GEOSPATIAL ACCURACY MATTERS!

A preliminary study about impact on Cultural Property in Afghanistan

Introduction

Cultural Property (CP) is defined as any movable or immovable property of great importance to the cultural heritage of every people (such as monuments of architecture, art or history, archaeological sites, important collections of books or archives), buildings whose main and effective purpose is to preserve or exhibit the movable cultural items as well as centers (cities, villages) containing a large amount of cultural property as previously defined.

Cultural Property Protection (CPP) comprises the safeguarding of cultural property (preventive measures taken to avoid destruction) and respect for cultural property (refraining from any act of hostility directed against such property, as well as refraining from any use of the property for purposes which are likely to expose it to destruction or damage).

The 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict and its two protocols (reference A) are the paramount international instruments for the protection of cultural property during armed conflicts and provide the primary legal framework for CPP.

CPP is therefore one of the many critical factors to ensure mission success of each NATO operation. But, taking apart the movable cultural items, one crucial issue is to exactly know where these CP sites are located. As it will be demonstrated, incompleteness and inconsistency in the CP sites list can lead to involuntary damage despite CPP planning is being considered. The aim of this study is to make a first evaluation of the impact of military infrastructures related to NATO Operations on CP sites in Afghanistan, which are both archaeological and monumental. It must also be underlined that the aim of this study is to seek for minor possible source of CPP-related errors, with the final end state of improving CPP planning for next NATO operations.

Aim and Methodology of the study

This is a preliminary study which started from an input of CPP NATO WG, which was created in order to study and propose doctrine and procedures on CPP between and has been active between 2014 and 2016.

This study followed a Geospatial-based methodology. In fact, the matching between the known Afghan CP sites and military locations was performed through a Geographic Information System (GIS). Due to the unofficial nature of the study, the coordinates of all military locations are from open sources (OS).

The high resolution aerial or satellite imagery layers, which is crucial in order to capture the archaeological or monumental site position, are from NATO unclassified archive and in particular:

- Satellite imagery:
  - US CIB 5 m ground resolution (1991-2003)
  - US CIB 1 m ground resolution, as above
  - FIL 40 cm ground resolution (2004-2013)
- Aerial imagery:
  - Buckeye color 10 cm ground resolution (2009-2015)

The main source used for the CP sites layer are the 1286 archaeological and monumental sites recorded by W. Ball in 1982. As these sites were collected in a pre-GPS era, their geographic coordinates are limited to

Degrees and Minutes, while Seconds are missing. This implies a positioning error of around 2 kilometers on the ground.

In order to mitigate this problem, a direct photointerpretation was performed by the author to accurately position Ball points and to find new archaeological places which were previously unknown.

The final result of this long work was a CP layer with an accuracy of at least one meter on the ground.

In order to build the open source military infrastructure layer the following data were used:

- 299 Military-related georeferenced locations from Wikimapia
- 245 Afghan Military locations from Wikipedia (very few of them georeferenced)
- Other internet sources

At the end of the process, a final matching was carried out between the CP sites layer and the OS military infrastructure layer. The results were as follows:

- 34 among the 299 georeferenced Afghan Military locations were less than 2 km from archaeological sites
- Among these, 3 are located on or immediately adjacent to archaeological sites

This matching was integrated by further research, which was performed thanks to author's direct and detailed knowledge of Afghan archaeological sites. In this way, other 6 military locations were found to be located on or immediately adjacent to archaeological sites.

Preliminary Study Results

On all military sites known from open sources or direct research, only 9 are located on or immediately adjacent to archaeological sites.
Among them, four inflicted heavy damage, which means bulldozer made trenches/pits or roads/infrastructures.
Among them, five are less than 100m away, which means light damage or danger of future damage.
This preliminary study shows that the impact for CPP directly and indirectly due to NATO Ops in Afghanistan can be considered low, but not absent.
As it could be expected, most of damage is due to infrastructure improvements directly or indirectly linked to current and former NATO Ops.
Another result from the study is that, especially in flat areas, there is a recurrence of military use of elevated ground through centuries.
Of course, this preliminary study could be enhanced through an official study which can include military site locations provided by official military sources.

Main case studies

In this article, only the four which inflicted heavy damage will be considered.

The most representative case study is the archaeological site of Spirwan, which is in Panjwayi District of Kandahar Province. It consists of a citadel and enclosure dating back to the Bronze Age (3rd-2nd Millennium BCE), Indo-Parthian period (1st-4th Century CE), Timurid period (15th-16th Century CE) and post Timurid (17th Century CE). It is therefore a very important site which was published by Ball together with a site plan (1982).

Ball's geographic coordinates are the following:

Lat (DMS): 31° 29' 48,863" N

Lon (DMS): 65° 25' 11,619" E

But an accurate validation through satellite imagery led to the following coordinates:

Lat (DMS): 31° 29' 48,863" N

Lon (DMS): 65° 25' 11,619" E

This implies a shift of about 1500 meters on the ground. The consequence is that despite this site was included into an unclassified CP list which was delivered for NATO operations, the totally inaccurate Ball's coordinates did not prevent from the construction of a military installation on the site itself. In fact, the elevated ground on the surrounding plan was probably the reason why FOB Sperwan Ghar was built. Open sources state that FOB Sperwan Ghar was occupied by Canadian Army, US Army, USMC and ANA forces. Unfortunately the type of damage is heavy because there are bulldozer made trenches/pits or roads/infrastructure.

