the north-east

7:39 *Tepe* SA2_536, surrounded by modern fields and ditch, visible in the satellite image available through Google Earth



7:40 SA2_101: *tepe* with towers guarding the entrance in the west;
note the overlapping *kārīz* spoil heaps running to the north and south of the *tepe*

Asia have demonstrated that deserts have been utilised by nomads for millennia, and that their sites survive, despite often being ephemeral.[75] Roger Cribb (2004: 96), for example, remarks on the substantial mud tent walls in arid areas of Afghanistan, along with stone, mud or brush / thornbush corrals.[76] The blanks on distribution maps are frequently due to a lack of investigation rather than a lack of archaeological sites.

Despite the lack of ground-truthing, I am confident that most of the sites we have identified are 'real' rather than being natural features, based on the study of known archaeological sites in satellite images available through Google Earth and over four years of archaeological fieldwork experience in semi-arid regions of north Africa, the Near East and central Asia. Some sites, such as the *tepe*s, are readily recognisable – their distinctive raised, often regular shapes are clearly not natural, as numerous analyses of aerial imagery, surveys and excavations in the region and further afield have demonstrated (Figs 7:38-40; see Alizadeh & Ur 2007: 152, Fig. 2; Gardin 1995; 1998; *inter alia*). Sometimes features such as citadels or towers are visible: site SA2_101, for example, has two distinct

[75] See, for example, the comparable array of Byzantine-Early Islamic sites discovered by the Archaeological Survey of Israel in the early 1980s in the southern Negev highlands (Avni 2007: 129; Rosen & Avni 1993: 192 fn. 1, 198).

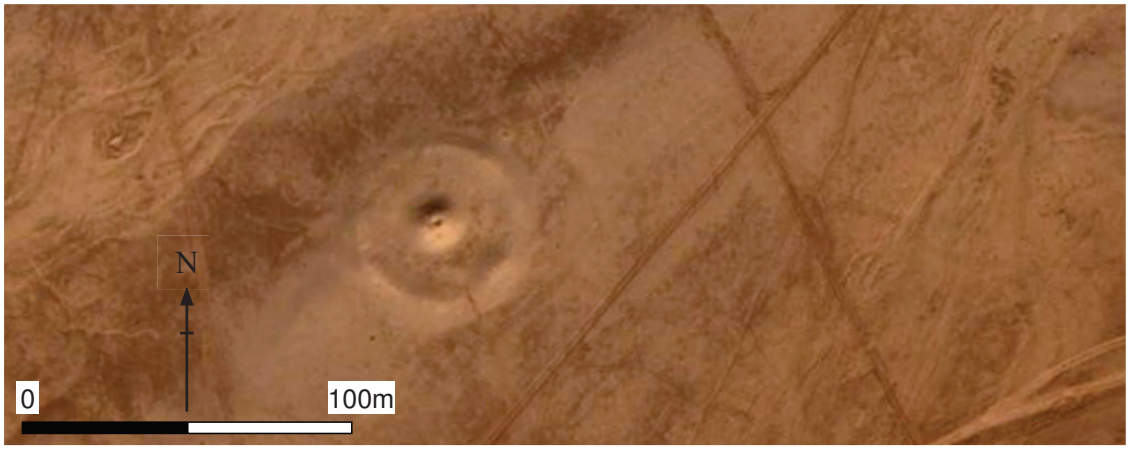
[76] See also Ferdinand (1962) and Jentsch (1973) on nomads in Afghanistan.

Location	Total no. of sites	Camp sites	Dams	Enclo-sures	Dwell-ings	Hamlets	Reser-voirs	Sub-total
Mud flat	133	4	7	17	6		78	112
Wadi	124	21	19	7	4	21	25	97
Plain	174	28	4	19	16	53	22	142
Elevated	17	1			1			2
Dunes	15	9		2			3	14
Total	463	63	30	45	27	74	128	367

Table 7:9 Total number of sites and site types with more than 25 occurrences, by location for Rīgistān Study Areas SA1-5

	Total no. of sites	Camp sites	Corrals	Dwellings	Hamlets	Reser-voirs	Sub-total
N-S	82	11	2	4	1	26	44
NE-SW	103	15	2	3	1	36	57
E-W	77	12	3	5	4	27	51
NW-SE	186	23	3	15	68	39	148
none	15	2	2				4
Total	463	63	12	27	74	128	304

Table 7:10 Orientation of sites – total number of sites, and site types with >25 occurrences, for Rīgistān Study Areas SA1-5



7:41 An enigmatic 'saucer-shaped' site (SA2_569) – possibly a burial in an banked enclosure – visible in the satellite image available through Google Earth

conical mounds in the west, the remains of the towers guarding its entrance (Fig. 7:40). Excavations of comparable mounds have revealed well-preserved, elaborate fortifications immediately beneath an apparently amorphous crust of weathered mud-brick.[77] Another mounded site, the 'saucer-shaped' SA2_569, is more enigmatic (Fig. 7:41). It is too circular

[77] See, for example, the remarkable Bronze Age to Islamic period sites in the Murghāb oasis around Marw (Herrmann 1999: 39, Fig. 31; Hiebert 1994: xxxii Fig. C, 20-1 Figs 2.6-7; Zavyalov 2007; *inter alia*).

to be a natural formation, but could be an ancient nomads' burial mound (*kurgan*) in an enclosure.

