Documentation ASDC

(Afghanistan Spatial Data Center)

Data and Methodologies

V0.9

Emlyn Hagen, iMMAP (September 2016)

Note: None of the items in this document can be copied or edited. This is a living document and presently must be considered as draft.

Author of the document is Emlyn Hagen, references to other authors are included where required. Some texts originate from the previous work of Emlyn Hagen; these have not been referenced.

Contents


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1 Introduction

iMMAP in Afghanistan is funded by The United States Agency for International Development (USAID)/ Office of U.S. Foreign Disaster Assistance (OFDA).

The Afghanistan Spatial Data Center is part of the iMMAP Disaster Risk Reduction (DRR) Program, which is a USAID/OFDA funded project to provide DRR relevant information and information management services to the humanitarian community in Afghanistan.

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The Afghanistan Spatial Data Center Data/Maps were created by the iMMAP DRR program. Some flaws and limitations of the data are described in this document. However, a degree of error is inherent in all datasets, especially modelled maps and maps of dynamic events such as floods. Accordingly, the information is distributed "AS-IS" without warranties of any kind, either express or implied. iMMAP shall not accept any liability or warranties for damages incurring from the use of this data, including but not limited to warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the data to define the limits or jurisdiction of any federal, state, or local government. The map is intended for use only at the published scale.

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1.4 Citing and Reference

When using the data/maps or referring to it, the Afghanistan Spatial Data Center should be referred to as following:

> ASDC iMMAP (2016). *Afghanistan Spatial Data Center. iMMAP 1300 Pennsylvania Avenue NW Suite 470 Washington, DC 20004 USA.*

When using a particular data source(s), use the source reference of each one source, see data layers or Annex B for more information. E.g.

> Mohadjer, S., Strube, T., Ehlers, T.A., Bendick, R., (2015). *Central Asia Fault Database.*
>
> Emlyn Hagen, NC3A (2008). *Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.*
>
> Emlyn Hagen, iMMAP (2015). *Afghanistan average snow and ice cover Jan-Dec 2006-2015.*

2 Data Source and Accuracy

iMMAP strives to provide the most accurate and most up to date information, many of which originate from governmental or humanitarian sources. The information provided main goal is to assist with DRR related projects, and pools together very diverse data topics (e.g. settlement data, river data).

iMMAP is not the official authority for many of the data within this site, the data is only provided to assist/provide additional information to users where appropriate. Users are advised to verify/check any information with the relevant Government Department(s) and/or other source(s), and to obtain any appropriate professional advice before acting on the information provided.

Details on data sources can be found within the ASDC and in ANNEX B of this document.

2.1 Data Accuracy

iMMAP follows rigorous data accuracy standards. In addition, we structure and store data using industry best practices. The map and data file naming convention originates from UN OCHA.

Our raw data sets originate from a variety of sources, including in-house data digitisation and creation of derived data products. iMMAP as one of the leading information Management agencies in Afghanistan, is in contact with relevant governmental authorities and most leading humanitarian organisations. Through our extensive network iMMAP has knowledge and access to the many optimal datasets, often helping organisations to capture, clean and perform quality control on their own datasets.

With this experience we are often able to provide the latest and most up to date information. This data is reviewed at regular intervals and often continuously updated or improved. This is done either internally by iMMAP or in conjunction with our humanitarian partners.

Methodologies for creating derived or analytical products are also reviewed at regular intervals. New innovations or alternative data sources are assessed if these will provide more accurate results.

This however does not imply that all data is accurate, the accuracy and deficits of each data set is documented with the respective data layer and/or in the documentation. Very frequently our data will have deficits, which must be taken into account when utilising the information.

However, we do not provide data which cannot be utilised, which is outdated or is simply inaccurate as a whole. It must be noted that there are a range of data sources available on the internet, including many global datasets, which is frequently outdated, incorrect and would not withstand our internal review process.

We strive to provide the latest and most accurate data, which with the help of our partners we will improve further over time.

2.2 Forecasting Information/Estimates General Disclaimer

The ASDC provides static data, which only alters when data is actively altered. In addition, there is dynamic data, which is updated automatically:

- Every hour the Flash Flood Risk is estimated valid for the next 6 hours
- Every 6 hours the river flood risk is estimated for the next 4 days
- Every day the snow cover is downloaded
- 4 times a day the snow depth is estimated
- Once a day the avalanche risk based on snow cover and depth is assessed
- Earthquake data is being monitored every 5 minutes
- Humanitarian access incident data is updated each working day

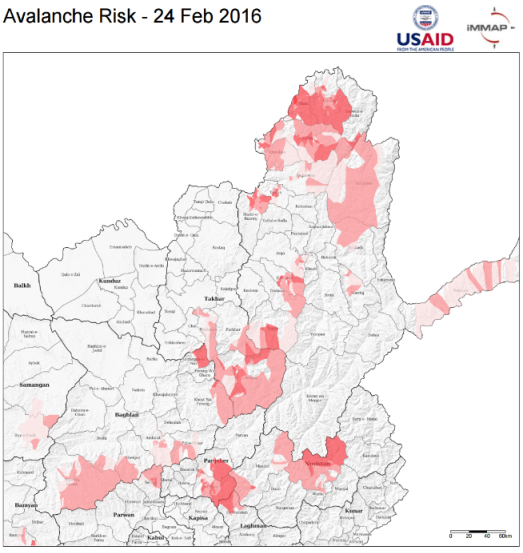
2.2.1 Forecasting

Flash floods, river floods, avalanche and snow cover data are affecting the operations of humanitarian and governmental agencies. Not only knowing which areas and how many people might be endangered by flood or avalanches, but also knowing when these might be affected helps prepare and warn the communities at risk.

iMMAP therefore captures and generates forecast data automatically multiple times per day. Flash floods forecast are updated hourly and have a validity of 6 hours. River flood forecast are updated 4 times per day daily and have a validity of 4 days. Avalanche risk is calculated once a day and gives an estimate on the current snow cover and associated avalanche risk.

These forecast models need further calibration and already segments have been identified which should be improved. However, at present to have already usable and realistic estimates in a fully automated system will be of great aid to government and the humanitarian community.

Figure 1 Avalanche risk forecast map and estimates on affected population



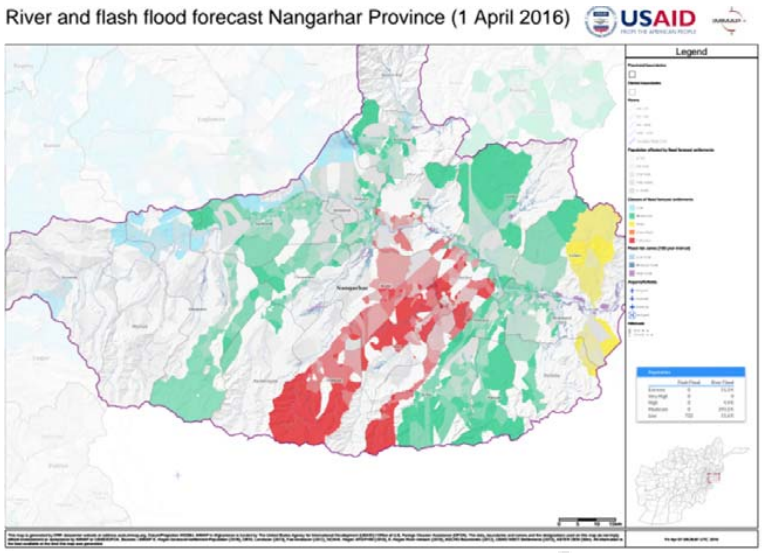
Flood Risk 24 Feb 2016

Population		
Total	Flash Flood	River Flood
10.5 K	0	10.5 K
Extreme	0	0
Very High	0	0
High	0	0
Moderate	0	0
Low	0	0
Very Low	0	10.5 K

Avalanche Risk 24 Feb 2016

Population	
Total	52 K
High	77
Moderate	11.2 K
Low	40.8 K

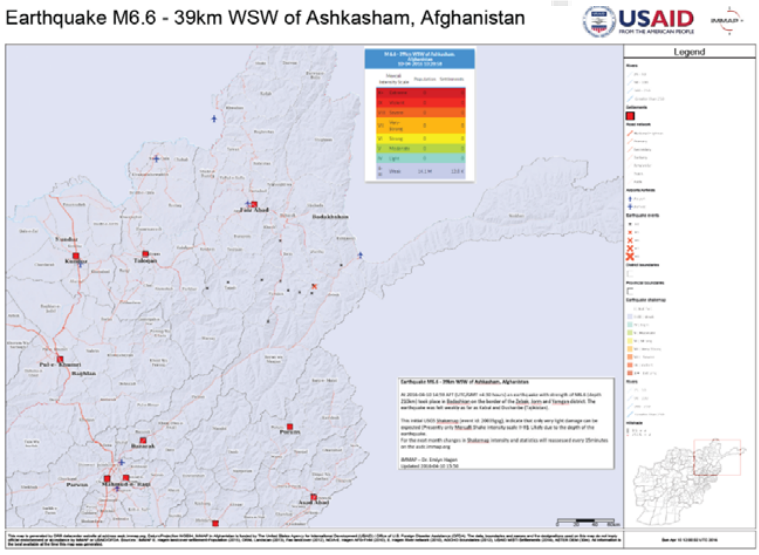
Figure 2 Flooding forecast disseminated to humanitarian and governmental agencies



2.2.2 Earthquakes

Every 5 minutes the ASDC checks for earthquake epicentre updates on USGS Earthquake centre, if a large earthquake occurs in or near Afghanistan a Shakemap will be downloaded when available (generally 30-60 minutes after the event). Changes in the USGS Shakemap are monitored every 15 minutes. The ASDC automatically uses the Shakemaps to calculate the impacted population. This data is generally available online approximately 1 – 1 ½ hours after the earthquake event. It can for example indicate the 100.000 persons in Badashkan province felt the earthquake at the intensity level IV. Larger shake intensity generally results in more damage.

Figure 3 Earthquake Intensity map semi-automatically produced 1 ½ hours after event



2.2.3 Limitations

The forecasting (flash floods, river floods, avalanches) and information on potential impact of earthquakes are based on simplified models. The information can assist in time of crisis to create an initial picture of the potential impact of an event, however these estimates can be widely over/under estimated. The information is only informative and not definite.

- Avalanche forecast data is based solely on
  - Snow presence and assessed snow depth (depth estimated snow water equivalent)
  - Avalanche areas (modelled by iMMAP)
  - Forecast avalanche risk is complicated and requires in field observation and measurements. This data is not available hence a very simplified forecast risk approach.
- Flash floods forecast is based solely on
  - Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats, within forecast watershed (from uncalibrated Flash Flood Guidance System)
  - Afghanistan Flood Hazard Map inundation extend (100-year interval)
  - iMMAP modelled population and land use estimates to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours.
  - Note: Flash floods can occur outside the indicated inundation extent
  - As the data is not calibrated there can be over/under estimations
  - Flash floods estimates are only valid for approximately 6 hours

- River floods forecast is based solely on
  - Global Flood Monitoring System (GFMS)
  - EU JRC Global Floods Awareness System (GLOFAS) from end-2016, early 2017
  - Afghanistan Flood Hazard Map inundation extend (100 year interval)
  - iMMAP modelled population and land use estimates to assess the potential number of persons or productive land area at risk of river flood for the next 4 days.
  - Note: As the data is not calibrated (yet) there can be over/under estimations
- Earthquakes assessment are based on
  - USGS Earthquake Program (latest and Shakemaps)
  - iMMAP modelled population and land use estimates to assess the potential number of persons
  - Note: Shakemaps indicate areas which have shook most at the surface, this is based on modelled information using only large regional fault lines.
    - Generally, more shaking at the surface has the potential to create more damage, however construction methods and soil conditions differ from region to region
    - Minor fault lines have been integrated on the ASDC, yet these are not utilised in the shake map estimates

3 Population data

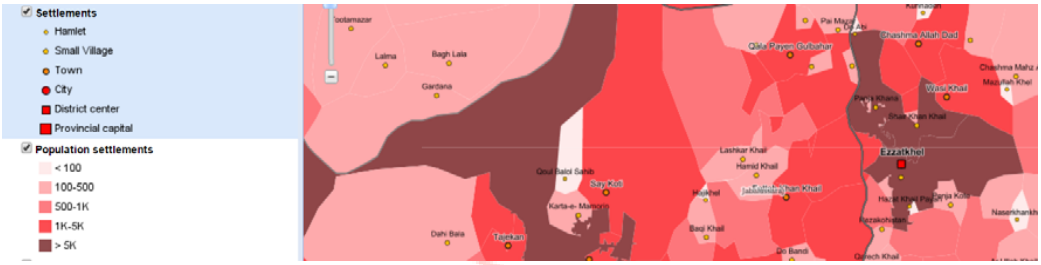
For the DRR program to be effective it required to have beneficiary details at the DRR project implementation level of the partners, which allows to appropriately allocate resources and prioritization of their program of work. For natural disaster risk assessments in Afghanistan this generally starts at the settlement and land use level to enable comparison between areas.

For this purpose, the DRR program has generated the “land cover-settlement-population” dataset, which enables risk analysis at unprecedented levels of accuracy in Afghanistan. This dataset was already utilized to get preliminary results on flood risk and has revised the previous estimation of 16 million persons living in potential flood hazard areas to 7.73 million persons. This base dataset will likely be one of the main DRR assessment tools for the coming years, however it will be updated at regular intervals.

Population data is utilised in forecast and risk assessments, yet can also be called in the “population” and “population density” interactive maps, as separate layers.

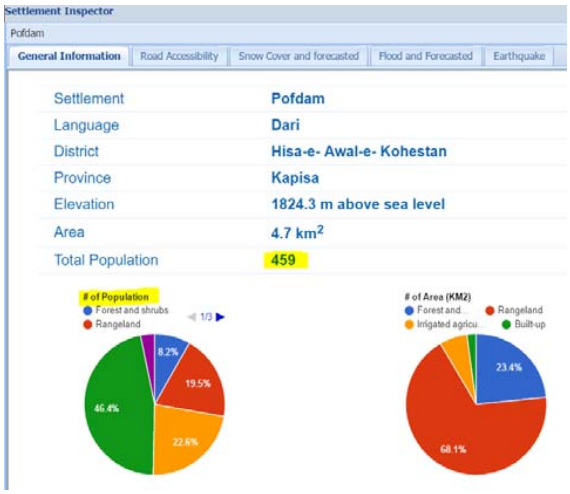
Note: These population/village boundaries are modelled boundaries have no relationship with the actual administrative boundaries or how the local population perceive the boundaries.

Figure 4 Total population estimates at settlement level



In the settlement inspector the total population of a specific settlement can be seen, as well as the population breakdown per land use category.

Figure 5 Population estimate in Settlement inspector and area breakdown



This information is also available within the statistics and dashboard tool for either entire Afghanistan, a province, district or custom drawn area.

Figure 6 Population estimate for area of interest in Statistics Tool

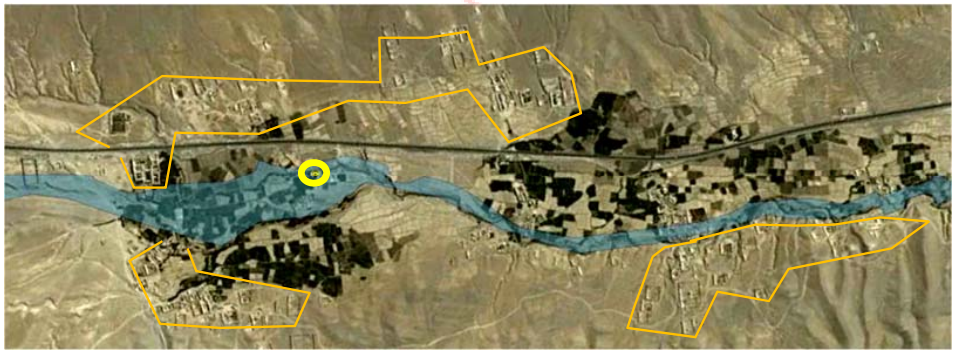
Population	
Total	218.1 K
Barren Land	1
Built-up	110.9 K
Fruit trees	5.5 K
Irrigated Agg land	92 K
Permanent Snow	0
Rainfeld Agg land	215
Rangeland	9.1 K
Sand cover	0
Vineyards	273
Water body and marshland	16
Forest and shrubs	153

3.1 Technical background on the "land cover-settlement-population" dataset

In Afghanistan not only are settlement coordinates unreliable many of the settlements are fragmented into smaller compounds. The present settlements data set (MISTI) for example places 5% of all settlements within the riverbed (overestimation). However, many more settlements will be located at a safe distance from flood/avalanche areas zones, yet their actual build-up area might be in danger (underestimation).

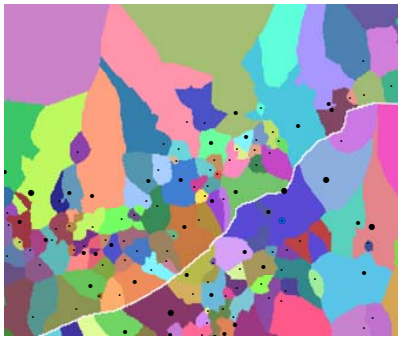
Below it is visualized that the village coordinates are located exactly in the center of the river (yellow circle), which would imply it is at flood risk (blue area). However, in the satellite imagery it is clear that the build-up areas (orange outline) are presumed safe from flooding.

Figure 7: Inaccurate village coordinates



To overcome the problem described the DRR program developed a methodology that utilizes FAO Landuse Data (50K Land cover data), ORNL LandScan Data (Population coverage at 1km resolution), river data (Emlyn Hagen, 2009) and the USAID developed MISTI settlement database.

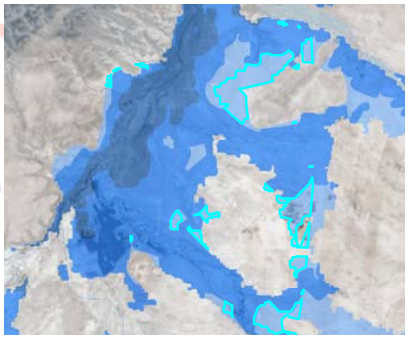
Figure 8: Settlement area allocation



With all the data needed processed, it results in a combined land cover-settlement-population dataset, in which each land cover area is allocated to a specific settlement and in which each land cover type is assigned the population broken down at settlement level. In the next figure each color represents an area of influence of a specific village. The area size is defined by the population count of the MISTI database and the number and size of build-up areas within the initial allocation (FAO). The final population attributed to a settlement originates from an allocation of LandScan data to the larger village area, which is then subsequently distributed at the land cover level based on nationwide estimates.