Another representative case study is the archaeological/monumental site of Lashkari Bazar, in Lashkar Gah District of Helmand Province. Lashkari Bazar was the published (Ball 1982) and renowned royal winter residence during Ghaznavid and Ghurid period (11th-13th Century CE) and thus consists of a vast concentration of palatial residences and public buildings. Also in this case the site was again roughly known also due to its evidence, but again a combination of inaccurate coordinates and the previous existence of local civilian houses led to the building up of a military installation just in coincidence of the Northern Palace, while the southern palace was obliterated by civilian houses. The infrastructure is MOB Lashkar Gah, which according to OS was initially occupied by British Army. Again, there is a heavy damage due to bulldozer made trenches/pits or roads/infrastructure.

As a third case study, there is the ancient town of Kuri, also known as Faizabad, which is in Argo District, Badakhshan Province. It consists of remains of ancient city dating back to the Kushano-Sasanian period (4th-5th Century CE), Early Islamic period (10th-13th Century CE) and Timurid period (15th-16th Century CE). Again, it is a well-known site (Ball 1982) whose published coordinates are not accurate enough. The western end of the town was at the first stage occupied by an airfield from the soviet era. But the worst damage came when the so called Faizabad airport was enlarged in favor of airport infrastructures used by the Czech Army. In this case, roads and infrastructure over low lying site with traces of mud and baked brick structures, some of which are visible from the image thanks to snow coverage.

The fourth and last case study is the fort/castle of Khan Neshin, which is in Reg-e Khan Neshin District, Helmand province. In this case the site is unpublished, therefore absent from any CP list. This fortification is apparently of the 18th Century, but it could also date back to older ages. A COP called "castle" was put in place using the walls themselves as defensive fence. This fact is also confirmed by an article published on America's Navy (Story Number NNS120621-11 of 6/21/2012), which is Naval Mobile Construction Battalion (NMCB) 11 and is justifying the choice of the site to the fact that the fort was safer than a previously occupied position and that the castle was captured from the Taliban in 2009. The article itself is saying that "Reportedly built by Alexander the Great in an area known as the Green Zone due to its abundant vegetation, the age-old structure was once an insurgent stronghold and the object of fierce battles between coalition forces and Taliban armed factions."

Of course, the type of damage is made up by bulldozer made trenches/pits or roads/infrastructure.

Conclusions

These case studies show that, when considering a list/database of known/published CP sites the two main possible source of error in CPP planning is due to:

1. Inaccurate/non validated coordinates from the list;
2. Incompleteness of the list itself, due to non-published/minor CP sites.

About the first source of error, it is crucial that all CP sites in the list are previously validated on the ground or, if not possible, through satellite/aerial imagery photointerpretation by certified experts. These experts should have at the same time deep archaeological/historical knowledge and deep experience in GIS/coordinate system. This last point is not always granted, because many academics are not so familiar with coordinate systems as the military are. In fact, their primary interest is to study the site itself and its historical relationship with others, but this leads to give less importance to their actual and accurate position on the ground. Furthermore, the apparent easiness to take coordinates from the internet leads especially non-experienced scholars and students to the misinterpretation or mismatching of the coordinate format of reference system. Some typical mistakes are:

1. The swapping between North and East coordinates (ex. 65°30'15"N, 31°00'45"E instead of 31°00'45"N, 65° 30'15"E).
2. A confusion/misinterpretation of the coordinate format to be used. The typical Degrees Minutes Seconds coordinate pair 31°00'45"N, 65°30'15"E could be also written 31°00.75N, 65°30'.25E (Decimal Minutes) or 31.0125°N, 65.50417°E (Decimal Degrees), but this is not always clear for many users.
3. Problems of number truncation related to the use of Decimal Degrees. For example, 31.0125°N, 65.50417°E it could be truncated to 31.01°N, 65.50°E without being noticed, but this means that the final positioning accuracy will be very poor.

About the second source of error, specific attention should be paid to the existence of cultural property that does not appears on the registers of international official lists. Complete and comprehensive information about CP sites should be collected not only through obvious sources (UNESCO, ICOMOS, Blue Shield, World Monument Fund, etc.), but also through dedicated research centers (Universities and others). Missing CP sites can be due to:

1. CP sites of new/recent discovery (ex. the magnificent Buddhist complex of Mes Aynak)
2. Minor CP sites for possible archaeological research (ex. unexcavated tells/mounds)
3. CP sites of uncertain relevance (ex. fortifications of the XIX Century, which could hide previous historical phases)
4. Minor CP sites relevant for the local population (shrines or heritage buildings).

A last consideration is about the type of geometric feature which is used to represent the CP site. The point feature is the most common way to indicate the position of a site. This is because it is the easiest to be found on list of published CP sites and also because is the easiest to be captured when a previously unknown/unpublished site is found. But in order to assure a complete protection to a CP site, a polygon feature is definitely more appropriate. This is evident when considering large ancient urban settlements, but also a tell/mound needs to be properly outlined in order to define its respect area. This has to be considered a second phase of the CP Geospatial Database building, which needs more time and effort to be carried out.

All these considerations show that the building up of a complete and consistent CP list is a task that is far away to be simple and granted.

As a best practice, NATO could embed CPP SMEs during Planning, Ops and Post-conflict phases.