Kārīz are readily identifiable due to the kilometres of circular spoil heaps from their shafts (Fig. 7:38, 7:40; Jentsch 1970: 115, Abb. 1, 117, Luftbild). Other sites, such as the U-shaped structures (SA1_058, 072) close to Qal'a-i Hauz, are more difficult to interpret (Fig. 7:36). These structures have irregular stretches of walls, some with niches / towers, and are usually open at one end. They range in size from less than 10 m to over 50 m long. Some of these sites may have functioned as reservoirs, while others could be corrals or shelters for caravans crossing the desert. A few may be hunting traps (desert kites) into which wild animals were driven (Echallier & Braemer 1995; Yagodin 1998) or hunters' hides. The linear raised feature (SA1_072) blocking the wadi to the east of the enigmatic structures is probably a dam. Along with the other water installations, this site indicates significant attempts to harvest and manage the water that periodically becomes available in the desert.[78]

Nomads' sites are notoriously difficult to date, even when fieldwork is possible (Betts 1998: 195; Politis 1993: 47; Rosen & Avni 1993: 195; *inter alia*). As I noted above, analysis of the declassified satellite images provides a *terminus ante quem* for some of the larger, more readily recognisable sites. Given that reconnaissance for the British Indian Army in the late nineteenth century CE noted extensive nomad activity in the Arghandāb valley to the north of the Rīgistān (Bellew, cited in Adamec 1980: 397), it is not unreasonable to suggest that many of the sites in the Rīgistān desert at least pre-date the twentieth century CE, with some, particularly those around Qal'a-i Hauz, being Early Islamic in date, and the *tepe* sites in the north dating back millennia.

Stratigraphic observations can provide a means of dating sites in relative terms – some of the lines of *kārīz* spoil heaps, for example, overlap each other (see Fig. 7:38), and overlie (and thus post-date) other sites. A mid-twentieth century CE tarmac road slices through an enclosure to the east of a circular site (Fig. 7:42). The degree of sedimentation visible is another rough indicator of age – older sites are more likely to have been affected by the build-up of wind-blown sands, although the type of site is obviously important – the standing remains of Qal'a-i Hauz are much less affected by aeolian deposition than the reservoir beside it (see Fig. 7:35).

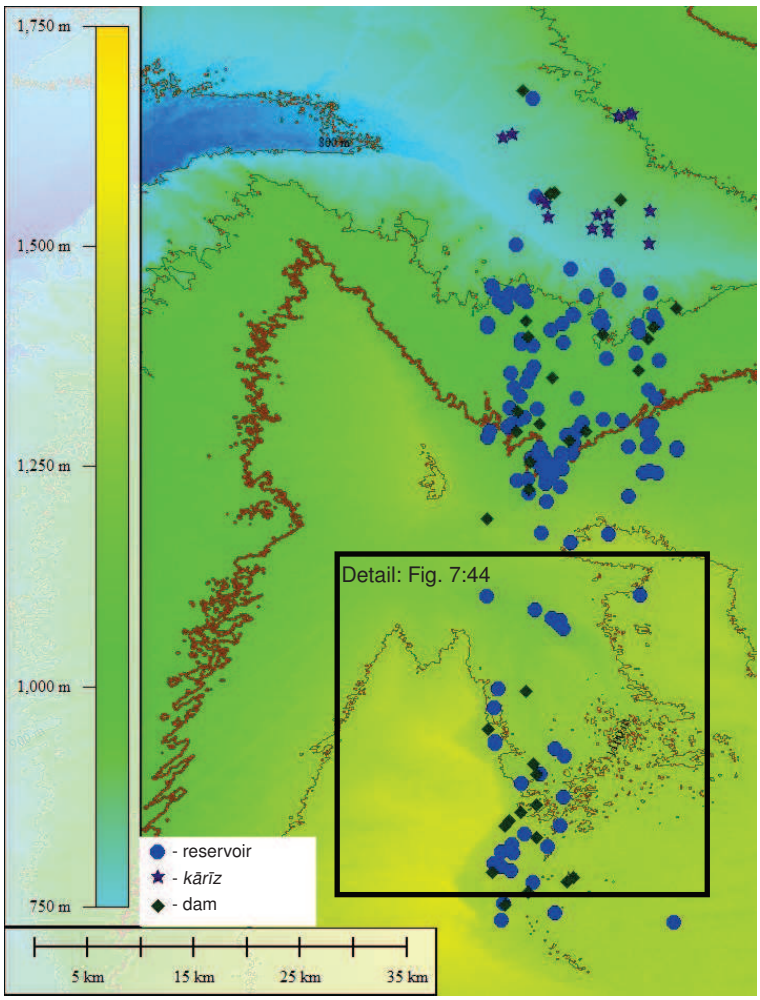
[78] The diachronic longevity of the 58 m long stepped dam at Wadi el-Jilat in Jordan illustrates that researchers should not assume that the dams in the Rīgistān are modern. The dam was constructed in the Nabatean period and although probably repaired or re-built in the later Byzantine / Umayyad period, remains un-breached today (Politis 1993) .

7:42 Circular embankment (SA2_533) truncated by the Ḳandahār to Harāt highway, which is visible in the satellite image available through Google Earth (above), and the Corona images from 1965; note also the rectangular mound and large rectangular enclosure to the east