The land cover-settlement-population dataset can give population estimates for a specific area. The zones highlighted in bright cyan outline in flood affected areas are irrigated agricultural areas of one village. It is estimated that 25 persons are at risk of flooding in this outlined area.

Figure 9: Agricultural areas at risk of flooding



This data available at settlement level, was subsequently summarized at district, provincial, nationwide level and at landcover level

3.2 Accuracy of population estimates

The population numbers are modelled and can at times be highly inaccurate. This is due to often incorrect or missing settlement locations. Whereas for a single village the population numbers can be inaccurate, as soon as one combines the estimates of several settlements together the projections become much more accurate. Even if surveys are done on the ground of the population, these might differ from these estimates. The ASDC will also include neighbouring buildup areas for which no village coordinates existet. These will naturally not be included in a ground survey. E.g. A survey of a village with 500 persons, can in our model have 800 persons if 1 km further another settlement is located without village.

Early 2017 the population estimates will be remodelled using a new methodology.

3.3 Methodology in-depth

The current documentation is a draft version. As additionally data will become available, a new methodology will be employed early 2017. This text will be replaced at that stage.

3.3.1 Problem Statement

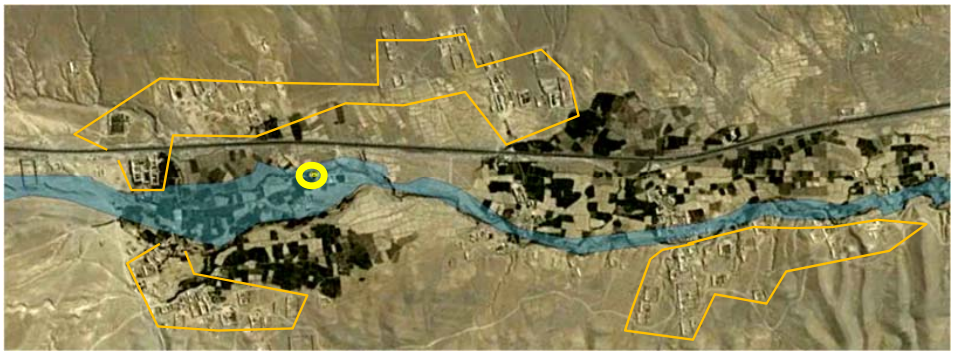
At present we have no indication of build-up areas and population data, and neither is there reliable data on the population and livelihoods of agricultural areas.

Such data at village level would allow to more accurately predict, utilising hazard overlays (e.g. Floods), the population or livelihoods at risk of specific natural disaster.

For example, in the below image the village is positioned are in the middle of the river, and would be clearly at risk of flooding. From 45017 villages more than 2500 are located in the river.

Yet as the build-up areas of the village are situated on both banks of the river, there is in reality no flood risk (the agricultural lands are at risk though).

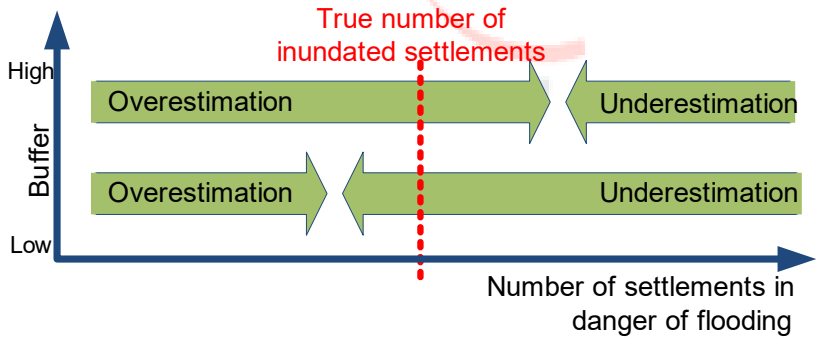
Figure 10: Centre point coordinates of settlement located in inundation area



Note: The yellow dot indicates the coordinates of the settlement. The houses and compounds can be seen stretched along both sides of the river inside the orange polygons

Until such data is available, we can only assess if a specific village is within a hazard area or not. Yet as the positional data of the villages are highly inaccurate the risk is either overestimated or underestimated, even when using buffering techniques.

Figure 11: Estimation of the number of settlements in danger of flooding



3.3.2 Solution

Generate a compound settlement and agricultural area data set which gives settlement and population identification to both build up areas and agricultural areas. Due to the quality of the data some generalisations will have to be made, yet it will generate a product which is much more accurate than any previously performed assessment.

3.3.3 Input Data

The main data requirements to generate settlement compound datasets are:

- Settlement and population data
- Land use: Build-up and agricultural

- Drainage/Rivers

Further datasets could be utilised to refine the outcome, e.g. mountain ridges, yet that would be beyond the scope.

3.3.3.1 Settlement data and population data

The most accurate settlement data presently available is the MISTI data set (Measuring Impact of Stabilization Initiatives (MISTI) Project of 2014). The positional accuracy is better than those provided in the AGCHO village dataset, and it includes population estimates for most villages.

Scale: unknown

Another dataset is the LandScan 2013 dataset, which is provided by Oak Ridge National Laboratory. This dataset is a global raster dataset with a resolution of 1km, however the methodology used to generate the dataset is very accurate. To be able to utilise this data, due to the resolution, compound villages must be generated before from the MISTI Database.

3.3.3.2 Land cover

Land cover data of Afghanistan is available from the 2012 FAO: Aggregated Land Cover Database of the Islamic Republic of Afghanistan (2010). Scale: 1: 50 000

3.3.3.3 Drainage/Rivers

Were provided by the 2010 drainage channel dataset (Emlyn Hagen): Scale of 1:50 000.

3.3.4 Methodology

3.3.4.1 Initial Population adjustment

Some settlements do not contain population estimates, these could be extracted if nearby build-up areas are present which are too far away to be associated to other villages.

The MISTI database contains a population count of 25.153.075 million persons, and the build-up areas amount for 3212 km2. This results in a 127 m2 per person build up area. This number could be further refined, when we consider a higher population density in urban areas than in rural – yet that would be beyond the scope.

- In total there are 7275 villages without population numbers. Of these are 3613 villages which both do not have population and any build up areas nearby. This can result of multiple reasons, likely 3 are:
    - only exist out of a few individual house, not captured in the landuse classification
    - the villages coordinates were recorded incorrectly
    - The village simply does not exit
- There are 3662 villages which do not have population, yet do have nearby build up areas. Some of these areas are major cities, which we have to exclude (as the settlement name will merely indicate a sub-city area). When we exclude all large segments there is still 141 km2 build up area. Amounting to a projected population of 1.116.313 which was calculated. Whereas these numbers are likely to be too small (mainly due to exclusion of sizable areas), they will help generate a better picture of the population in remote areas.
- There are 83 Villages in the MISTI database with identical coordinates, though with different names and population attributes. The population of these is 98000 persons,

but is likely to be only around 50000 as these likely duplicate names/the same place. No action taken

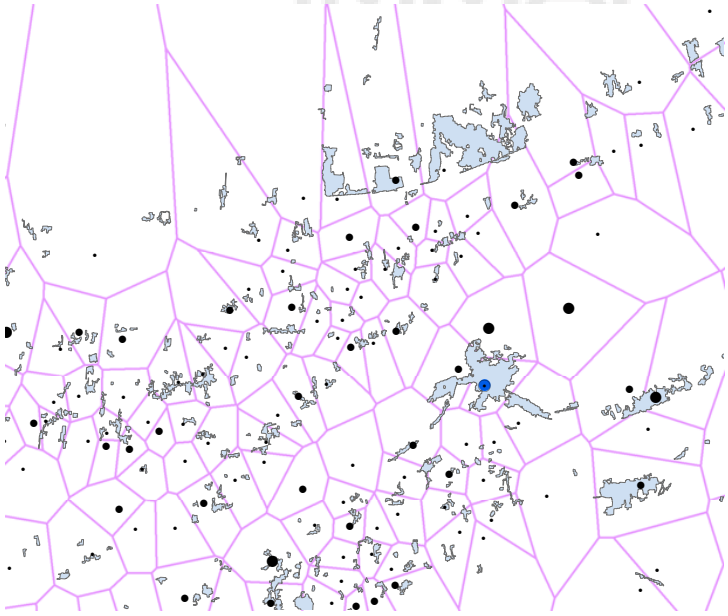
- The MISTI database was updated with population counts for AGCHO, where the MISTI database indicated a value of 0 and the AGCHO did contain population numbers. This was only done within the same area of interest there was a AGCHO (using a non weighted Voronoi grouping) and MISTI, and subsequent QC on populous cities did indicate that the population was not 0. The total population accounted is 175000 persons

- The total population of the Settlements has increased from 25.153.075 to 26.267.672. The original population assessment was based on data from 2013 whereas presently the UN Population Division estimates that Afghanistan has around 30 million persons, therefore it difficult with such large fluxuation to hold much value on the actual number. However, the increase of population in areas where there is clearly build up area is appropriate from an analysis perspective.

3.3.4.2 Compound Settlement creation

As there is presently no weighted Voronoi Polygone creation tool for ArcGIS, and the standard method results in every compound settlement boundary being at an equidistant location of its centre point. Which does not take into consideration the population size, and thus making it difficult assigning a specific build-up area to a specific settlement.

Figure 12: Standard Voronoi Diagram (pink lines) with Settlements by population size (black dots)



Therefor a custom methodology was utilised, with the added benefit of being able to utilise barriers.

The main following steps were executed:

Figure 13: Natural Neighbours Interpolation based on the Population size.

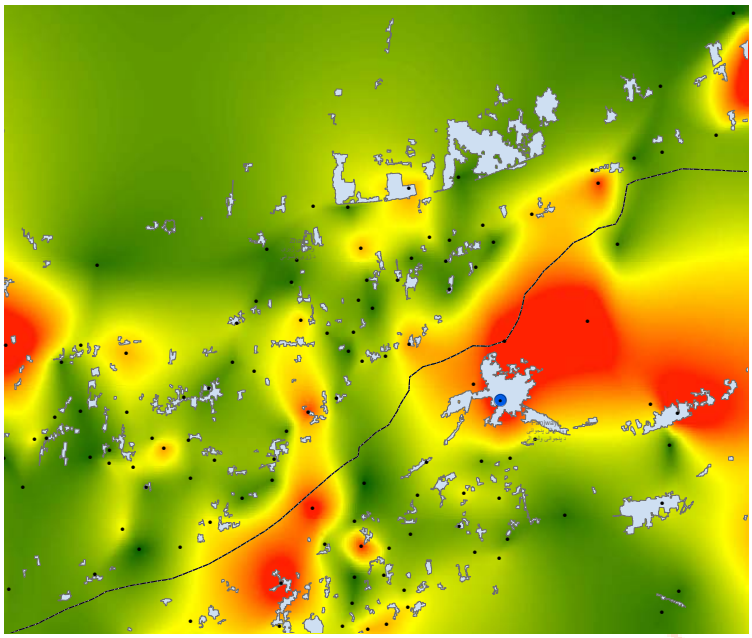
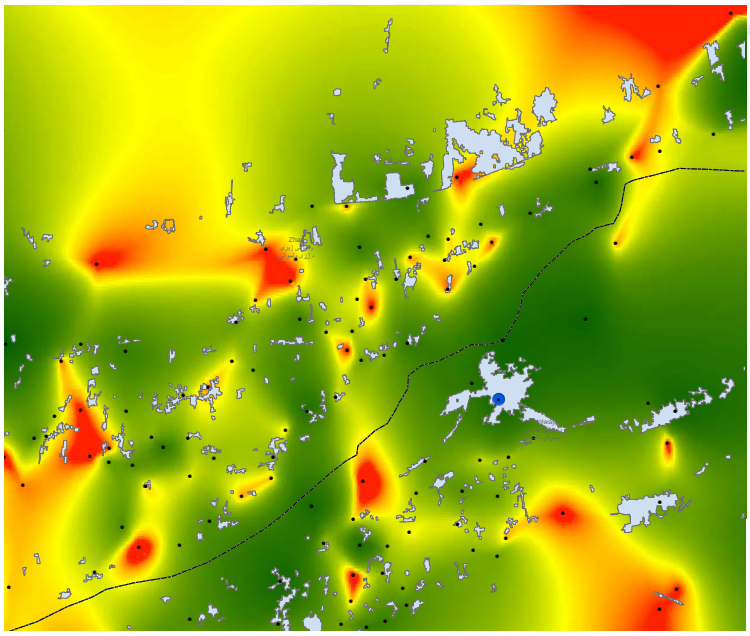
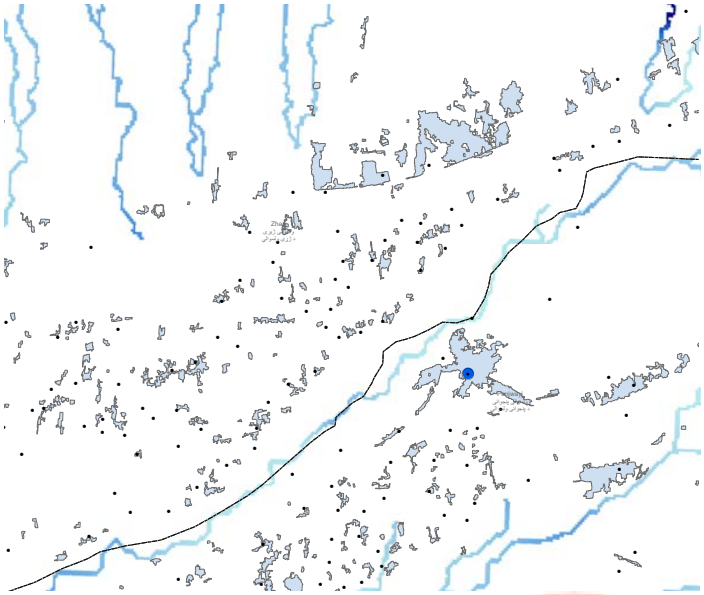


*Figure 14: Cost Raster: (1/(Popnat+1))*1000.*



To generate a cost raster based on the highest cost for small population, but adding 1 person to each unit to avoid no data areas.

Figure 15: River river barriers



Generate a cost based raster to account for rivers, villages have a tendency to have their AOI on one side of the river. This is not an barrier, simply a soft boundary.

Generate a barrier for district boundaries. Settlements will only be allocated buildup areas within their own district.

Figure 16: Final cost raster combining inverted settlement cost, river and boundaries

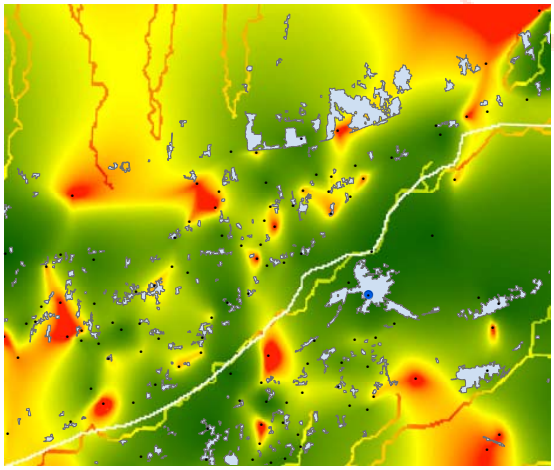
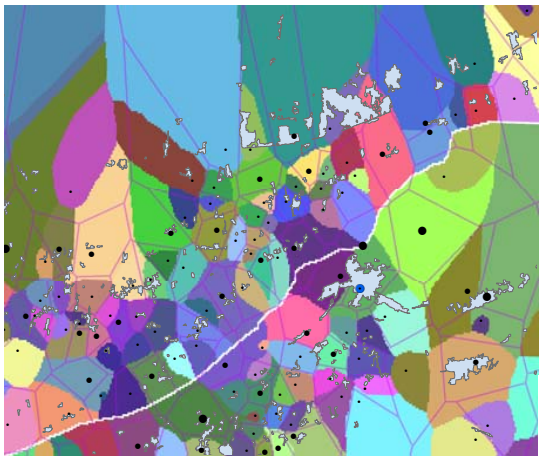


Figure 17: Final allocation using the settlement data and the final surface costs data



The data quality of the Misti settlement data generates the following issues as is evident in the above sample:

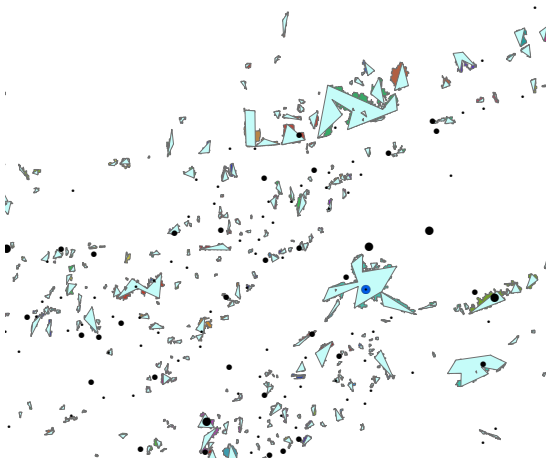
- Very large build-up areas can still be assigned to small villages, when there is no larger settlement nearby
- Settlements with very large population data can acquire build-up areas from settlements with almost no population, although it is clear that these form a compound
- Some of the compound areas take odd shapes when district barriers are nearby.

None of the fallacies of the compound data set can be solved without any more accurate data. However, it is important to note, that in agricultural areas a large population may be assigned to a region yet there will not be a settlement centre/buildup area. Thus it is important to assign population and livelihoods to agricultural areas as well

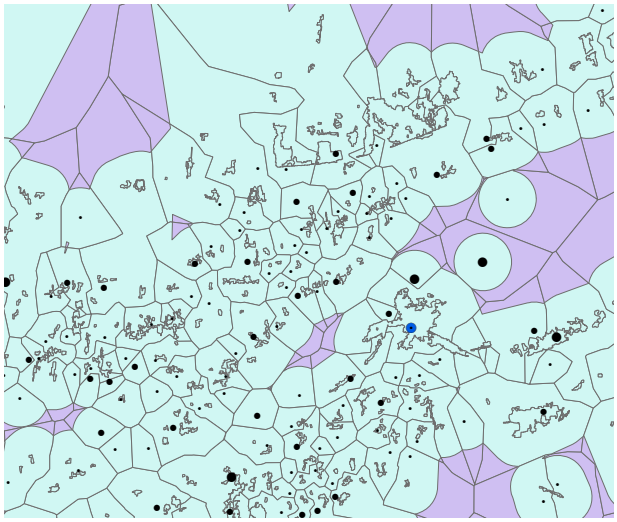
3.3.4.3 Agricultural areas village designation

To assign a specific agricultural area to a specific village the results of the settlement compound data sets will be utilised, in combination with the settlement data.