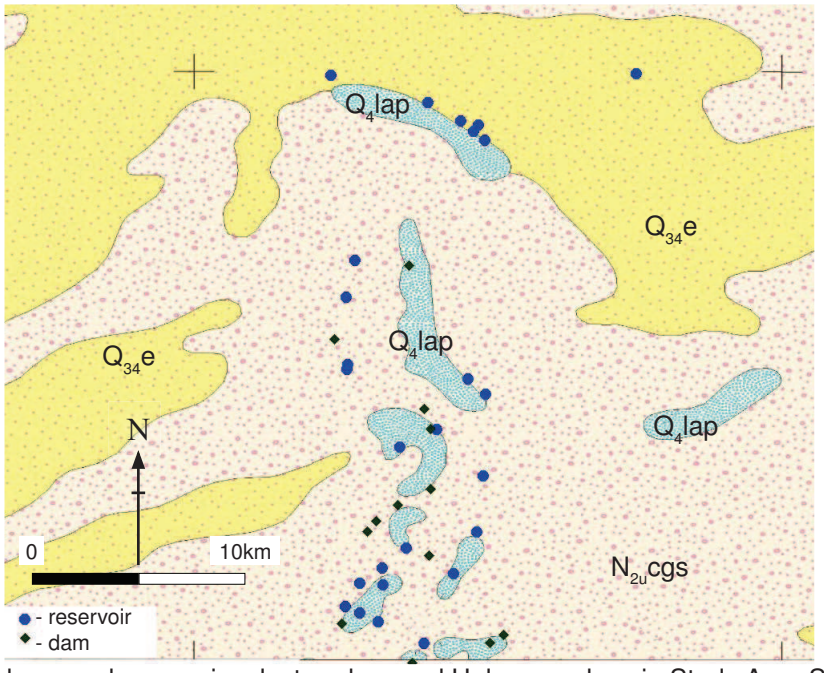
The majority of sites in the Rīgistān are concentrated in the north of the strip of five Study Areas, close to the Arghandāb (see Fig. 7:34). The number of sites declines markedly ca 24 km to the south of the Arghandāb, where the geology changes from conglomerate and sandstone to Eolian deposits (sand),[79] although a significant number of sites (primarily water installations and campsites) are found well into the desert, clustering around the Holocene *playa* (flat-bottom depressions found in desert basins – Figs 7:43-4). With one possible exception (SA3_061, 18 km into the Rīgistān to the south of the Arghandāb), *kārīz* are only found in the hills north of the Arghandāb, primarily in a ring around a protrusion of Holocene and late Pleistocene Fan alluvium and colluvium overlying middle Pleistocene conglomerate and sandstone (Figs 7:45-6).[80] Hamlets are concentrated in a 5 km wide strip along the banks of the Arghandāb (Fig. 7:47); those on the south bank cluster in a band of middle Pleistocene conglomerate and sandstone (alluvium). Modern settlements are only found to the north of the river – the abandoned villages to the south may indicate wetter climates in the past, or an increasing emphasis on *kārīz*-based irrigated cultivation which is only feasible in the foothills of the mountains.

[79] http://pubs.usgs.gov/of/2005/1119/A/index.html# [accessed 04/04/2011].

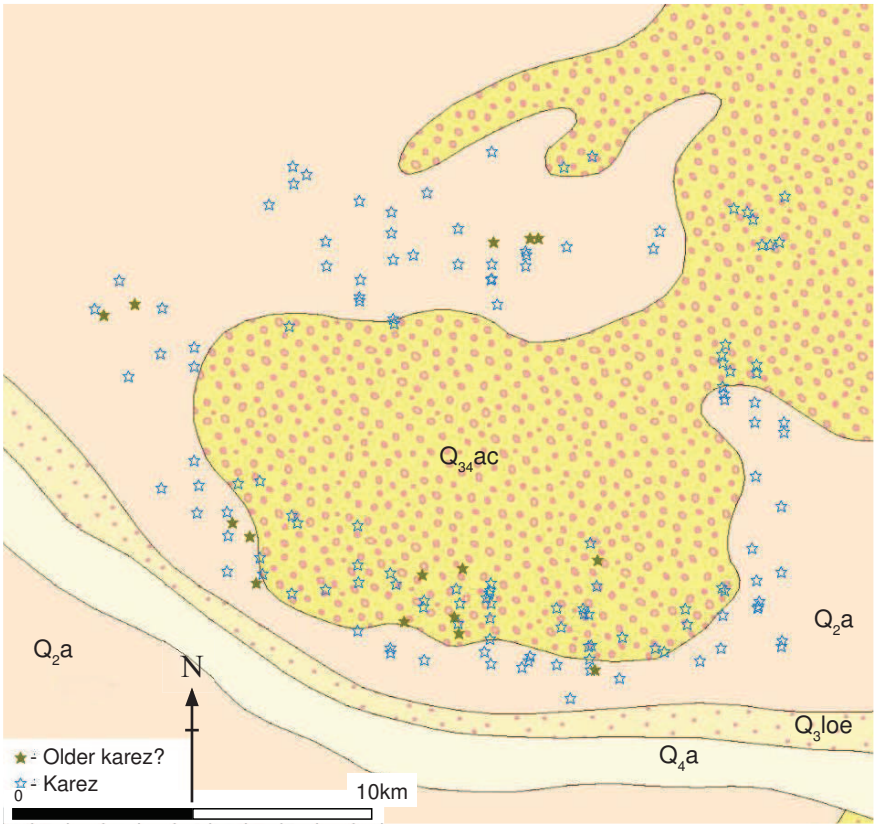
[80] Jentsch (1970: 119) attributes the broader concentration of *kārīz* to the west, south and east of the Hindu Kush to the distribution of ethnic (primarily Pashtūn) groups rather than hydrological reasons.



7:43 Distribution of water installations in the Rīgistān Study Areas, overlain on contour map generated from ASTER GDEM data in Global Mapper; see Fig. 7:44 below for detail

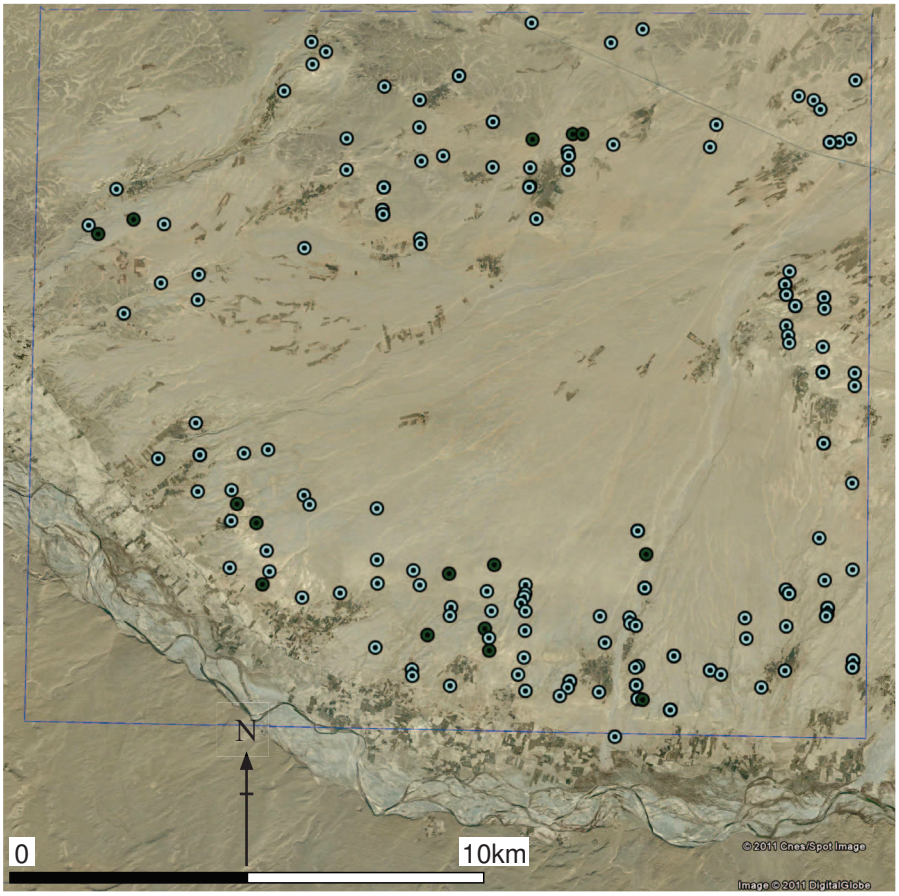


7:44 Detail of dams and reservoirs clustered around Holocene playa in Study Area SA1 (see Fig. 7:45 above for location); Q_4lap - Playa deposits (Holocene); Q_{34}e Eolian deposits (Holocene and late Pleistocene); N_{2u}cgs - Conglomerate and sandstone (late Pliocene)

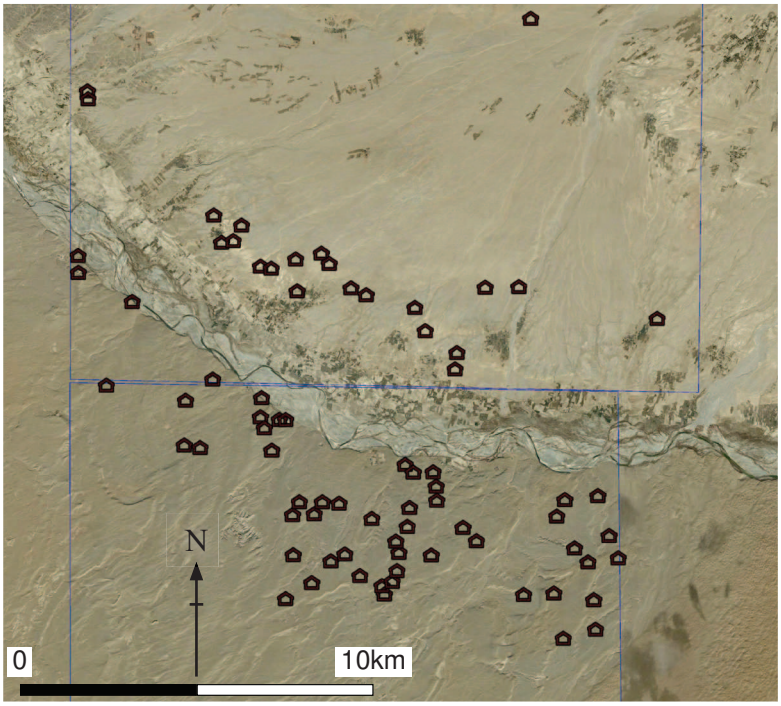


Q_4a -Conglomerate and sandstone (Holocene)—Alluvium (Arghandāb)
Q_{34}ac Fan alluvium and colluvium (Holocene and late Pleistocene)
Q_3loe - Loess (late Pleistocene)
Q_2a - Conglomerate and sandstone (mid Pleistocene) alluvium

7:45 Distribution of *kārīz* in Study Area SA2, north of the Arghandāb, overlain on USGS geological map
(see also Fig. 7:46)



7:46 Satellite image of *kārīz* in Study Area SA2, north of the Arghandāb, avaiable through Google Earth (darker symbols indicate possibly older *kārīz*); note the central alluvial/colluvial fan, equivalent to Q_{34}ac in Fig. 7:45, which has a dearth of *kārīz* (see also Jentsch 1970: 115, Abb.1)