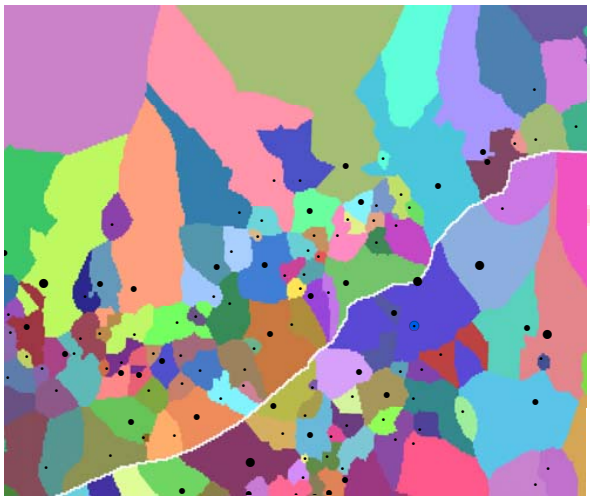
1) Simplify Build up areas



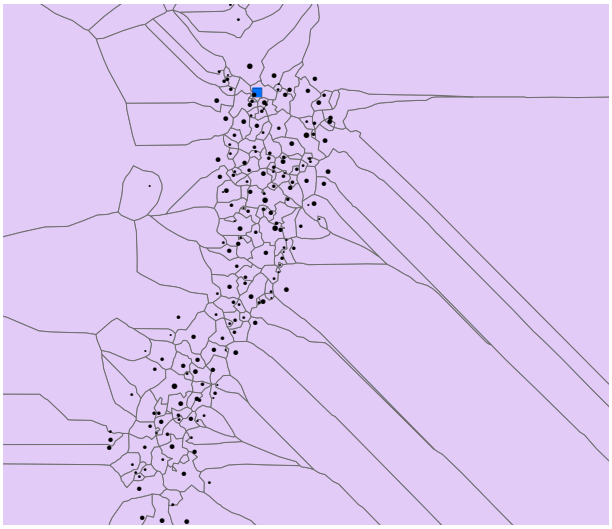
2) Convert polygon vertices to points and merge these with the settlement points



3) We will have to utilise a barrier Cost allocation approach using the district boundaries as to avoid assigning agricultural areas cross district boundary, for this purpose we use the previous cost surface but include the urban areas vertices points as well.



3) Convert the Raster to Polygon, yet due to the no data elements of the district boundary these must be cleaned up using Integrate with 50m distance. Subsequently the dataset has to be cleaned for irregularities.



Although the compound boundaries are acceptable near other villages, there is not outward limit. Thus giving way to regular shaped funnels.

4) To Limit the distance of the population distribution there will be two factors:
    a. Buffers around the build up areas and village centres: 500, 1000 and 2000m.
    b. Only populated/productive land use will be considered, e.g. Agricultural lands but not barren land.
5) Buffers:

Here it is clear with the buffers visible that there are build-up areas (buffers without village point) which do not have any near villages. These will automatically be assigned to the nearest village.

6) Utilising only the Urban Areas with the LandScan 2013 dataset we can extract 8.2 million persons living in the urban areas. This is clearly not adequate. Therefore a methodology needs to be developed to capture accurate details.

The landscan data consist out of 69 categories, yet there are only 11 main types. The others are set together out of a combination of 60/40 percent of one of the main types. For entire

Afghanistan, we can a) extract for each landuse category the total area amount. And using Zonal statistics we can extract the total population living in each of these categories. These totals can subsequently be converted into percentages. See table below. For very large areas these numbers can be relied on, however for very small segmented areas such as water the results will be skewed due to the resolution of the LandScan source data, therefor some elements have been adjusted. Reduction for Water and Barren Land (both influenced by vicinity to large urban areas and relative small coverage), vineyards/fruit trees had to be increased as these were also to fragmented in agricultural areas.

By adjusting these numbers we can calculate the correct percentage categories for the 58 sub categories, using the 60/40 key..

Main Code	Type	Percentage of Population in landcover types	Adjustment
AGI	Irrigated agricultural land	0.31630	0.30911
AGR	Rainfed agricultural land	0.06687	0.06535
AGT	Fruit trees	0.01557	0.04886
AGV	Vineyards	0.01677	0.04886
BRS	Barren land	0.02911	0.00782
BSD	BSD: Sand cover 8B, 8C	0.00183	0.00179
NFS	Forest and shrubs	0.01359	0.01328
NHS	Rangeland	0.22387	0.21878
SNW	Permanent snow	0.00037	0.00036
URB	Built-up	0.28443	0.27797
WAT	Water body and marshland	0.03130	0.00782

All the above tables can be combined with the Aggricultural Areas which have a village ID assigned to them. Using Excel PivotTables, we can:

- Extract for each VillageUID the total Area
    - To be able to calculate the percentage of landcover for each AGGCODE
- For each AGGCODE in a VillageUID the total area
    - To be able to calculate the percentage of landcover for each AGGCODE
- The Total amount of unique AGGCODE in a VillageUID
    - To be able to calculate the population distribution in each AGGCODE
    - E.g. Some areas might have Water, Agricultural and Build up areas, whereas other areas might only have barren land
- The count of individual AGGCODES in an area
    - There will be multiple indentical AGGCODES to a VillageUID, yet these cannot be counted twice in the population distribution as it will skew the result
    - E.g. if there are 3 unique AGGCODE classes we can calculate the population distribution (water, build up, forest), yet if there are 5 AGGCODES in total (3 water, 1 build up, 1 forest) the water area will get a higher percentage of the population

Formula to Calculate Population:

- VUID_Area = VillageUniqueIdentifier Area: Extracted from DistanceAllocation Described Before (m2)

- VUID_Pop = VillageUniqueIdentifier_Population: Extracted by overlaying LandScan2013 and VUID_Area (Pop count)
- AGGClass_Pop = Aggcicultural_Class_Population: Extracted from Overlaying FAO Landcover data with LandScan2013 Data (Pop count)
- VUID_AGGC_Area: VillageUniqueIdentifier Agricultural Classes Area: Extracted by Overlaying VUID_Area and the FAO Landcover data.

Count: Count of Unique featues

$$VUID_{Pop} * \left(\frac{\left(\frac{\left(\frac{AGGClass_{pop}}{Total_{Pop}} \right)}{VUID\_AGGC\_Area_{Count}} \right)}{Total_{AGGCYpes_{VUID}}} \right) \Big/ \left(\frac{VUID\_AGGC\_Area}{VUID\_Area} \right)$$

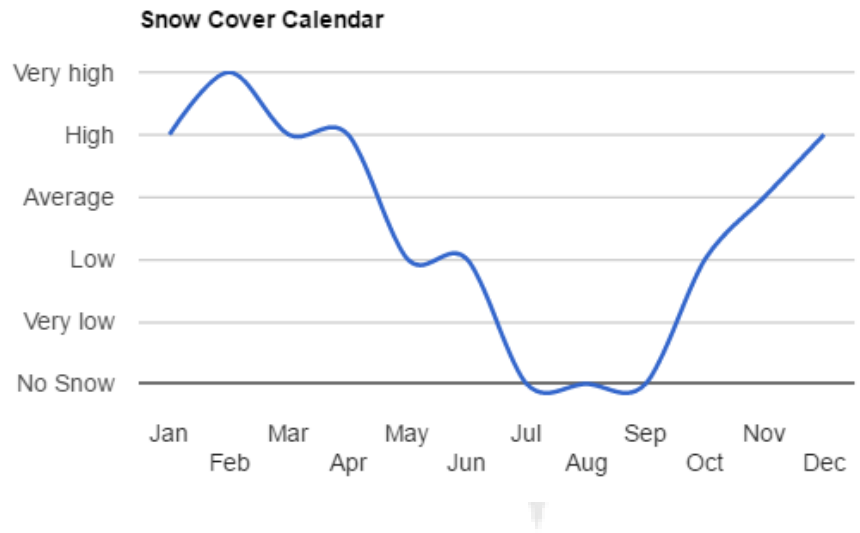
Note: The methodology as described above has been altered and corrected.

4 Snow Coverage

4.1 Snow Calendar

Average snow and ice cover for Afghanistan is estimated from February 2006 until October 2015. The data was aggregated from more than 3500 daily 4km resolution observations grouped by month. The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS). It is derived from a variety of data products including satellite imagery and in situ data. The data is represented in 5 classes, minimum and maximum coverage extent observed between 2006 and 2015. The monthly average, and high and low average coverage extent observed. Source: National Ice Center. 2008, updated daily. IMS Daily Northern Hemisphere Snow and Ice Analysis at 4 km Resolution

Figure 18: Snow calendar in Settlement inspector



4.2 Snow Coverage Average Extent

The data depicts the maximum extend of each of the snow coverage classes over the year. The data is represented in 5 classes, minimum and maximum coverage extent observed between 2006 and 2015. The monthly average, and high and low average coverage extent observed. Average snow and ice cover for Afghanistan is estimated from February 2006 until October 2015. The data was aggregated from more than 3500 daily 4km resolution observations grouped by month. The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS). It is derived from a variety of data products including satellite imagery and in situ data. Source: National Ice Center. 2008, updated daily. IMS Daily Northern Hemisphere Snow and Ice Analysis at 4 km Resolution

Figure 19: Average snow cover in interactive map

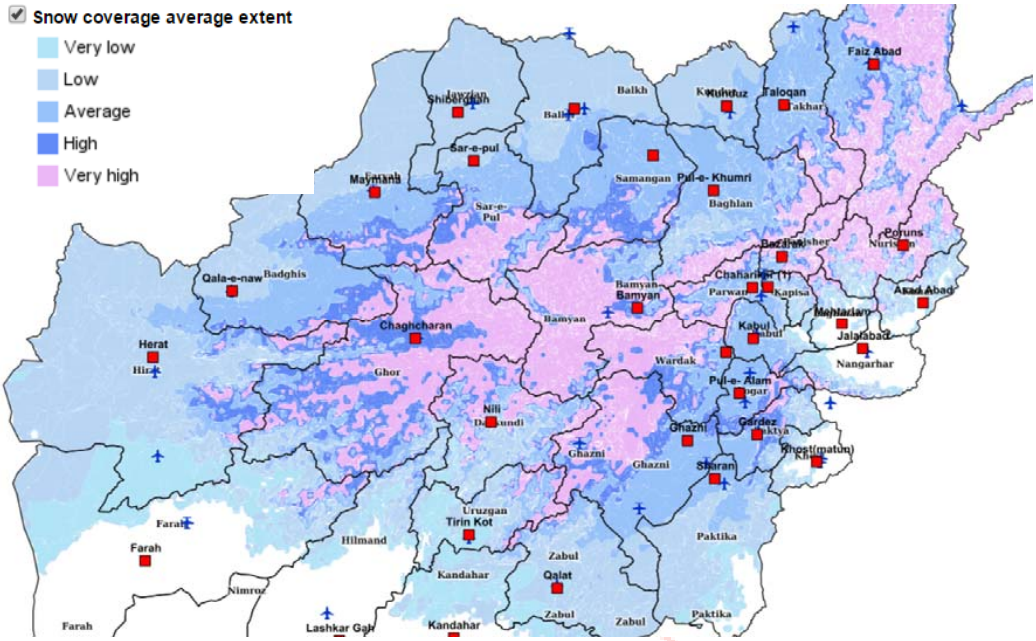
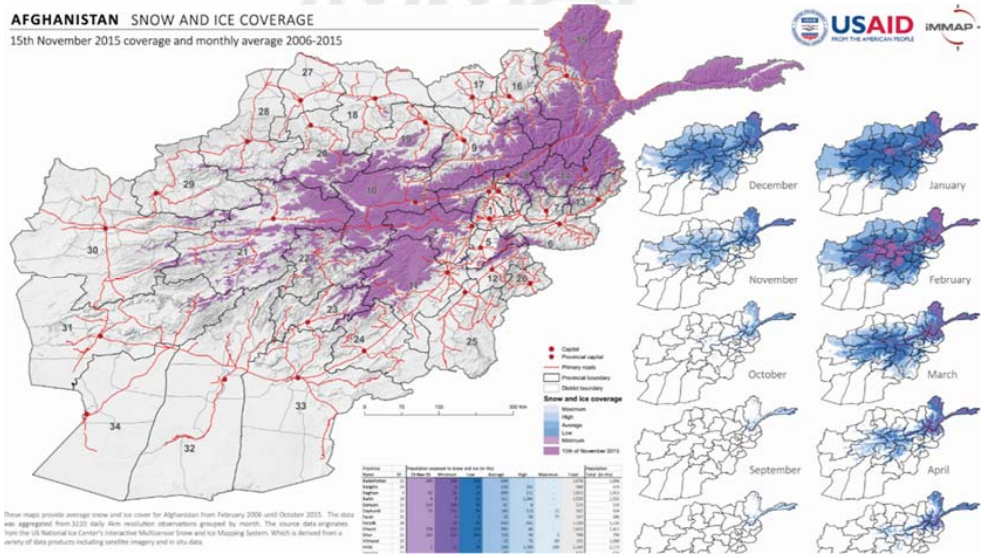


Figure 20: Snow and ice coverage map, data to be utilised for winterisation and avalanche forecasting



4.3 Current Snow Cover

The current snow coverage extent is updated daily, and is extracted from a 1km resolution “Snow and ice cover”. The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS) at 1km resolution. The snow coverage gives no approximation on depth by itself. It can range from a few mm of snow and ice to multiple meters of snow

Figure 21: Snow coverage and depth in interactive map and settlement inspector

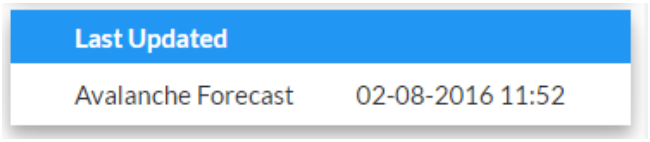
4.4 Current Snow Depth

The snow depth is based on the Snow Water Equivalent (SWE), which gives how much water a snow pack would contain in melted form (in mm depth). The depth is approximated from the snow compactness ratio, with a minimum of 1/10 (fluffy snow) to 1/2 for very dense/compact snow (heavy/wet snow). The Snow Water Equivalent (SWE) is extracted from the SNOW-17 snow accumulation and ablation model, aggregated at the Flash Flood Guidance System Basis level. Snow-17 was first described by Anderson (1973) as a component of the National Weather Service River Forecast System (NWSRFS)

4.5 Current Snow Cover and Depth Status

The Snow coverage and depth is updated on a daily basis. The status of when it was last updated can be found in the Statistics Avalanche Forecast overview under. This should in general be less than 24 hours before of the current date/time, should this not be the case: Kindly contact the administrator.

Figure 22: Snow coverage and depth status



5 Avalanches

5.1 Avalanche Risk Areas

5.1.1 Background

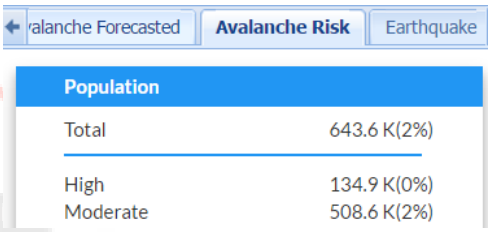
For Afghanistan no detailed avalanche maps were available. The DRR Program has, using established methodologies, calculated avalanche trigger areas. A further simplified avalanche runout model was generated to assess how far the avalanches can travel and which areas and population are at risk of avalanches.

5.1.2 Functionality

Using the avalanche locations, it is possible to identify areas, population and infrastructure at risk of avalanches. At one hand the avalanche areas can be simply mapped and overlaid, which is practical for detailed planning purposes. At the other hand using the Statistics tool it be assessed how much area or population is at risk of avalanches, e.g. within a valley, district or province. This information can be used to prioritise mitigation measures.

Figure 23: Avalanche trigger and runout areas modelled by iMMAP in Google Earth

Figure 24: Avalanche static risk estimates



5.1.3 Methodology

iMMAP has modelled 340.000 avalanche areas for entire Afghanistan. The modelling process was conducted in two major components, at one hand the identification of the avalanche trigger areas, and at the other hand modelling the avalanche chute and run-out areas. The iMMAP data is modelled, and utilises as a main input dataset 30m resolution ASTER DEM.

- The avalanche areas were only computed for areas which had snow cover of the past 9 years.
- The trigger areas were calculated using established methodologies, employed in Norway, Slovakia, Czech and Switzerland. Notable methodologies employed came from Marek Biskupič and Ivan Barka, which was used in Slovakia (Spatial modelling of snow avalanche run-outs using GIS, 2010).