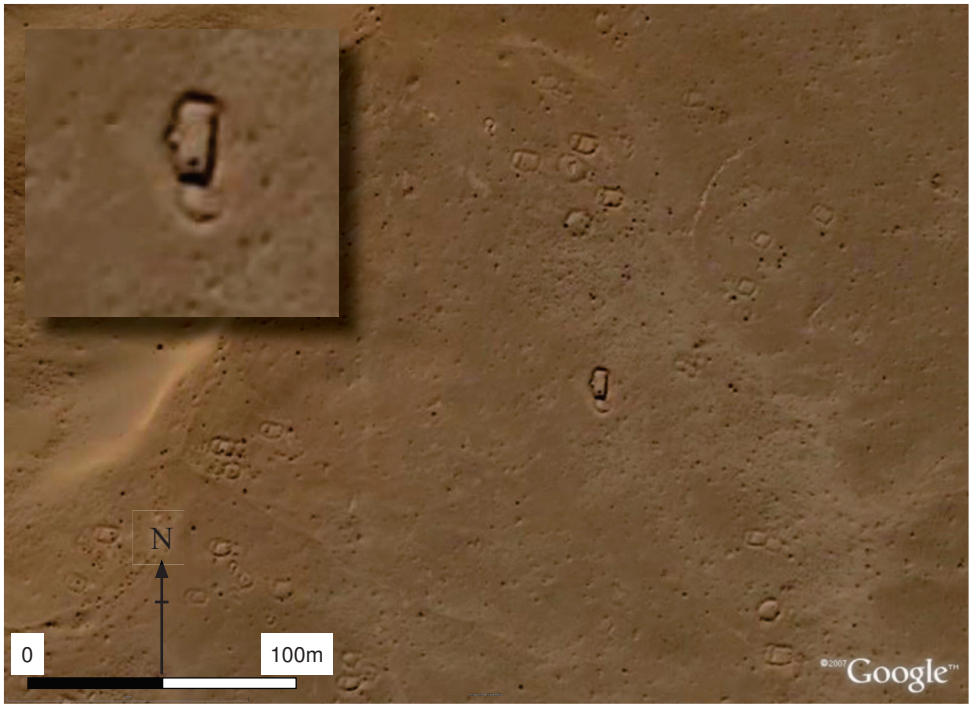


7:47 Distribution of pre-modern hamlets either side of the Arghandāb, visible in the satellite image available through Google Earth; modern settlements are only found to the north of the river

Individual double-room, rectilinear dwellings and sub-circular corrals, comparable to the Byzantine and Early Islamic hamlets, farmsteads and campsites found in the Negev (Rosen & Avni 1993: 192, 195) are clearly distinguishable in many of the abandoned hamlets and campsites (see Fig. 7:37 and Fig. 7:51 below).[81] The architecture and settlements are less complex than the likes of Dīwāl-i Khudaidād in Sīstān (Fischer *et al*. 1974-76 II: Kartenbeilage 5). As Fischer and others have found (see Chapter 5.3.2), the dwellings tend to be orientated north-west to south-east, with entrances (where identifiable) favouring the eastern side of buildings, away from the prevailing wind (Table 7:10).[82] The orientation of structures in campsites is less consistent, possibly reflecting varying seasonality of use and types of structures. In several cases, the dwellings cluster around an elongated

[81] Campsites in the Negev such as Nahal Oded have twenty-five structures, while the well near Be'er Karkom facilitated the agglomeration of fifty-eight round and oval structures and two open-air mosques (Rosen & Avni 1993: 193-6). Most of the stone-built structures have low walls with little or no stone fall, indicating the use of fabric or organic superstructures (see also Cribb 2004: 96). An oval tent structure at Biqat Hisun measured 6 x 5 m, with an attached courtyard or pen measuring 8 x 6.5 m. A nearby larger pen enclosed an area of 17 x 16 m, while an 11.5 m diameter threshing floor was located just to the north of a dammed wadi. Rosen and Avni (1993: 196) suggest that the more structurally solid, slightly subterranean structures at the Oded sites indicate autumn-winter occupation, the inhabitants moving north in spring-summer after the harvest in the Highlands.

[82] See also Rosen and Avni (1993: 194).



7:48 SA3_499: double-room dwellings, circular corrals and camp sites clustered around an elongated structure (inset), probably a mosque

structure which was initially interpreted as a communal reservoir or possibly a *madjlis* (a meeting place / guest house for visitors), until I noticed a niche in the west wall of several such structures, which presumably indicates the *miḥrāb* of a mosque (see Fig. 7:48 and site SA3_520).[83]