Figure 25: Avalanche trigger area methodology schema

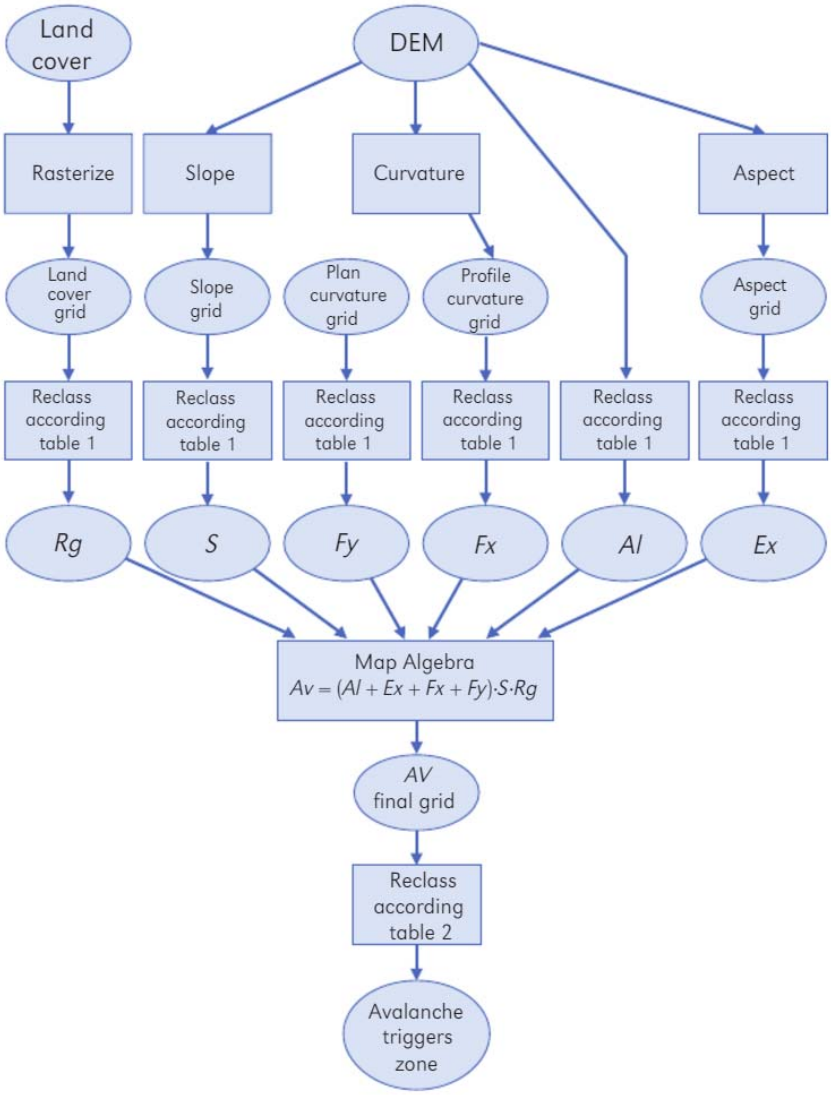
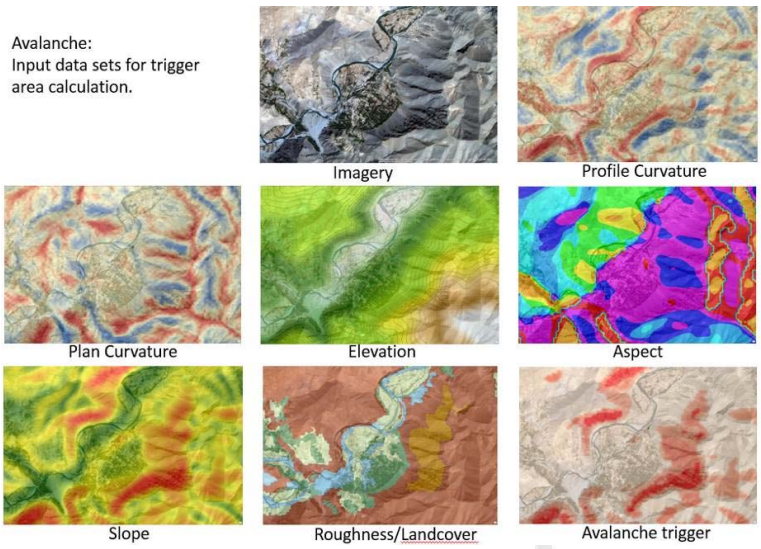


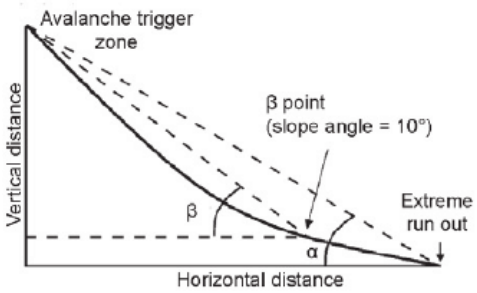
Figure by Martin Boltižiar, Marek Biskupič, Ivan Barka. Spatial Modelling of Avalanches by Application of GIS on selected slopes of the Western Tatras Mts and Beliankse Tatra Mts. Others see below.

Figure: 26 Avalanche trigger area methodology



- The run out zones, were calculated using simplified spatial modelling techniques developed by Emlyn Hagen.
    - These are based upon downward movements (no avalanche can move uphill)
    - with a maximum 35° degree angle from the current flow path
    - a flow to maximum 10° degree slope angle

Figure 27: Avalanche trigger and run out areas



    - extended with 60 meters additional run-out path.
    - There are other more accurate methodologies based upon hydrological modelling, yet these would not have been computationally possible within the short time period available.

- Hreško, J. 1998. Avalanche hazard of the high mountain landscape in Tatras territory (in Slovak) Folia Geographica 2, Prešov, p. 348 – 352
- Lied, K., Bakkehoi, S., 1980. Empirical calculation of snow-avalanche run-out distancebased on topographic parameters. Journal of Glaciology 26 (94), 165–177

- Furdada, G., Vilaplana, J.M., 1998. Statistical predication of maximum avalanche run-out distances from topographic data in the western Catalan Pyrenees (northeast Spain). Annals of Glaciology 26, 285–288
- Toppe, R., 1987. Terrain models: a tool for natural hazard mapping. In: Salm, B., Gubler, H. (Eds.), Avalanche Formation, Movements and Effects (Proceedings of the Davos Symposium, September 1986). International Association of Hydrological Sciences (IAHS), Wallingford, UK, pp. 629–638.

5.1.4 Limitations

The avalanche run out areas cut often too deep into the populated areas. It was a conscious decision based upon the available digital elevation model to have a runout area of 60m. In reality many of actually avalanches will not progress this far from the slope. It is also noticed that many wide but short avalanche areas were modelled, having only little potential damage effect aside from blocking a road. These should be in the future filtered, as these overestimate houses at risk.

5.2 Avalanche Forecast

The avalanche forecast risk is based on solely on the Current Snow Coverage and Depth extent and the presence of avalanche areas. This is a very rudimentary risk forecast as there are no accurate/sufficient ground observation stations available. With proper observations the stability condition of the snowpack, can be assessed.

The avalanche risk is based on the following categories of snow water equivalent (SWE):

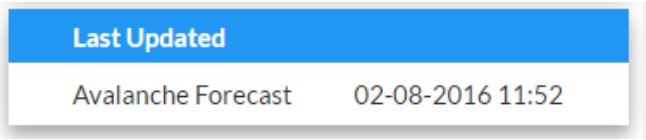
- Low: SWE > 60 and <= 100 mm
- Moderate: SWE > 100 and <= 140 mm
- High: SWE > 140 mm

Figure 28: Avalanche forecast in Statistics tool

5.3 Avalanche Risk Forecast Status

The avalanche risk is estimated on a daily basis. The status of when it was last updated can be found in the Statistics Avalanche Forecast overview under. This should in general be less than 24 hours before of the current date/time, should this not be the case: Kindly contact the administrator.

Figure 29: Avalanche Status in Statistics tool



6 Flood Risk

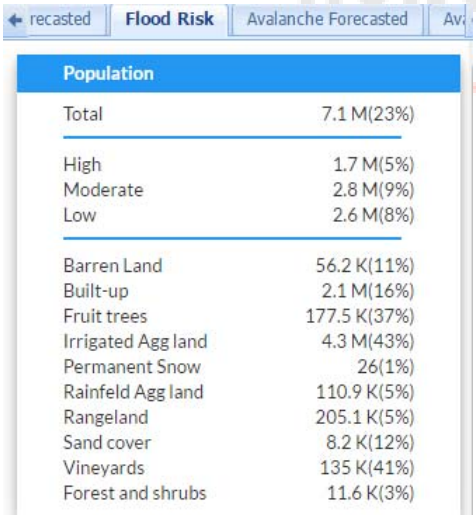
6.1 Static Flood Risk

Static Flood Risk relates to both River and Flash Floods and is based on the "NATO C3 Agency, Emlyn Hagen (2009) Afghanistan Flood Hazard Map" (AFG-FHM) inundation outline. The AFG-FHM is categorised in high, moderate and low flood risk. These categories are based on potential flood depth at a 100-year inundation event. Low flood risk relates to inundation more than 29cm, moderate to 1.21m and high flood risk more than 2.7m. The 100-year inundation interval. Implies that every year there is a 1% chance of such a flood event occurring. Though most events will naturally be 5,10, 20-year inundation interval. These events will not be as deep. For additional information see documentation of the AFG-FHM.

Figure 30: Static flood risk estimates in interactive maps

Flash flooding can also occur in areas not modelled in the AFG-FHM. Unfortunately at present this data is not available hence, estimates also for flash flooding are limited to river inundation areas.

Figure 31: Static flood risk estimates in Statistics tool



6.2 Land Cover and Flood Risk

The Land Cover Atlas of Afghanistan (2012) has 11 different land use classes. For each of these there is a different flood risk, both in the type of area covered as in the population density. For example, the inundation of Agricultural areas will put at risk both the population who live there as well as the livelihoods depended on the agricultural produce. Barren land on the other hand will have a low

population density and little impact on livelihood. Note that Waterbody and Marshland, are by default largely at flood risk. However, in the Nimroz and Farah province there is population who live in these regularly inundated areas, yet are not necessarily flood areas.

Figure 32: Land cover and flood risk estimates in interactive map

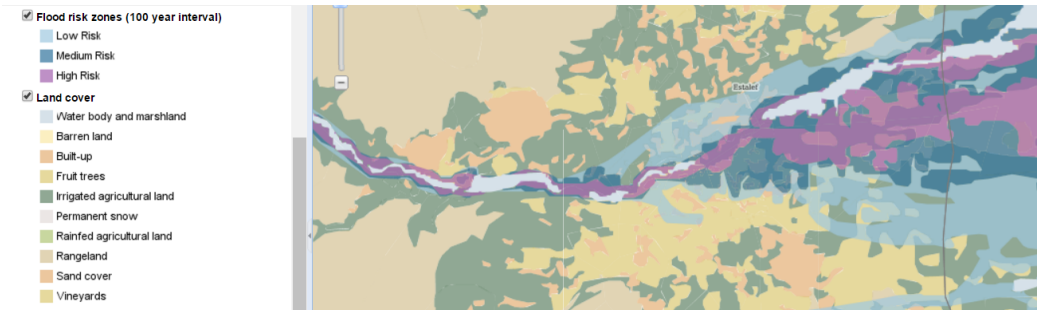


Figure 33: Land cover and flood risk estimates in Statistics tool

Area (KM2)	
Total	75.2 K(12%)
High	13.2 K(2%)
Moderate	33.5 K(5%)
Low	28.5 K(4%)
Barren Land	33.9 K(20%)
Built-up	815.4(27%)
Fruit trees	473.5(41%)
Irrigated Agg land	17.1 K(48%)
Permanent Snow	45.5(20%)
Rainfeld Agg land	2.4 K(1%)
Rangeland	14.1 K(5%)
Sand cover	5.4 K(10%)
Vineyards	409.8(43%)
Forest and shrubs	528.2(3%)

6.3 Settlements and mitigated areas

Flood risk is also assessed for the number of settlements, however only when a build-up area of a settlement is within flood risk area it will be assessed as such. Thus when a village has agricultural areas and build-up areas, it will not be assessed if only the agricultural area is within a flood risk zone.

Figure 34: Flood mitigation in Statistics tool

Settlements	
Total	14,765

Mitigated Population	
Total	1.5 M
High	592.5 K
Moderate	520.8 K

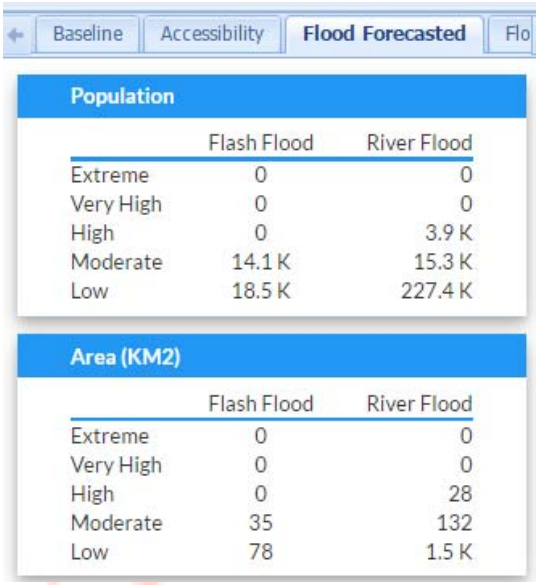
Mitigated areas are also included within the ASDC. If an area, which is designated as flood risk, is subsequently assessed as either mitigated or not at flood risk, it will be subtracted from the overall population at risk. This mitigated population will however be listed at the bottom of the statistics tool.

6.4 Flood Forecasts

6.4.1 Flash Flood Forecast

Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. In addition, FFGS also provides a good source for additional meteorological, soil moisture observations and snow water equivalent data. Some are used in combination with the iMMAP developed Avalanche Risk Map to rudimentary forecast avalanche risks in Afghanistan.

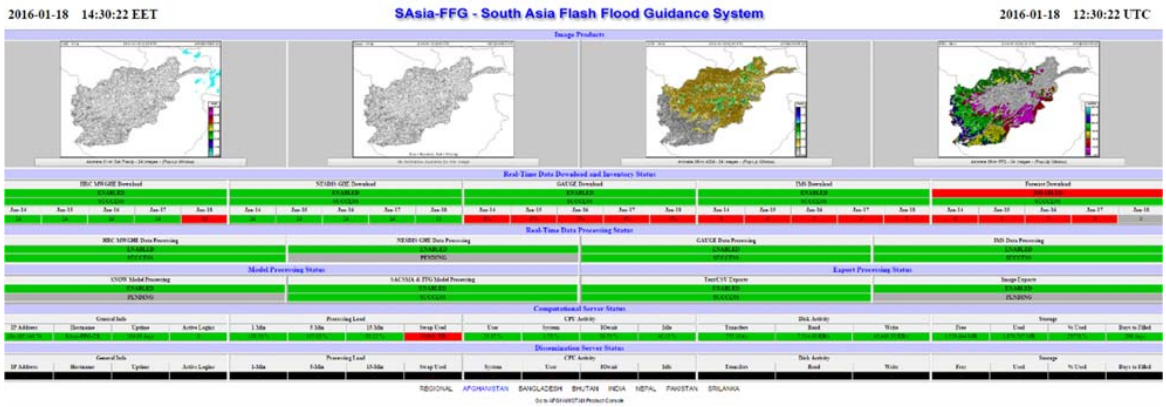
Figure 35: Flood risk forecast in Statistics tool



As at present there is no detailed Flash Flood Risk Map available and the FFGS gives risk estimates at the watershed/basin level. Therefor we overlay the FFGS watershed forecast risk data with the population at risk from the NATO Afghanistan Flood Hazard Map.

Example: In a FFSG Basin there is a high flash flood risk and there are approximately 25.000 people living in the area. However according to the AFG-FHM 3000 out of 25.000 population live within flood risk areas: therefore the Flash Flood Forecast population at risk will be 3000 population and not 25.000

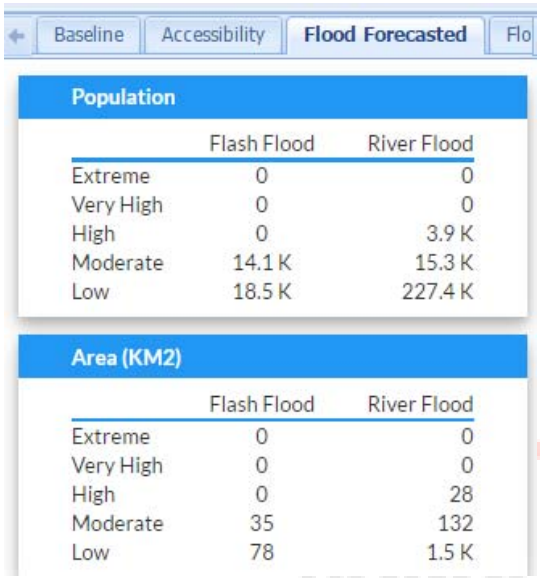
Figure 36: WHO S-Asia FFGS – Afghanistan – Dashboard Interface



6.4.2 River Flood Forecast

The other flood risk are typical river floods, these are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS).

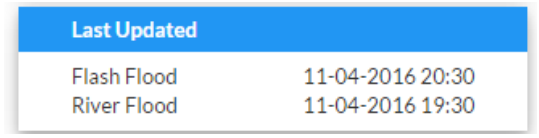
Figure 37: Flood risk forecast in Statistics tool



6.4.3 Flood Forecast Status

The flash flood forecast risk is estimated every hour, whereas the river flood forecast risk is estimated every 6 hours. The status of when it was last updated can be found in the Statistics Tool under Flood Forecast overview. This should in general be less than 6 hours before of the current date/time, should this not be the case: Kindly contact the administrator.

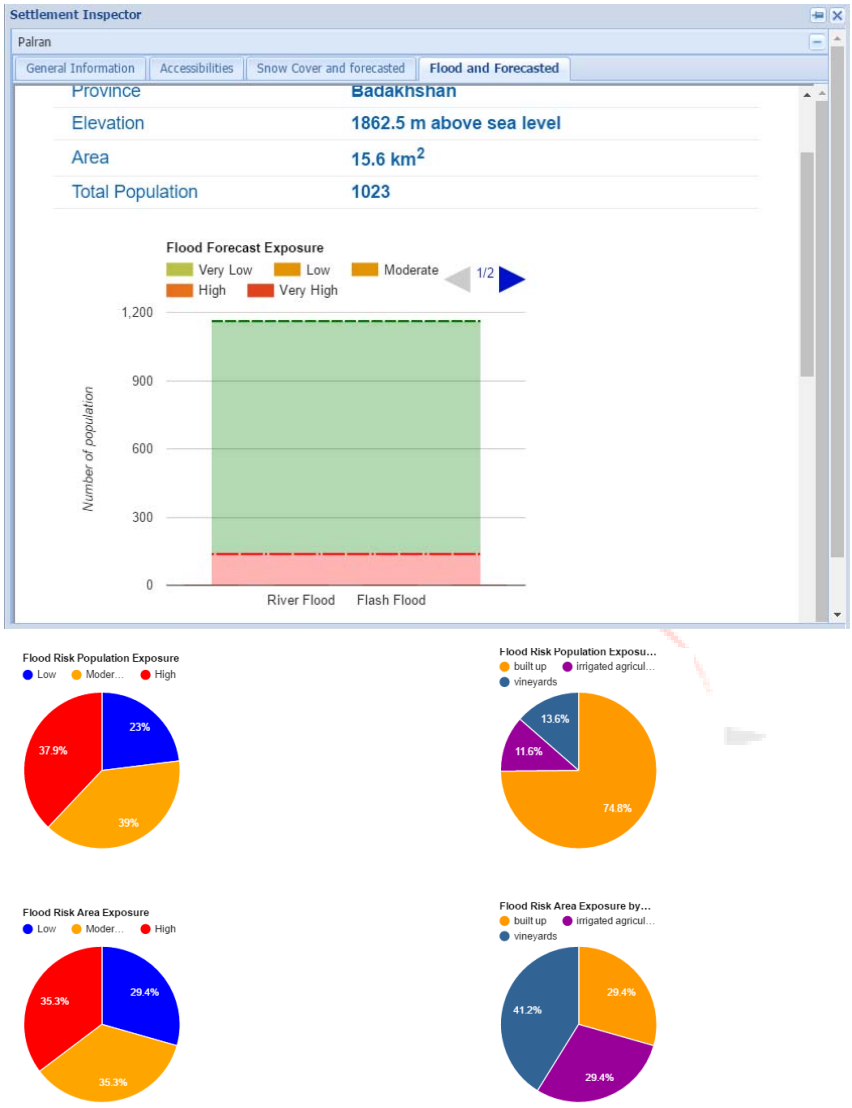
Figure 38: Flood risk forecast status in Statistics tool



6.5 Flood in Settlement Inspector

Within the Settlement Inspector the forecast risk and static flood risk for a settlement can be seen. This is practical to assess the number of people and types of land cover at risk of flooding. Various diagrams show the population and areas size at risk.

Figure 39: Static and forecast flood risk in Settlement inspector



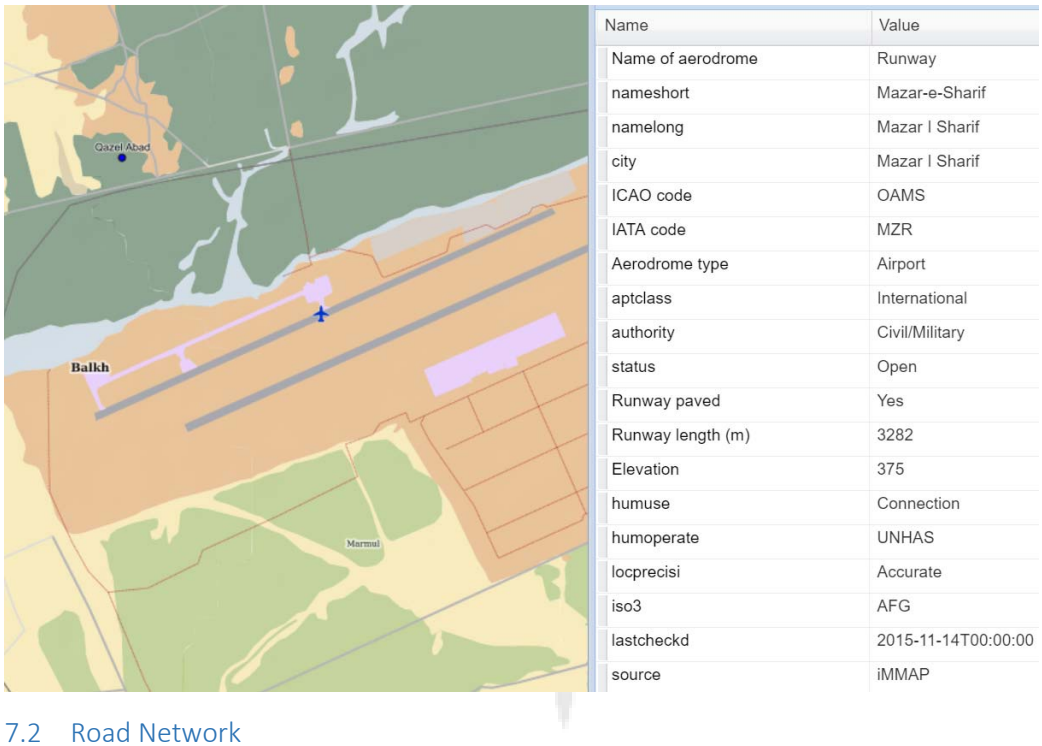
Note that as the population estimates and areas estimates for a specific settlement can be incorrect, these must the investigated by using the statistics tool for the larger areas and by visually inspecting the area in satellite imagery.

7 Transportation

7.1 Airports

Airports and heliports available on the ASDC were all visually confirmed, corrected and digitised on satellite imagery by iMMAP staff. Runway length and paved status were extracted from the digitised runway. Other attributes came from a variety of sources.

Figure 40: Airports in Interactive map with identify tool



Name	Value
Name of aerodrome	Runway
nameshort	Mazar-e-Sharif
namelong	Mazar I Sharif
city	Mazar I Sharif
ICAO code	OAMS
IATA code	MZR
Aerodrome type	Airport
aptclass	International
authority	Civil/Military
status	Open
Runway paved	Yes
Runway length (m)	3282
Elevation	375
humuse	Connection
humoperate	UNHAS
locprecisi	Accurate
iso3	AFG
lastcheckd	2015-11-14T00:00:00
source	iMMAP

7.2 Road Network

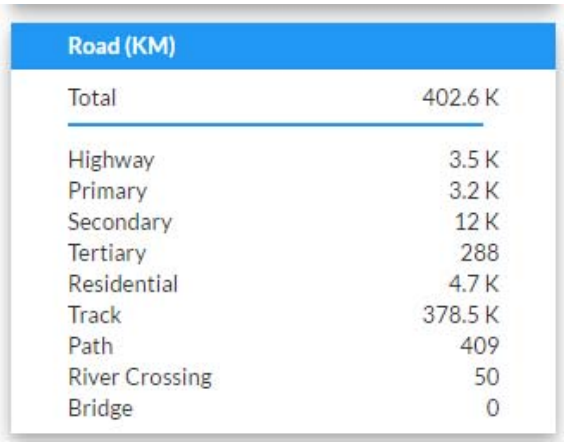
As part of the DRR program a very complete road network of Afghanistan has been created. The availability of such road network is required, to be able to estimate travel time between settlements and features of interest, e.g. hospitals.

To create the road network, initially road network sources were identified. For major cities the road network and classifications originate from OSM, whereas for rural areas a variety of sources were available. Unfortunately for rural areas, only the district and highways were categorised, all other road segments did not have any attributes. Using a variety of techniques, the roads classifications were added to rural roads, as well as a merging and inclusion of OSM data of major cities.

As not all roads were available in our sources, and often small connecting segments between roads were missing these needed to be corrected. At one hand by digitisation by iMMAP staff (+9000 km of roads), at the other hand by semi-automated techniques where missing segments were matched automatically with nearby roads. Thus creating a geometric correct road.

In the statistics tool and in the dashboard information of the types and length of roads can be found for a specific area.

Figure 41: Road network details in Statistics tool



Road (KM)	
Total	402.6 K
Highway	3.5 K
Primary	3.2 K
Secondary	12 K
Tertiary	288
Residential	4.7 K
Track	378.5 K
Path	409
River Crossing	50
Bridge	0

7.3 On-Road–Mobility

GIS vector data is a second cornerstone to create trafficability maps. They will highlight existing roads that are passable, even when going through apparently inaccessible areas such as deserts, agricultural or even river zones. In our study area the slope factor will be weighted less for roads, except for tracks. Eg. It is assumed that the terrain beneath a highway/tarred road that apparently traverses a slope of >14% is remodeled, adjusted or the slope data might be incorrect.

7.3.1 Road Tracks

For the tracks the slope will be considered using the same formula as for off-road vehicles, according to the reclassification of the table below. All tracks, soily roads, dessert roads and paths were exported from a polyline to a 30m raster data set, and include the maximum speed for each type of track. The speed data of the track was then divided by the classification values. Subsequently each raster value was divided by 108, to achieve the seconds needed to traverse the 30m grid.

Figure 42: Speed reduction of tracks

Slope-Percent	*Speed Reduction in Percent*
0-1	0
>1-2	1
>2-3	2
>3-4	3
>4-6	5
>6-9	10
>9-14	20
>14-21	30
>21-28	40
>28-35	50
>35-42	60

>42-49	70
>49-56	80
>56-63	90
>63-487	100

7.3.2 BuildUp Areas

For buildup areas the population density was used to induce a speed reduction for on-road traffic. It is assumed within more densely populated areas, more traffic will be present leading to a reduction the maximum attainable speed, furthermore the presence of shops, pedestrians, potential traffic jams and checkpoints will further decrease the speed.

Figure 43: Speed reduction in build up areas

Buildup Area/pop. density	*Source/Scale*	*Reduction Road*	*Increase Off-Road*
	iMMAP Population estimates	10%	170%
>700		8%	170%
>1200		10%	170%
>4000		15%	170%
>9000		20%	170%

7.3.3 Sinuosity and Fractal Dimensions

Road speed is in a large part also dependent on the curviness or road sinuosity. A road with many bends is travelled more slowly than one a simple straight road. For the road network we utilized the Geometric Fractal dimensions to express the curviness.

For each line (arc), fractal dimension (D) is calculated as follows:

$$D=log(n)/(log(n)+log(d/L))$$

Whereby n is the number of line segments that make up the line, d is the istance between the start and end points of the line, and L is the total length of the line.

Figure 44: Speed reduction for Fractal Dimensions

Fractal dimension	*Reduction Road*
>1	0%
<1.004	5%
<1.007	10%
<1.025	20%
>1.12	35%

7.3.4 River crossings

For each road the number of river crossings was estimated as well as the distance travelled through the river bed. Travel through a river bed reduces the speed by 90% for the distance the road segment through the river bed. Whereas for each river crossing travel time will be reduced by 80% for the estimated river width.

7.3.5 Minimum travel speed

If roads speed drops below 4 km/h, it will be set to 4km/h. Although vehicles at times will travel slower in mountainous areas many areas will not be traversable vehicle at all, yet will be either travelled by walking or donkey at approx. 4km/h.

7.3.6 Geometric Road Network

7.3.6.1 Background

Over the past years iMMAP has digitized an considerable amount roads, which are of critical importance to assess roads accessibility for the humanitarian community.

The base road network data collection has been finalized, and in 2017 additional roads will be added. It is required that the current data is cleaned of irregularities, and also the road network topology needs to be corrected. This is required to be able to avoid conflicting data, furthermore this is an essential requirement to make the iMMAP road data routable. A routable road network is a requirement to enable travel time-distance calculation and potentially for in Vehicle GARMIN devises.

Hereby some examples of incorrect topology in the iMMAP Road data:

Figure 45: Dangle, the road is not connecting to the main road

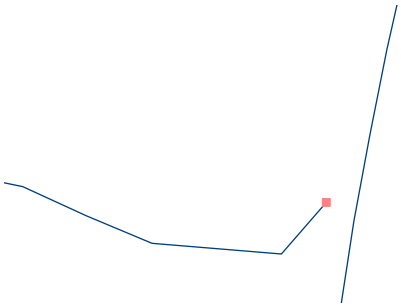


Figure 46: Double navigated roads, unroutable

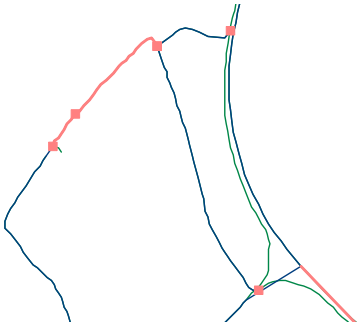


Figure 47: Self intersecting road, needs removal

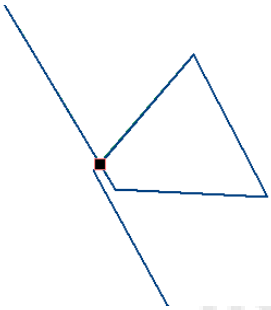
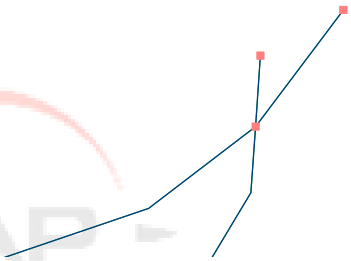


Figure 48: Incorrect road network, ending/intersection



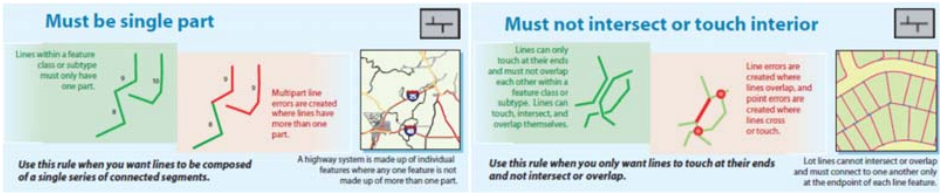
7.3.7 Topology Corrections

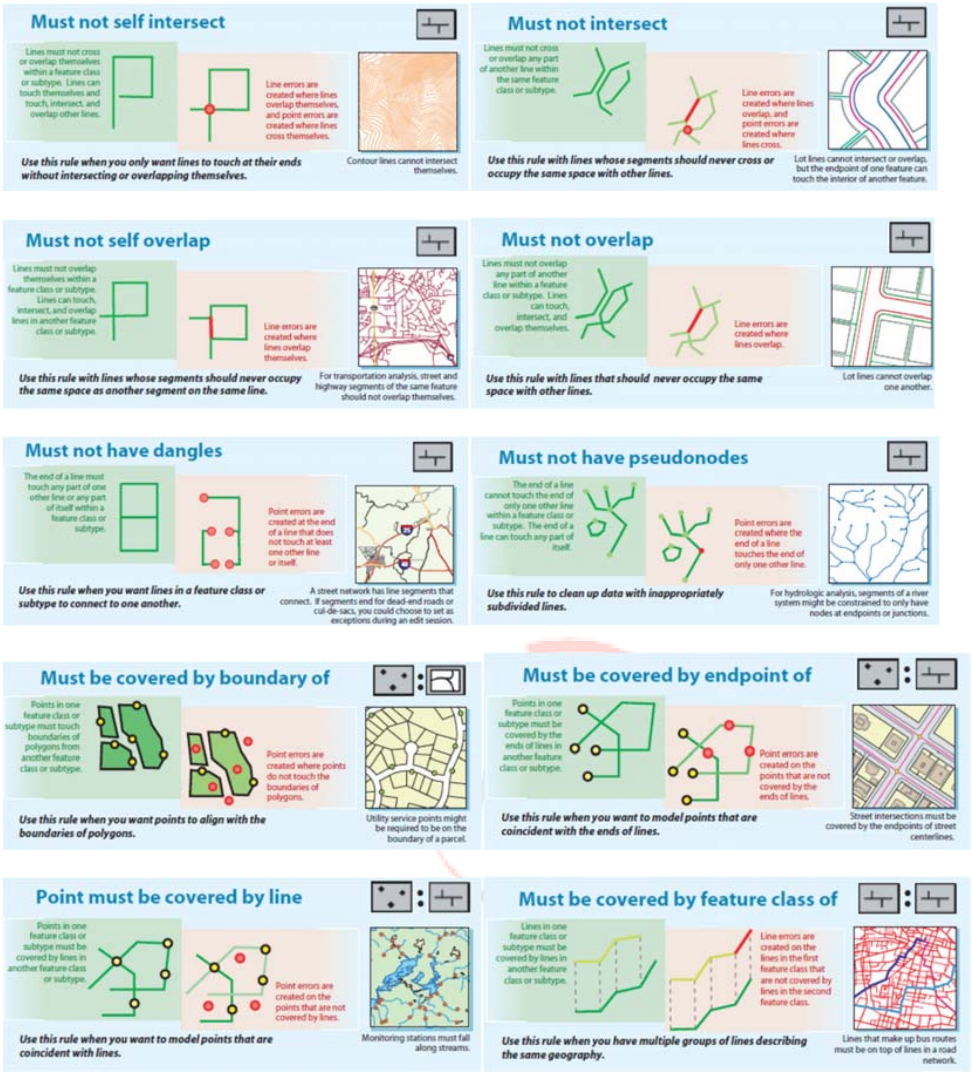
The road network topology was corrected part through fully automated, semi-automated an manual procedures. It is essential that the operator comprehends the terrain and the potential reasons for the incorrect topology. In part these can originate due to incorrect cleanup of digitized road data or incomplete terrain coverage.

It is required that high-resolution satellite imagery must be available as well as a Digital Elevation Model, this will prevent snapping of network layers beyond pre-determined thresholds.

The relevant topology rules for the road network can be found below, et is critical that points such as driving hazards also have correct topology rules attributed to them.

Figure 49: Relevant topology rules





Source: ESRI 2009

7.3.8 Generating a Geometric Road Network

Having a correct topology is the step of being able to generate a routable road network, the second step is to transform it into a geometric road network where the geometric attributes are created and set correctly.

For example at road intersections a geometric network will ensure that the routing algorithms will know which direction to drive, it sets the correct junction connectivity attributes. It will help with shortest path analysis according to specific rules, e.g. shortest route, safest (e.g. prefer tarmac road in good condition).

8 Access and Proximity Maps

As part of the DRR program iMMAP has calculated for more than 400.000 km of roads the average driving speed. This data opens up a whole new analysis type which so far have alluded the humanitarian community in Afghanistan. For example: It is now possible for any village to calculate the time and distance to the nearest airport, hospital, provincial capital and district center.

It also allows us to map “white areas”, which areas are beyond a certain threshold of emergency services/elementary infrastructure e.g. How many people live more than 4 hours away from the nearest comprehensive medical facility; or as indicated in the map below more than 8 hours away from the nearest airport.

Statistics on accessibility areas are available online, as well as information for each village which is the nearest hospital, administrative center or airport. These calculations can be expanded with schools or humanitarian warehouses, however due to the absence of data this will not be actively pursued in this phase.