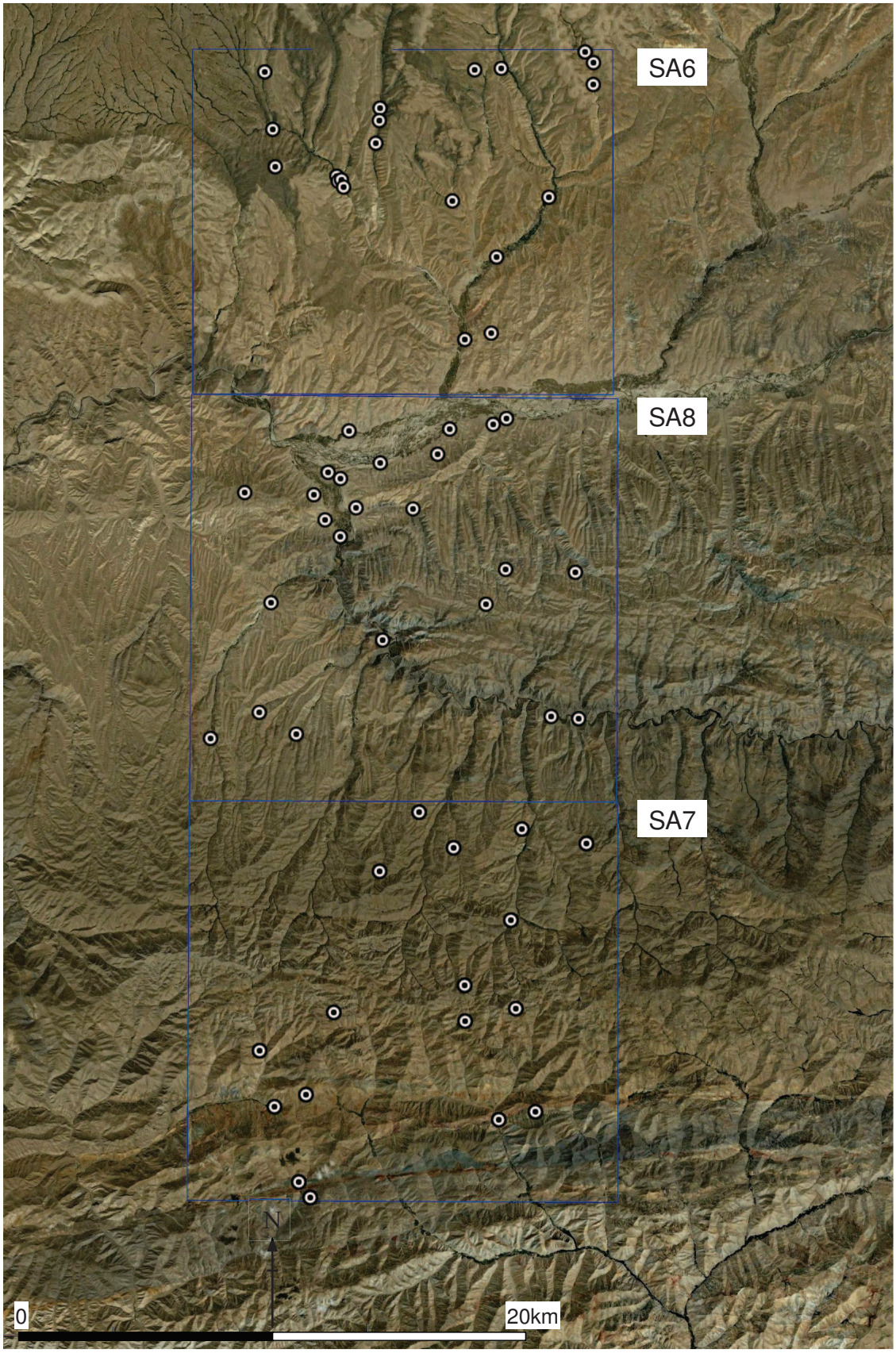
Ghūr and Harāt Study Areas

The wealth of sites found in the Arghandāb river valley and Rīgistān desert contrasts with the much smaller numbers identified in the three Study Areas in the mountains of Ghūr province (SA6-8; see Fig. 7:49), and the two on the steppe in the north of Harāt province (SA9-10; see Fig. 7:50). Image quality does not explain the different site densities – modern campsites, with their distinctive black tents made from goat hair, are visible in the satellite images of Study Areas SA6-8 available through Google Earth (see Fig. 3:16), as well as flocks of animals grazing on the hillsides.[84]

As in the Rīgistān, only a handful of archaeological sites were previously known in

[83] See also Avni (1994; 2007).

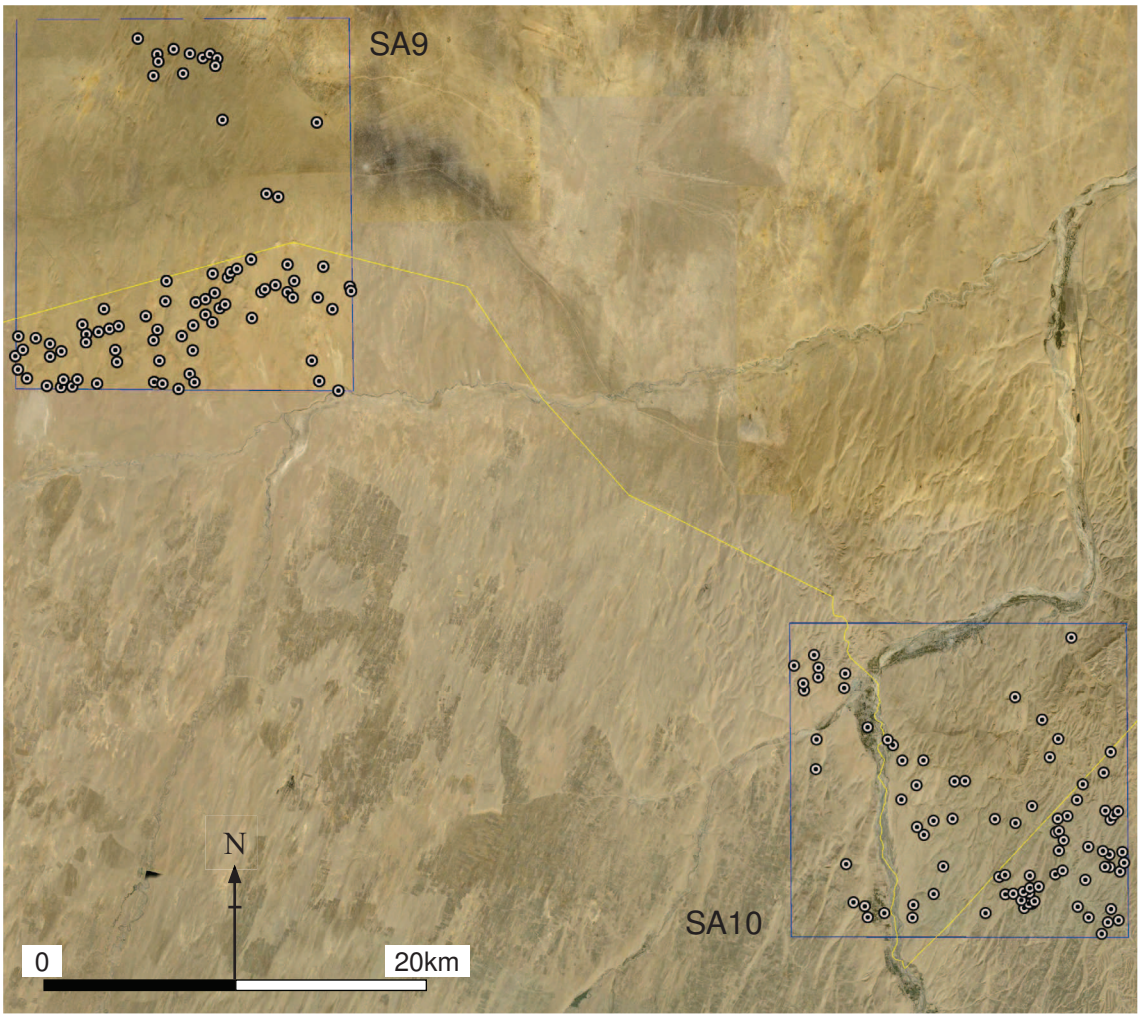
[84] The distribution of tents and flocks is not of incidental curiosity, as they provide an indication of the carrying capacity of the landscape, in the absence of accurate ethnographic and livestock data (Figs 3:13-14). It would, however, be erroneous to equate the current post-conflict distribution of nomads with those of thirty years ago, let alone eight hundred years ago (Herold 2003; Ker & Locke 2010).