Figure 50: Static hospital accessibility map (Pdf)

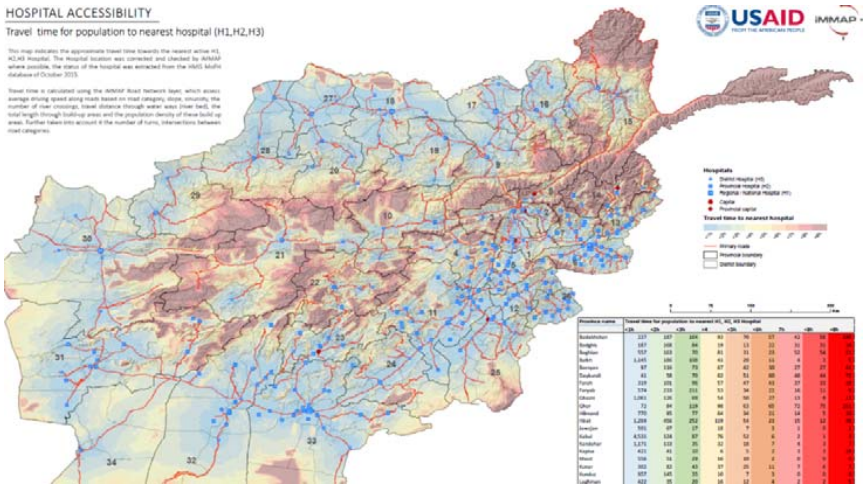
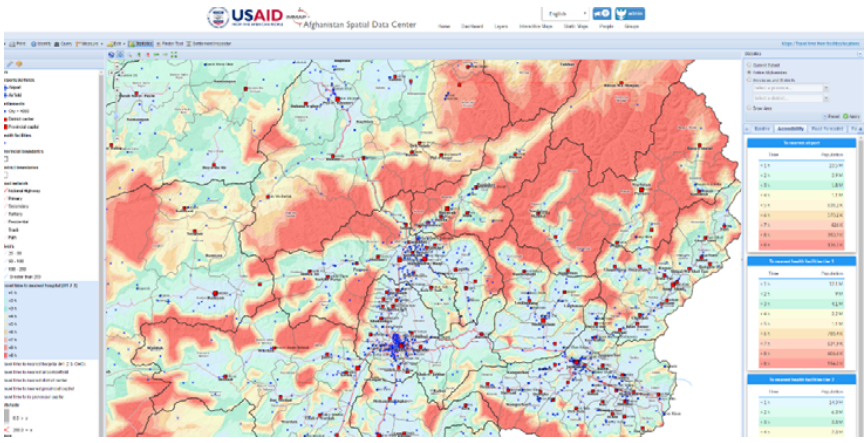


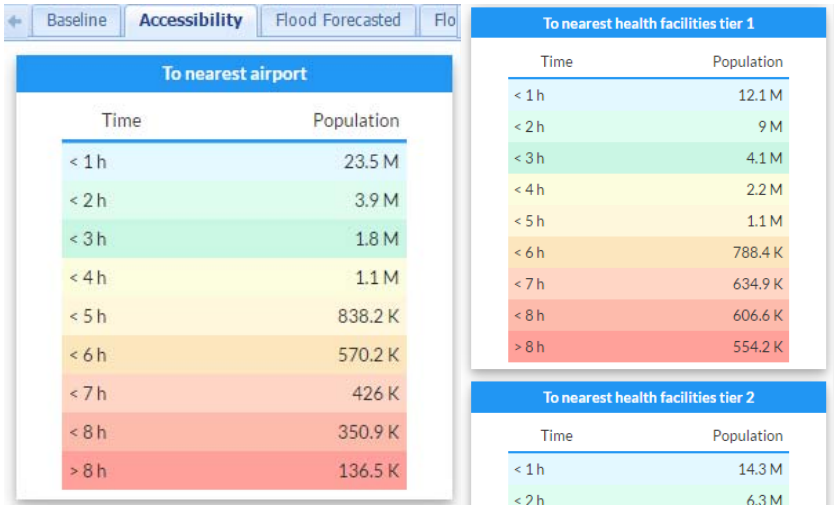
Figure 51: Interactive hospital accessibility map (online with statistics)



In the statistic tool menu following information can be found for the number of population which live within pre-defined time interval from a specific point of interest (POI).

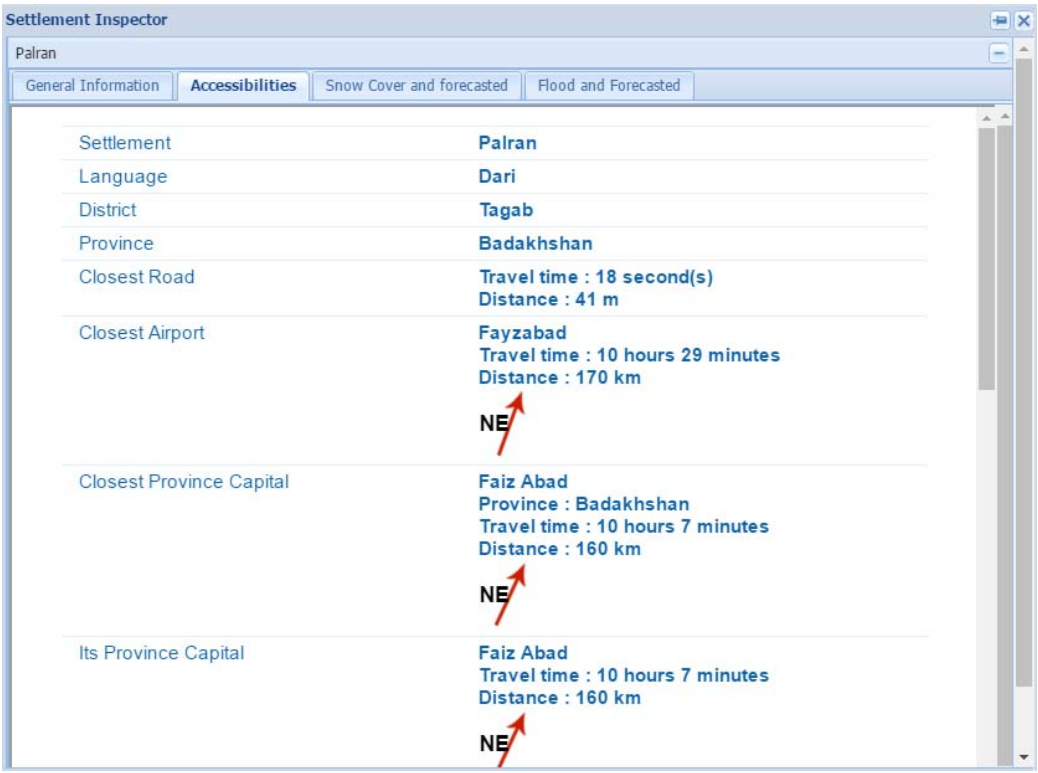
- Time intervals are:
  - <1h, <2h,…<8h
  - >8h
- POI:
  - Nearest Airport
  - Nearest Provincial Capital and District Centre
  - Its Administrative Capital and District Centre
  - Health Facilities Tier 1-2-3-All

Figure 52: Accessibility in Statistics tool



In the settlement inspector information on the travel time for each settlement can be found for each POI's (described above) as well as travel distance and name of the POI.

Figure 53: Accessibility in Settlement Inspector



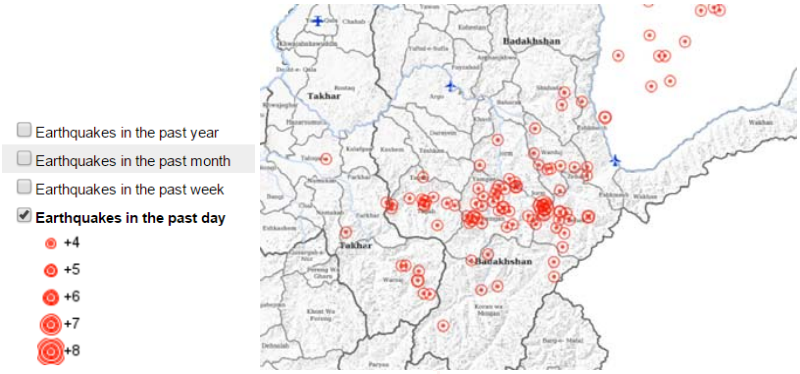
9 Earthquakes

Utilizing USGS Earthquake data, iMMAP has been automatically monitoring all +4 magnitude earthquakes in Afghanistan and neighbouring countries since end 2015. There were multiple Earthquake +5 magnitude, yet luckily these occurred were at high depth and therefore no damage was to be expected from these events. iMMAP has produced Shakemaps (Mercalli Intensity scale) for these events which also indicated the low damage risk. In addition, maps are available (USGS) that can be used to estimate the overall earthquake risk of an area.

9.1 Epicenter

Every 5 minutes the ASDC checks for earthquake epicentre updates on USGS Earthquake center. Earthquakes with magnitude +4 or higher will be displayed on the ASDC. In the Interactive Earthquake map these can be visualised for various periods (past day, week, month, year)

Figure 54: Earthquake epicentre data in interactive maps



9.2 Seismic intensity and fault lines

On the Earthquake interactive map the seismic intensity map can be activated. This information might be used to for regionalised shelter design or prioritising locations of earthquake resilience programs (see Earthquake Risk Assessment). It is based on the Peak Horizontal Acceleration with 2 Percent Probability of Exceedance in 50 years. A 2 percent probability of exceedance in 50 years corresponds to a ground-motion return time of approximately 2500 years, or approximately a 10% probability of of exceedance in 250 years. The seismic intensity data and classes originate from the USGS Earthquake Hazard Map for Afghanistan (2007), by By Oliver S. Boyd, Charles S. Mueller, and Kenneth S. Rukstales

USGS regional faults or Central Asia Fault Database fault lines can be visualised as well. In addition, the various tectonic regions of Afghanistan area available for visualisation.

Figure 55: Earthquake interactive map, added Seismic intensity and fault lines

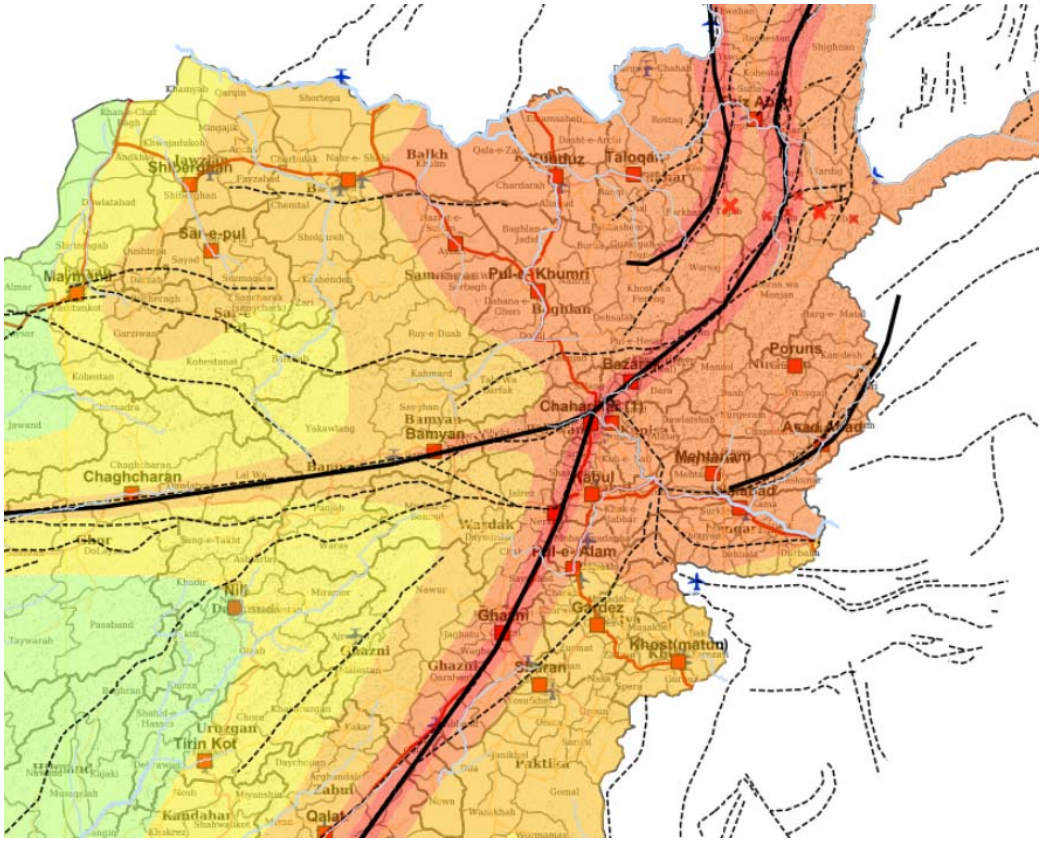
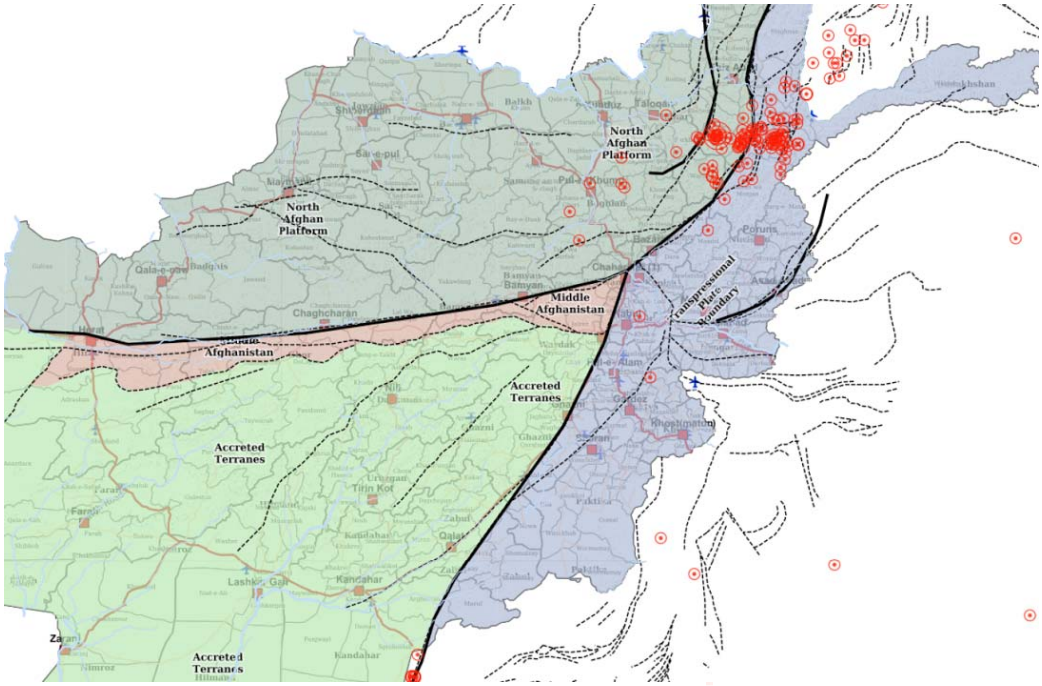


Figure 56: Earthquake interactive map, with tectonic regions and fault lines



9.3 Earthquake Risk Assessment

Earthquake functionality has been added to the ASDC to help identify regions and settlements with higher earthquake risk.

For each settlement the following risk scale is given, see table and description of each of the categories below.

Earthquake Hazard Risk* :

II-III Weak	IV Light	V Moderate	VI Strong	VII Very Strong	VIII Severe	IX Violent	X+ Extreme
						X	

* Seismic intensity and description of potential damage (USGS, 2007) Peak Horizontal Acceleration with 2 Percent Probability of Exceedance in 50 years

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound.

		Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X+	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

9.4 Latest 20 earthquakes

For each settlement, the last 20 earthquakes for which an Shakemap has been calculated, can be found within the settlement inspector tool.

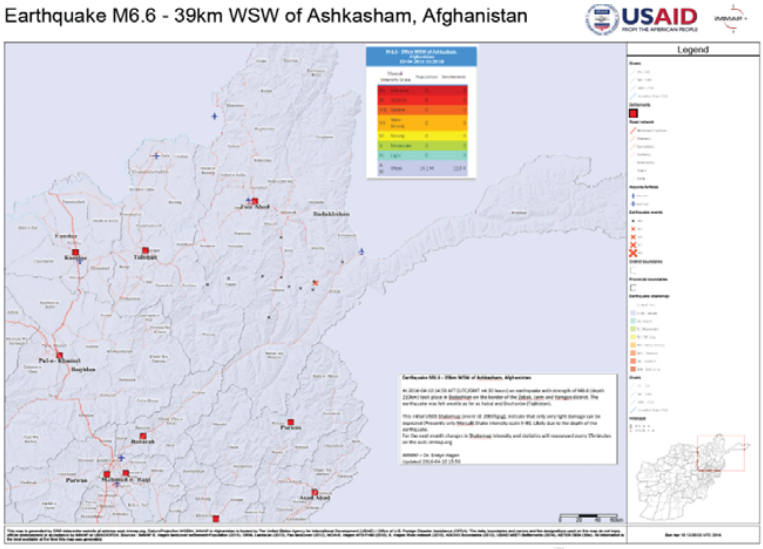
Figure 57: Last 20 earthquakes to affect a settlement in Settlement Inspector

Magnitude	II-III Weak	IV Light	V Moderate	VI Strong	VII Very Strong	VIII Severe	IX Violent	X+ Extreme
2016-04-10 10:28	X							
6.6 M								
2015-12-26 01:14	X							
6.3 M								
2015-10-26 14:09			X					
7.5 M								

9.5 Shakemap

Every 5 minutes the ASDC checks for earthquake epicenter updates on USGS Earthquake center, if a large earthquake occurs in or near Afghanistan a Shakemap will be downloaded when available (generally 30-60 minutes after the event). Changes in the USGS Shakemap are monitored every 15 minutes. The ASDC automatically uses the Shakemaps to calculate the impacted population. This data is generally available online approximately 1 – 1 ½ hours after the earthquake event. It can for example indicate the 100.000 persons in Badashkan province felt the earthquake at the intensity level IV. Larger shake intensity generally results in more damage.

Figure 58 Earthquake Intensity map semi-automatically produced 1 ½ hours after event



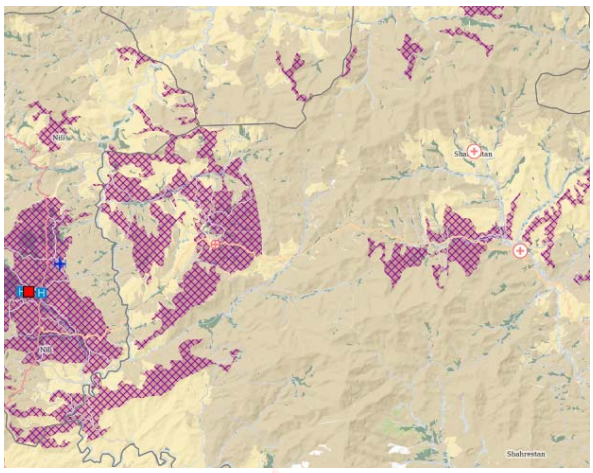
10 Mobile phone coverage

GSM/Mobile phone coverage has been modelled for entire Afghanistan. This knowledge enables better emergency response, safer field operations, as well as open the opportunity for potential early warning systems.

10.1 Functionality

Using this data, it is possible to assess which villages/infrastructure and which population have GSM coverage. E.g. To assess which health facilities have mobile phone access, one needs to visualise health facilities together with mobile phone coverage.

Figure 59 GSM Coverage map



Currently it is assessed that 21.1 million persons (31.1 million total pop. in Afghanistan) live in areas with GSM coverage.