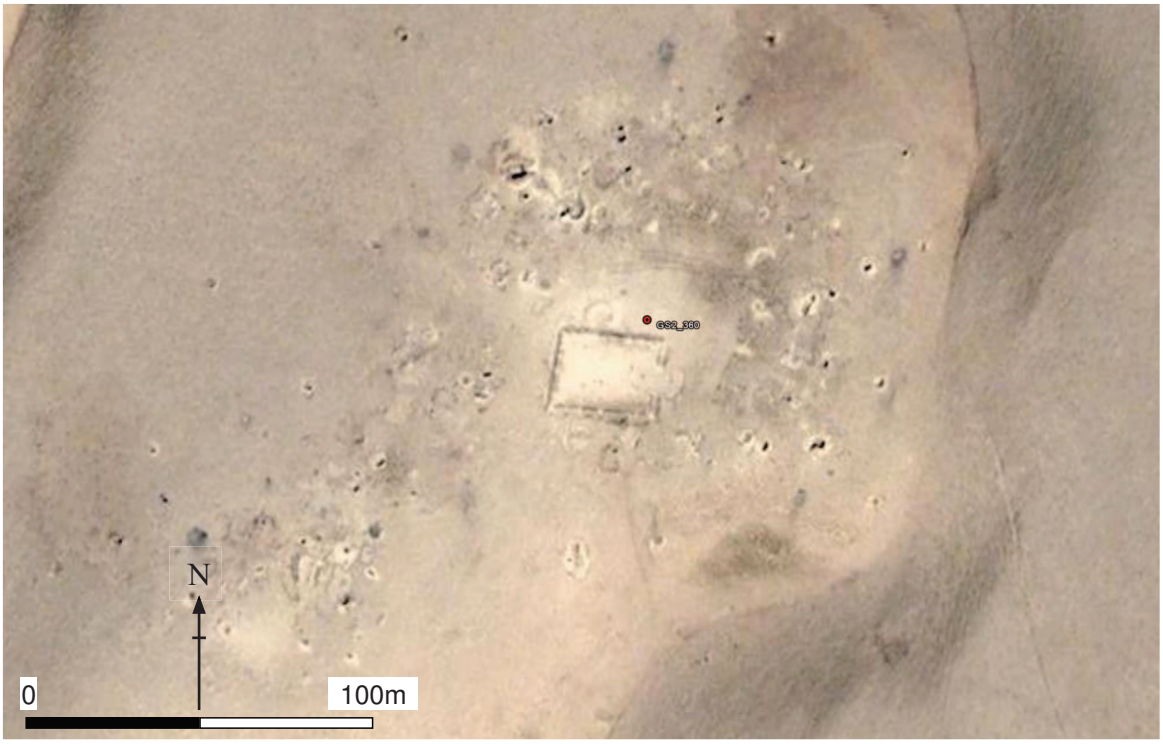
7:49 Archaeological sites (n=61) identified in high resolution Google Earth Study Areas SA6-8 in Ghūr province

	Total no. of sites	Camp	Enclosure	Fort	Dwelling	Hamlet	Sub-total
Ghur SA6	20				9	4	13
Ghur SA7	17			4	8		12
Ghur SA8	24			13	4		17
Herat SA9	81	15	23		19	12	69
Herat SA10	86	35	22		8		65
Total	228	50	45	17	48	16	176

Table 7:11 Total number of sites and most numerous site types in the Ghūr and Harāt Study Areas



7:50 Archaeological sites (n=167) identified in high resolution Google Earth Study Areas SA9-10 in the Harāt province



7:51 SA10_360 campsite, visible in the satellite image available through Google Earth (see Fig. 3:16 for a modern campsite [SA7_024])

these Study Areas – the numerous, but undated "circular and square towers" of Alayār (Ball 1982 I: 33, Site 27) and similar towers attributed to the Ghūrid period around Shīniya (Ball 1982 I: 252-3, Site 1081) in SA8, and two undated *tepe*s at Kizghundi (Surkh Tepe – Ball 1982 I: 164, Site 614) and another large, undated *tepe* at Tūrghundi (Kara Tepe – Ball 1982 I: 280, Site 1206) in SA10. While the *tepe*s are relatively easy to recognise in Google Earth, the Early Islamic fortifications at the site proved to be more elusive.