In 2016 this data has been integrated in the ASDC as part of the *Statistics Tool - Accessibility* segment. For every province/district or custom area, an ASDC user can quickly get estimates on cell phone coverage.

Additionally, with the village settlement, it is now possible to get the likelihood of mobile phone signals within that specific settlement. A video describing this functionality has been added to YouTube.

Figure 60: GSM Coverage in Statistics Tool Accessibility

GSM / cell phone Coverage	
Population with GSM Coverage	104.6 K
Area with GSM Coverage (km2)	1.5 K

Figure 61: GSM Coverage in Settlement Inspector yes/no

GSM Coverage	Yes
GSM Coverage	No coverage

10.2 Methodology

GSM Coverage was calculated by iMMAP, Emlyn Hagen (2016) of the DRR Team, after digitisation of all mobile phone towers. One Afghan operator shared their coverage data with iMMAP, which was used to calibrate the coverage methodology for other operators.

- Basic RF signal propagation model was used based upon a GSM signal of 900Mhz uplink.
- A regular Irregular Terrain Model (ITM) was used, without obstructions. Ericsson, ECC33A and Okumra models performed less well in mountainous terrain. “The ITM model is a general purpose model developed by the US NTIA and used by the FCC which meets most radio engineering requirements for frequencies between 20 MHz and 20 GHz. It factors in

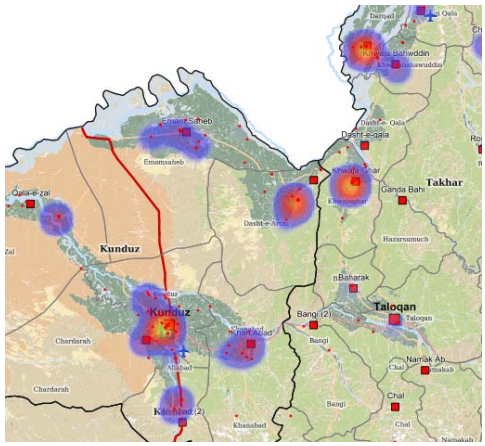
electromagnetic theory, terrain features, ground clutter, diffraction and radio measurements to predict the attenuation of a radio signal at a given point on the earth" (CloudRF, 2015 Farrant Consulting Ltd).

- Maximum signal strength radius of 15km was used from the base tower. Signal strength can in general reach further, though our benchmark operator has a Maximum range of 12km.
- The GSM Tower elevation was set to 80m above ground level, whereas the receiver/user was set at 20m above ground level. Realistically these should have been set at 60m and 1.5m, however to counter anomalies and variations in the DEM higher values were chosen. Again to reflect a close match to the existing operator measurements.
- A maximum vertical transmitter angle of 30° was used, whereas for the horizontal

11 Humanitarian Access

In July 2016, the DRR program developed and integrated a base Humanitarian Access Module, which shows the location of incidents such as kidnappings. At present it is the most comprehensive incident database in Afghanistan accessible to the humanitarian community.

Figure 62: Incident casualties heat map



11.1 Background

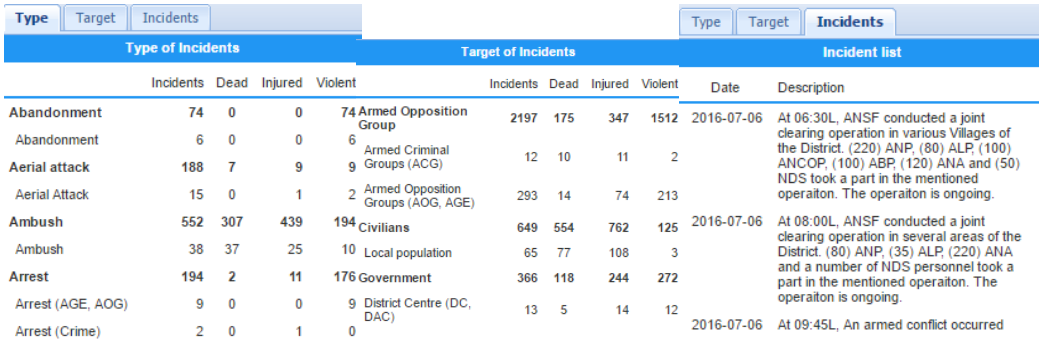
Incident data is one of the most essential datasets in Afghanistan and most humanitarian organisations assess the security situation daily. Security information is available almost exclusively in written reports and tables. It can be expected that security officers with long experience in Afghanistan will have a good understanding of their area of interest but there is little geospatial data available for the humanitarian actors for planning or emergency response. Moreover, for M&E purposes it is not easy to check the security risks of a certain district as reported by the implementing partner. Historic knowledge is quickly lost and it is time consuming to retrieve it from the written reports. Therefore, for an organisation it is not easy to answer which districts/valleys have Taliban/armed/criminal, etc. presence or how many kidnappings/thefts/killings have taken place over the past years in an area.

11.2 Functionality

The Humanitarian Access Module allows ASDC users, to visualize and filter various types of incidents. Incidents can be geo-filtered by province, district or even a custom region such as a valley or a road. Filtering is also available by date range (e.g. incidents between 15th July 2012 and 10th October 2012), by 65 different types of incidents (e.g. kidnapping, IED Explosion) and target types (e.g. Armed Criminal Groups, Civilians, Military).

The iMMAP security database presently contains more than 135.000 security incidents from 2008 onward, all of which are geo-located. iMMAP staff update this incident data on a daily basis using a variety of sources. A video describing this new functionality has been added to Youtube.

Figure 63: Humanitarian Access: Statistics Samples (Last 365 days for "Incident casualties heat map")



Type | Target | Incidents

Type of Incidents

	Incidents	Dead	Injured	Violent
Abandonment	**74**	**0**	**0**	**74**
Abandonment	6	0	0	6
Aerial attack	**188**	**7**	**9**	**9**
Aerial Attack	15	0	1	2
Ambush	**552**	**307**	**439**	**194**
Ambush	38	37	25	10
Arrest	**194**	**2**	**11**	**176**
Arrest (AGE, AOG)	9	0	0	9
Arrest (Crime)	2	0	1	0

Type | Target | Incidents

Target of Incidents

	Incidents	Dead	Injured	Violent
Armed Opposition Group	**2197**	**175**	**347**	**1512**
Armed Criminal Groups (ACG)	12	10	11	2
Armed Opposition Groups (AOG, AGE)	293	14	74	213
Civilians	**649**	**554**	**762**	**125**
Local population	65	77	108	3
Government	**366**	**118**	**244**	**272**
District Centre (DC, DAC)	13	5	14	12

Type | Target | Incidents

Incident list

Date	Description
2016-07-06	At 06:30L, ANSF conducted a joint clearing operation in various Villages of the District. (220) ANP, (80) ALP, (100) ANCOP, (100) ABP, (120) ANA and (50) NDS took a part in the mentioned operaiton. The operaiton is ongoing.
2016-07-06	At 08:00L, ANSF conducted a joint clearing operation in several areas of the District. (80) ANP, (35) ALP, (220) ANA and a number of NDS personnel took a part in the mentioned operaiton. The operaiton is ongoing.
2016-07-06	At 09:45L, An armed conflict occurred

11.3 Limitations

Not every incident will be reported or will have been mapped, the data is as accurate as possible. It can give a good indication if a particular area has humanitarian access challenges or not. And if so, which type of incidents have taken place and when.

Incident reports will often mention a village name, without providing further location details. The incident will thus be positioned by the staff close to the village centre. On other circumstances it might mention a particular building, e.g. mosque or police station, unfortunately these location details will frequently be not available to iMMAP staff to accurately position the incident.

Should an incident occur on e.g. the road between two settlements, the incident will be placed randomly alongside of the road.

11.4 Sources and definitions

Presently most of the incidents originate from the GoIRA NPCC reports which iMMAP receives on a daily basis. Many of the older incidents in the database originate from JOG, UN DSS, NPCC.

With a variety of sources iMMAP staff categories the incidents using the definitions and criteria found in Annex A. iMMAP has developed its own iMMAP Security Glossary v2-2014

12 Scientific articles

Notable publications which helped in creating some of the datasets.

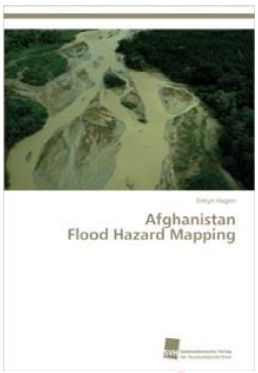
Reverse engineered flood hazard mapping in Afghanistan: A parsimonious flood map model for developing countries (Emlyn Hagen · J.F. Shroder · X.X. Lu · John F. Teufert). Article · Oct 2010 · Quaternary International
→ Download

Afghanistan Flood Hazard Mapping (Emlyn Hagen) ISBN 978-3-8381-3530-4. SW Verlag. 314pages.

→ Download

Abstract

Most flood models are based on advanced algorithmic and multiple data requirements that are sometimes difficult to apply in developing countries. These feed-forward models cannot be applied to large areas and can lead to extreme over/under estimations in some developing countries due to extrapolation from inadequate datasets where each additional parameter adds further uncertainty. This study proposes to employ a parsimonious model that only relies on adequate available data reducing forward-uncertainty-propagation. A ‘‘reverse engineering’’ approach that relies on past inundation depths does provide a solution for flood hazard mapping where extracting the flood extent of extreme floods is the primary goal and where only inadequate hydrological input data are available. The feedback method was successfully deployed to create the nationwide Afghanistan Flood Hazard Map (AFG-FHM) at a scale of 1:100,000 using a high-resolution digital elevation model, sample measurements and Dartmouth Flood Observatory past flood data. This paper describes the parsimonious flood map model



Abstract

Every year, Afghanistan’s violent floods make thousands homeless and kill scores of people. Additionally, these floods destroy houses, bridges, roads and other essential infrastructure. Until now, it was not known where these floods would occur; however by developing a new parsimonious inundation model, the Afghanistan Flood Hazard Map (AFG-FHM) has been created. The model does not rely on advanced algorithmic and data requirements often only available in the developed world; it can therefore be employed in other developing countries. In addition to relief operations, the AFG-FHM is supporting the planning for NATO/ISAF on strategic, operational and tactical levels. It can help the UN, Red Cross and NGOs to save millions of dollars in investment by locating safe construction and flood mitigation sites. This book describes the methodology employed to create the AFG-FHM, as it is a robust method to generate extreme inundation outlines. It further gives a comprehensive overview of the Afghanistan flood crisis and concludes with an overview of the flood analyses, such as landmine migration and roads with flood risk, which can be performed in developing countries.

and general methodology employed to create the AFG-FHM, as it is a robust method to generate extreme inundation outlines, which can be utilised in other developing nations as well.

Spatial modelling of avalanches by application of GIS on selected slopes of the Western Tatra Mts. and Belianske Tatra Mts., Slovakia. (Martin Boltižiar, Marek Biskupič, Ivan Barka) In Geographia Polonica 89(1):79-90 · January 2016
→ Download

Abstract
The avalanches represent a significant and very dynamic process within the Tatra high-mountain landscape. Undoubtedly avalanche run-out distances play a key role in land use planning within avalanche prone areas. The Žiarska valley and Predné Meďodoly valley are considered as one of the most avalanche prone valleys in Tatra Mts. This environment represents an excellent opportunity for studying and modelling extreme avalanche run-outs. Primarily avalanche release zones were estimated by using an existing model proposed by Hreško (1998). This model was modified and calibrated for both valleys. The alpha-beta regression model developed in Norway has been used to estimate avalanche run-outs. Data processing and model calibration have been elaborated in GIS

environment. Avenue script for ArcGIS was written to perform automated runout estimation based on alpha-beta regression model. Model managed to estimate run-outs on some slopes while it failed to model run-ups. Finally the results were visualized by creating the fly-through simulations and 3D views. Comparison between model calculation and avalanche cadastre showed correlation.

13 Abbreviations

AFG-FHM	Afghanistan Flood Hazard Map
ASDC	Afghanistan Spatial Data Center
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer (DEM)
DEM	Digital Elevation Model
DRR	Disaster Risk Reduction
FAO	Food and Agricultural Organisation
FFGS	Flash Flood Guidance System
GFMS	Global Flood Monitoring System
GLOFAS	Global Floods Awareness System
GoIRA	Government of the Islamic Republic of Afghanistan
GSM	Global System for Mobile Communications
IED	Improvised explosive device
IMS	Snow and Ice Mapping System
ITM	Irregular Terrain Model
JOG	Joint Operational Guidelines
JRC	Joint Research Centre
M&E	Monitoring and Evaluation
MISTI	Measuring Impacts of Stabilization Initiatives
NPCC	National Police Command Center
NWSRFS	National Weather Service River Forecast System
ORNL	Oak Ridge National Laboratory
OSM	OpenStreetMap
RF	Radio Frequency
SWE	Snow water equivalent
UNDSS	UN Department of Safety and Security
USGS	United States Geological Survey
WMO	World Meteorological Organization

14 Annex A: Humanitarian Access - iMMAP Security Glossary

iMMAP has developed its own iMMAP Security Glossary (latest version v2-2014), which is used by staff to categorize various incidents. (Source, iMMAP Security)

14.1 Incidents

Category	Label Full	Definition	Source
Armed Conflict	Adhesive IED Explosion	An explosion which was confirmed caused by an Adhesive IED	iMMAP Security Glossary v2-2014
Armed Conflict	Adhesive IED Found/Cleared	An Adhesive IED which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Armed Conflict	Air Strike	An attack on specific objectives by fighter, bomber, or attack aircraft on an offensive mission.	Joint Publication 1-02, DOD Dictionary of Military and Associated Terms
Armed Conflict	Ambush	A sudden attack made from a concealed position, often used in the context of road/vehicle attacks.	iMMAP Security Glossary v2-2014
Armed Conflict	Anti-vehicle Mine Explosion	An explosion which is confirmed caused by an Anti-vehicle Mine.	iMMAP Security Glossary v2-2014
Armed Conflict	Anti-vehicle Mine Found/Cleared	An Anti-vehicle Mine which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Armed Conflict	Armed Opposition Group Activity	Activity of an Armed Opposition Group such as movements, visible presence in areas, assembly of fighters and equipment, etc.	iMMAP Security Glossary v2-2014
Crime	Armed Assault	An aggravated assault in which the perpetrator controlling a deadly weapon, threatens the victim with death or serious bodily injury.	iMMAP Security Glossary v2-2014
Crime	Armed robbery	The unlawful taking of the property of another individual or group by the use of violence or intimidation with a dangerous or deadly weapon.	iMMAP Security Glossary v2-2014
Crime	Arrest	To seize and hold under the authority of law.	iMMAP Security Glossary v2-2014
Crime	Arson	The willful or malicious burning of property (as a building) especially with criminal or fraudulent intent.	iMMAP Security Glossary v2-2014
Crime	Assassination	To murder (a usually prominent person) by sudden or secret attack often for political reasons.	Merriam-Webster Online Dictionary
Crime	Assault	The threat to inflict injury or death with an apparent ability to do so. Also, any intentional display of force that would give the victim reasonable apprehension of imminent harmful or offensive contact.	iMMAP Security Glossary v2-2014
Armed Conflict	Attack	See: Engagement	
Crime	Ballot Stuffing	The illegal act of one person submitting multiple ballots during a vote in which only one ballot per person is permitted.	iMMAP Security Glossary v2-2014
Crime	Beheading	To separate the head from the torso; to decapitate.	Merriam-Webster Online Dictionary
Armed Conflict	Bomb Threat	The threat to inflict injury or death using an explosive device.	iMMAP Security Glossary v2-2014
Armed Conflict	Bombardment	Term often used to refer to the heavy indirect or aerial fire to saturate an area rather than hit a specific target.	iMMAP Security Glossary v2-2014
Crime	Bribery	The corrupt payment, receipt, or solicitation of a private favor for official action.	iMMAP Security Glossary v2-2014
Crime	Burglary	The act of breaking and entering a building with the intent to commit a crime	Merriam-Webster Online Dictionary
Crime	Carjacking	The act of stealing of a car in transit with the use of force.	HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Armed Conflict	Cease-Fire	A suspension of armed conflict agreed to by both sides. It may be aimed at freezing the conflict in place, in which case it is often called a cessation of hostilities agreement. Or it may be a formal cease-fire with more elaborate terms and provisions including external monitoring, often undertaken as part of a larger negotiated settlement.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Checkpoint (Illegal)	A place used by Armed Opposition Groups, military or security forces to check vehicular or pedestrian traffic in order to illegally obtain money or goods or for unlawful circulation control.	iMMAP Security Glossary v2-2014
Civil Unrest	Civil Disturbance	A civil unrest activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain public safety.	Federal Emergency Management Agency (DHS) - Glossary
Armed Conflict	Collateral Damage	Unintentional or incidental injury or damage to persons or objects that would not be lawful military targets in the circumstances ruling at the time.	Joint Publication 3-60 - Joint Targeting
Armed Conflict	Command Wire IED Explosion	An explosion which was confirmed caused by a Command Wire IED.	iMMAP Security Glossary v2-2014
Armed Conflict	Command Wire IED Found / Cleared	A Command Wire IED which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014