Isolated dwellings and possible forts constitute the major site types in the mountains of Ghūr although neither is particularly common. Surprisingly few recognisably pre-modern camp sites and corrals were identified (Fig. 7:51; Table 7:11). The overall site density of ca 0.07 sites per km^2 in Study Areas SA6-8 compares to an average of 0.33 sites per km^2 in the Rīgistān (Table 7:4).[85] The most obvious explanation is the differing intensities of use in the different environmental zones. Other factors may have contributed to the reduced site numbers – summer campsites in the mountains are likely to be more dispersed and

[85] By way of comparison, Alizadeh and Ur (2007: 15 Fig. 6) identified 261 campsites in Corona images of their 267 km^2 study area in the Mughan Steppe in Iran (a density of 0.98 campsites per square kilometre), although "the distribution is uneven; the majority of the campsites appear to cling to the edges of the larger drainages, probably for ease of access to water from wells sunk into their bottoms".

ephemeral than winter ones,[86] while the harsh winters, which are accompanied by heavy snow falls and violent spring floods, may also have impacted on site preservation and visibility in the mountains of Ghūr.[87]

More sites were identified in the two Study Areas in Harāt province, the most notable being a well-preserved square structure on the edge of a wadi (SA10_321 – Fig. 7:52). The building measures 26 x 26 m and appears to have corner towers and twelve small humps (the remains of columns?) around an internal courtyard. Given its strategic location beside a modern track at the junction of several wadis, it might be an Early Islamic caravanserai, similar to the larger one at Daya-Khatyn in Turkmenistan (Fig. 7:53; Muradov 2009), those identified in satellite images at Marw (Williams 2008: Fig. 59)[88] or a *madrasa*.

The other interesting feature of the sites identified in the Harāt province Study Areas is their distribution. The two Study Areas straddle the modern political border with Turkmenistan and show what appears to be a relatively unfrequented no-mans' land on the Turkmen side of the border. I initially concluded that a significant number of the sites post-date the formal establishment of this border (which probably occurred after the creation of the Turkmen Soviet Socialist Republic in 1924), when authorities became concerned about trans-national movement. The underlying geomorphology, however, may also contribute to this pattern – land north of the border is predominantly *dasht* (volcanic Eocene-Oligocene Liparite) compared to the sandy desert (middle Pleistocene loess) to the south.[89]

[86] See de Planhol's description of summer (*yailāq*) and winter pasture (*qishlāq*) in the region of Damāvand in Iran. He notes that in the summer pastures the "dry stone shelters [are] roofed with loose-fitting planks, which are removed during the winter; in areas where wood is not available, black awnings (imitated from the nomads) are stretched over fixed and permanent bases during the fine season" (de Planhol 1968: 420).

[87] See Alizadeh and Ur (2007) on the effects of modern and older irrigation projects on the survival of pastoral nomads' sites.

[88] http://intarch.ac.uk/journal/issue25/1/images/fig59.html [accessed 13/8/2011].

[89] USGS Geological maps of Afghanistan, 2005 (http://afghanistan.cr.usgs.gov/afghan_geo.php [accessed 24/3/2011]).

7:52 Caravanserai SA10_321, with modern trenches and tank emplacements on the hill to the south, visible in the satellite image available through Google Earth

7:53 Ruins of a Early Islamic caravanserai at Daya-Khatyn in Turkmenistan, visible in the satellite image available through Google Earth

7.7 Conclusions

This chapter has demonstrated the potential uses of satellite imagery of Afghanistan in archaeological research, particularly in conjunction with fieldwork. I have used a variety of images to investigate the extent and characteristics of sites which have previously been partially or imprecisely documented. I have also discovered over four hundred archaeological sites in previously under-explored parts of the country. The use of satellite imagery in archaeological research in Afghanistan will become increasingly important given the on-going difficulties of accessing many sites and the recent increase in the availability of affordable and archival images.

Satellite images provide archaeologists with the capacity to conduct analysis in a systematic, replicable manner, from the safety of their offices. This is highly significant, both from a methodological point of view, and given the Occupational Health and Safety issues of working in a country where landmines proliferate and the security situation remains volatile. The resultant data have the potential to prompt future fieldwork when that becomes possible, alert the Afghan authorities and NGOs to the presence of important archaeological sites, facilitate heritage management projects and overcome some of the biases and weaknesses inherent in data collated in Ball's gazetteer. At the site specific level of analysis, the detailed sketch plans the ASAGE project has generated from Google Earth images are an important development in the documentation of Afghan archaeological sites, so many of which are unsurveyed or only schematically planned.

A variety of approaches were necessary during this part of my research, due to the distribution and range of sites under investigation and the variable nature of the existing data. Inevitably, some of these approaches have proved more successful and productive than others, but each needed to be explored, and has provided useful insights. The complex issues of geo-rectifying images, and synchronizing different map projections and coordinate systems highlight the value of using GIS software to merge disparate datasets, and engaging with specialists in the fields of GIS and remote sensing. Some aspects of remote sensing, such as multi-spectral data which Parcak (2009b: 366) argues is the most useful form of satellite image analysis, remain unexplored. I have also not attempted to use GIS to conduct sophisticated spatial analysis, due to the weaknesses and limitations of the available data.

The fact that archaeological landscapes are palimpsests means that few of the new sites identified using Google Earth can definitively be attributed to the Early Islamic period. The quantitative data garnered for existing sites of known date(s), however, provide a few

insights into the Ghūrids' settlement hierarchy. These suggest that they did not radically alter that of their predecessors. As I discussed in Chapter Five, many of the fortified sites in central Afghanistan appear to have been founded in earlier periods and exhibit continuity of occupation. Archaeologists have yet to identify evidence of the proliferation of fortresses attributed to Ghūrid rulers by al-Djūzdjānī. Although it is difficult to gauge their precise use of, and impact upon, the existing major urban centres, the historical sources and archaeological evidence from Ghazna and Lashkar-i Bāzār suggest limited elite patronage of cities during the early years of the Ghūrid interlude, with subsequent modifications of existing structures and some, later major building programmes.

Although the tentative nature of these conclusions is frustrating from the point of view of this thesis, it should not detract from the potential contribution the analysis of satellite images has to make in the broader study of archaeological sites in Afghanistan and elsewhere. This topic and others more directly relevant to the Ghūrid polity will be discussed in the concluding chapter of the thesis, Chapter Eight.