Armed Conflict	Complex Attack	An attack involving multiple different weapon systems, i.e. an IED and small arms fire.	iMMAP Security Glossary v2-2014
Crime	Corruption	The abuse of power for private gain, including bribery, extortion, fraud, nepotism, embezzlement, falsification of records, kickbacks, and influence peddling.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Crime	Cyber-attack	The use of computers and the Internet to disrupt computer networks and telecommunications infrastructure.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Civil Unrest	Demonstration	An organized, non-violent public protest expressing strong objection to an official policy or course of action	iMMAP Security Glossary v2-2014
Armed Conflict	Direct Fire	Fire delivered on a target using the target itself as a point of aim for either the weapon or the director.	JP 3-09.3
Armed Conflict	Explosively Formed Projectile Explosion	An explosion which is confirmed caused by an Explosively Formed Projectile.	iMMAP Security Glossary v2-2014
Armed Conflict	Explosively Formed Projectile Found/ Cleared	An Explosively Formed Projectile which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Crime	Embezzlement	The fraudulent appropriation by a person to his own use or benefit of property or money entrusted to him by another.	iMMAP Security Glossary v2-2014
Armed Conflict	Engagement	A short, violent, armed attack against a local objective.	iMMAP Security Glossary v2-2014
Armed Conflict	Escalation of Force Incident	Situations where deadly force is used by security forces due to civilians not paying attention to warnings from security forces personnel when in the proximity of, approaching or overtaking military convoys or do not follow instructions at check points.	iMMAP Security Glossary v2-2014
Armed Conflict	Ethnic Cleansing	Deliberate, organized, and usually violent expulsion of people from an area on the basis of their perceived ethnic, communal, sectarian, or religious identity.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Crime	Extortion	Obtaining money or property by threat to a an individual or organization's life, health or property, intimidation, or false claim of a right (such as pretending to be a government offical or law enforcement officer).	iMMAP Security Glossary v2-2014
Crime	Fraud	A knowing misrepresentation of the truth or concealment of a material fact to induce another to act to his or her detriment.	iMMAP Security Glossary v2-2015
Crime	Gender-based Violence	Violence directed against individuals or groups on the basis of their gender or sex. It includes acts or threats of acts that inflict physical or mental harm or suffering, coercion, and other deprivations of liberty, including rape, torture, mutilation, sexual slavery, forced impregnation, and murder.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Hand Grenade Attack	An explosion which was confirmed caused by a hand grenade.	iMMAP Security Glossary v2-2015
Crime	Harassment	Abusive conduct, verbal or physical, directed at a person, which causes distress or discomfort.	HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Crime	Hijacking	To stop and steal from a vehicle in transit whilst using force or threat with death or bodily injury.	iMMAP Security Glossary v2-2014
Crime	Homicide	The killing of one person by another. This is the generic legal term for killing a person, whether lawfully or unlawfully.	iMMAP Security Glossary v2-2014
Crime	Hostage Taking	Where a person or group is held in a siege situation in a known location. Similar to a kidnapping scenario, their safety and subsequent release is usually dependent on the fulfillment of certain conditions. These conditions may include: the publicizing of a political cause; the exchange of hostages for political prisoners; or the evasion of prosecution by criminals when their activity has been discovered by the authorities.	HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Crime	Human Remains Find	Discovery of the body of a deceased person, in whole or parts.	iMMAP Security Glossary v2-2014
Armed Conflict	IED Explosion	An explosion which was confirmed caused by an IED although the type of IED has not been determined or disclosed.	iMMAP Security Glossary v2-2014
Armed Conflict	IED Found/Cleared	An IED which was positively detected, identified, rendered safe and recovered; the type of IED has not been disclosed.	iMMAP Security Glossary v2-2014
Armed Conflict	Indirect Fire Attack	A bombardment delivered by indirect fire weapon systems, commonly used to describe artillery, mortar or rocket fire.	iMMAP Security Glossary v2-2014
Crime	Intimidation	See: Threat	
Crime	Kidnapping	The forcible capture and detention of someone with the explicit purpose of obtaining something (money, materials or certain actions) in return for their life and release.	HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Crime	Looting	The illegal taking of goods during conditions of armed conflict.	iMMAP Security Glossary v2-2014
Armed Conflict	Mass-atrocities	Large-scale and deliberate attacks on civilians. The victims of mass atrocities are typically targeted because of their identification as members of a group.	USIP - Glossary of Terms for Conflict Management and Peacebuilding

Armed Conflict	Military Operations	Coordinated military actions of combat or non-combat types.	iMMAP Security Glossary v2-2014
Armed Conflict	Mine Explosion	An explosion which was confirmed caused by a mine.	iMMAP Security Glossary v2-2014
Armed Conflict	Mine Found/Cleared	A mine which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Crime	Murder	The killing of a human being with malice aforethought.	iMMAP Security Glossary v2-2014
Armed Conflict	Political Violence	Organized or systematic use of force, the motive for which is primarily political, that is, aimed at influencing government policy, rather than criminal. It can include terrorism, rebellion, war, conquest, revolution, oppression, and tyranny.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Precision Small Arms Fire (Sniping)	Accurate Small Arms Fire, often delivered over longer distances, conducted by a specially trained shooter commonly using a rifle developed for accuracy.	iMMAP Security Glossary v2-2014
Armed Conflict	Propaganda	A form of communication that is aimed at influencing the attitude of a community toward some cause or position. Often the term is used with a negative connotation.	iMMAP Security Glossary v2-2014
Crime	Rape	Unlawful sexual activity with a person without consent and usually by force or threat of injury.	iMMAP Security Glossary v2-2014
Armed Conflict	Remote Controlled IED Explosion	An explosion which was confirmed caused by a Remote Controlled IED.	iMMAP Security Glossary v2-2014
Armed Conflict	Remote Controlled IED Found/Cleared	A Remote Controlled IED which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Civil Unrest	Riot	A violent public protest, including one or more of the following occurrences; assault, arson, stone pelting, throwing of other objects, (aerial) firing, clashes with police / security forces or breaching a security perimeter.	iMMAP Security Glossary v2-2014
Civil Unrest	Road Blockage	Blocking a road for the purpose of demonstrating.	iMMAP Security Glossary v2-2014
Crime	Robbery	The act of taking goods from a victim by violence or threat.	iMMAP Security Glossary v2-2014
Crime	Sabotage	Destructive or obstructive action designed to hinder capability.	IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Armed Conflict	Secondary Device (IED)	An additional IED used to attack individuals or vehicles after the initial event.	UNMAS Explosive Hazards Lexicon
Crime	Sexual Violence	A form of gender-based violence, sexual violence refers to any act, attempt, or threat of a sexual nature that results, or is likely to result in, physical or psychological harm. It includes all forms of sexual exploitation and abuse, such as rape, spousal battering, sexual abuse of children, dowry-related violence, marital rape, female genital mutilation, sexual harassment and intimidation at work and in educational institutions, and trafficking and forced prostitution.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Crime	Shooting	The act of discharging a fire arm.	iMMAP Security Glossary v2-2014
Armed Conflict	Small Arms Fire	Fire delivered using man-portable, individual, and crew-served weapon systems used mainly against personnel and lightly armored or unarmored equipment.	iMMAP Security Glossary v2-2014
Crime	Smuggling	Illegal movement of goods crossing an international boundary	iMMAP Security Glossary v2-2014
Crime	Stabbing	The penetration of a victim's body with a sharp or pointed object at close range with the intent to cause bodily harm or death.	iMMAP Security Glossary v2-2014
Civil Unrest	Strike Action	A work stoppage caused by the mass refusal of employees to work.	iMMAP Security Glossary v2-2014
Armed Conflict	Suicide IED Explosion	An explosion which was confirmed caused by a Suicide IED.	iMMAP Security Glossary v2-2014
Armed Conflict	Suicide IED Found/Cleared	A Suicide IED which was positively detected, identified, neutralized, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Armed Conflict	Suicide Vehicle Borne IED Explosion	An explosion which was confirmed caused by a Suicide Vehicle Borne IED.	iMMAP Security Glossary v2-2014
Armed Conflict	Suicide Vehicle Borne IED Found/Cleared	A Suicide Vehicle Borne IED which was positively detected, identified, neutralized, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Armed Conflict	Surrender	The non-compulsory relinquishing of fighters and arms.	iMMAP Security Glossary v2-2014
Crime	Theft	The felonious taking and removing of another's personal property with the intent to permanently deprive the true owner thereof.	iMMAP Security Glossary v2-2014
Crime	Threat (verbal/written)	The act of making an intimidating statement of an intention to inflict injury, damage, or other hostile action as retribution - verbally or in writing - towards an individual or organization.	iMMAP Security Glossary v2-2014

ERW	Unexploded Ordnance Explosion	An explosion which is confirmed caused by Unexploded Ordnance.	iMMAP Security Glossary v2-2014
ERW	Unexploded Ordnance Found/Cleared	Unexploded Ordnance which positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Crime	Vandalism	The malicious damaging of another persons property.	iMMAP Security Glossary v2-2014
Armed Conflict	Vehicle Borne IED Explosion	An explosion which is confirmed caused by a Vehicle Borne IED.	iMMAP Security Glossary v2-2014
Armed Conflict	Vehicle Borne IED Found/Cleared	A Vehicle Borne IED which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Armed Conflict	Victim Operated IED Explosion	An explosion which is confirmed caused by a Victim Operated IED	iMMAP Security Glossary v2-2014
Armed Conflict	Victim Operated IED Found/Cleared	An Victim Operated IED which was positively detected, identified, rendered safe and recovered.	iMMAP Security Glossary v2-2014
Armed Conflict	War Crimes	Crimes committed during armed conflict in violation of the laws of war or international humanitarian law, described more fully in the Rome Statute of the International Criminal Court, article 8. Most war crimes are perpetrated against noncombatant and civilian populations; they include murder, torture, deportation, rape, the taking of hostages, and forced labor.	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Weapons Cache Found/Cleared	The detection and recovery of a Weapons Cache.	iMMAP Security Glossary v2-2014
General	Road traffic Accident	An accident involving a motor vehicle.	iMMAP Security Glossary v2-2014
Armed Conflict	Raid	An operation to temporarily seize an area in order to secure information, confuse an adversary, capture personnel or equipment, or to destroy a capability. It ends with a planned withdrawal.	Joint Publication 3-26 - Counterterrorism

14.2 Terms

Category	Label Full	Definition	Acronym	Source
ERW	Abandoned Explosive Ordnance	Explosive ordnance that has not been used during an armed conflict, that has been left behind or dumped by a party to an armed conflict, and which is no longer under control of the party that left it behind or dumped it. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.	AXO	IMAS - International Mine Action Standards IMAS 04.10 Glossary of mine action terms, definitions and abbreviations (Second Edition May 2013)
General	Armed Opposition Group	All individuals and non-state armed groups involved in armed conflict with or armed opposition against the government and/or international military forces.	AOG	iMMAP Security Glossary v2-2014
Other	Arrest	To seize and hold under the authority of law.		iMMAP Security Glossary v2-2014
General	Casualty	A person who is wounded, killed or missing due to the direct result of hostile action or an accident.	CAS	iMMAP Security Glossary v2-2014
General	Checkpoint	A place used by military or security forces to check vehicular or pedestrian traffic in order to enforce circulation control measures and other laws, orders, and regulations.		iMMAP Security Glossary v2-2014
General	Civil War	A large-scale armed conflict within a country fought either for control of all or part of the state, for a greater share of political or economic power, or for the right to secede. Analysts differ on how to define “large-scale,” but several sources say a conflict must cause at least 1000 war-related deaths a year to be labeled a civil war.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Civil-Military Cooperation	A broad term that covers a variety of collaborative relationships between civilian and military actors in a conflict environment.	CIMIC	USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Civil-Military Operations	Activities of a commander performed by designated civil affairs or other military forces that establish, maintain, influence, or exploit relations between military forces, indigenous populations, and institutions, by directly supporting the attainment of objectives relating to the reestablishment or maintenance of stability within a region or host nation.		Joint Publication 3-57 Civil-Military Operations
Armed Conflict	Combatants	Those actively engaged in hostilities.		UNTERM - United Nations Multilingual Terminology Database
General	Conflict Analysis	The systematic study of conflict in general and of individual or group conflicts in particular. Conflict analysis provides a structured inquiry into the causes and potential trajectory of a conflict so that processes of resolution can be better understood.		USIP - Glossary of Terms for Conflict Management and Peacebuilding

Armed Conflict	Counter-Insurgency	Comprehensive civilian and military efforts designed to simultaneously defeat and contain insurgency and address its root causes.		Joint Publication 3-24 - Counterinsurgency
General	Counter-Terrorism	Actions taken directly against terrorist networks and indirectly to influence and render global and regional environments inhospitable to terrorist networks.		Joint Publication 3-26 - Counterterrorism
Armed Conflict	Crimes Against Humanity	Mass killings and targeted attacks against civilians, including systematic rape. These crimes are described more fully in the Rome Statute of the International Criminal Court, article 7. To be found guilty, an individual must have developed or carried out a policy of widespread or systematic violations. Crimes against humanity do not require the specific intent that genocide does.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Other	Detention	The holding of a person by someone acting under authority (e.g. police, border guards) where the person is not free to leave.		HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
General	Deterrence	An effort by one actor to persuade an opponent not to take an action by convincing the opponent that the costs and risks of doing so will outweigh what might be gained.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Disarmament, Demobilization and Reintegration	The process of disarming soldiers or other fighters, disbanding their military units, and helping them integrate socially and economically into society by finding civilian livelihoods.	DRR	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Other	Explosion	Sudden release of energy producing a blast effect with the possible projection of fragments		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
ERW	Explosive Ordnance Disposal	The detection, identification, evaluation, render safe, recovery and disposal of explosive ordnance.	EOD	IMAS - International Mine Action Standards IMAS 04.10 Glossary of mine action terms, definitions and abbreviations (Second Edition May 2013)
ERW	Explosive Remnants of War	Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO).	ERW	Protocol on Explosive Remnants of War (Protocol V to the 1980 CCW Convention), 28 November 2003
Other	Expulsion			
General	Fatality	A person who is killed due to the direct result of hostile action or an accident.		iMMAP Security Glossary v2-2014
Other	Flooding			
Armed Conflict	Genocide	The Convention on the Prevention and Punishment of the Crime of Genocide defines genocide as “any of a number of acts committed with the intent to destroy, in whole or in part, a national, ethnic, racial or religious group: killing members of the group; causing serious bodily or mental harm to members of the group; deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part; imposing measures intended to prevent births within the group, and forcibly transferring children of the group to another group.”		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Guerilla War	Warfare conducted by an irregular military or paramilitary unit using techniques such as harassment, sabotage, and surprise attacks against a more powerful force. Guerrilla groups may seize control of and live among unarmed civilian populations that are influenced to provide labor, food, and other supplies. Successful guerrilla campaigns are usually protracted and have the support of the local population as well as external assistance.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Other	Hate Speech	Speech that is intended to foster hatred against groups based on race, religion, gender, sexual preference, national origin, or other traits. At the least it fosters hatred and discrimination, and at its worst it promotes violence and killing.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Ideology	A system of beliefs or theories, usually about politics or culture, held by an individual or a group.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Injury	Damage or harm done to or suffered by a person caused by physical harm.		iMMAP Security Glossary v2-2014
General	Insurgency	The organized use of subversion and violence to seize, nullify, or challenge political control of a region. Insurgency can also refer to the group itself.		Joint Publication 3-24 - Counterinsurgency
General	Insurgency	Paramilitary, guerrilla, or other uprisings directed against a state from within in order to achieve political objectives. Insurgencies typically		USIP - Glossary of Terms for Conflict Management and Peacebuilding

		aim to either replace the current regime, or to secede from the state. Successful insurgencies have the support of the local population.		
Armed Conflict	Insurgent	An individual involved in armed conflict with or armed opposition against the government and/or international military forces.		
General	Internally Dispaced Person	A person who has been forced from his home but did not cross an internationally recognized border.	IDP	iMMAP Security Glossary v2-2014
General	Internally Displaced Person	A person who has been forced to leave their home, in particular as a result of armed conflict, generalized violence, violations of human rights, or natural or human-made disasters, but has not crossed an internationally recognized state border.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	International Organization	A formal institutional structure generally created by international agreement with the goal of fostering cooperation in specific areas.	IO	USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Interrogate			
Armed Conflict	Irregular Warfare	A violent struggle among state and non-state actors for legitimacy and influence over the relevant population(s). Irregular warfare favors indirect and asymmetric approaches, though it may employ the full range of military and other capacities, in order to erode an adversary's power, influence, and will.		Joint Publication 3-26 - Counterterrorism
Other	Mass Grave	A grave containing multiple, usually unidentified human corpses.		iMMAP Security Glossary v2-2014
Armed Conflict	Militant	See: Insurgent		
Armed Conflict	Militia	See: Armed Opposition Group		
General	Mob	An aggressive group of people with destructive or violent intent.		HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Other	Natural Disaster			
General	Nongovernmental Organization	A private, self-governing, nonprofit organization dedicated to advancing an objective or objectives such as alleviating human suffering; promoting education, health care, economic development, environmental protection, human rights, and conflict resolution; and encouraging the establishment of democratic institutions and civil society. Some people use the term international nongovernmental organization (INGO) to differentiate those organizations that transcend national boundaries from local NGOs.	NGO	USIP - Glossary of Terms for Conflict Management and Peacebuilding
General	Nonstate Actor	A large category that includes nongovernmental organizations, multinational corporations, media, terrorist groups, warlords, insurgents, criminal organizations, religious groups, trade unions, universities, and diaspora communities.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Other	Pandemic			
General	Paramilitary Forces	Forces or groups distinct from the regular armed forces of any country, but resembling them in organization, equipment, training, or mission.		Joint Publication 3-24 - Counterinsurgency
Armed Conflict	Peace Operation	A generic term sometimes used to encompass peacemaking, peacekeeping, peace enforcement, and peace building, the lines between which are not always clear.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Security Terminology	Perimeter Breach	The violation of a security boundary either overtly or covertly.		iMMAP Security Glossary v2-2014
Security Terminology	Perpetrator			
Security Terminology	Personal Protective Equipment	All equipment and clothing designed to provide protection, which is intended to be worn or held by an employee at work and which protects him/her against one or more risks to his/her safety or health.	PPE	iMMAP Security Glossary v2-2014
Other	Pollution			
Other	Population Movement			
Other	Prison/Hostage Exchange			
General	Refugee	A person who has been forced to leave their home, in particular as a result of armed conflict, generalized violence, violations of human rights, or natural or human-made disasters, and has crossed an internationally recognized state border.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Security Terminology	Residual Risk	The remaining potential for harm to persons, property or the environment following all possible efforts to reduce predictable hazards.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions

Security Terminology	Risk	The likelihood and potential impact of encountering a threat.		HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Security Terminology	Risk Reduction	Actions taken to lessen the probability, negative consequences or both, associated with a particular risk.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Other	Road Traffic Accident	An accident involving a motor vehicle.	RTA	iMMAP Security Glossary v2-2014
General	Rule of Law	A principle of governance in which all persons and institutions, public and private, including the state itself, are accountable to laws that are publicly announced, equally enforced and independently adjudicated, and consistent with international human rights norms and standards. The drafting of laws must be transparent, and they must be applied fairly and without arbitrariness. In addition, all persons must have access to justice—the ability to seek and obtain a remedy through informal or formal institutions of justice.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Rules of Engagement	The rules delineating the circumstances and limitations under which force should be used by the military or police, including when, where, and against whom.	ROE	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Security Terminology	Security Concern			
General	Security Forces	Duly constituted military, paramilitary, police, and constabulary forces of a state.		Joint Publication 3-22, Foreign Internal Defense
General	Security Sector	The security sector is defined as those who are, or should be, responsible for protecting the state and communities within the state. This includes military, paramilitary, intelligence and police services as well as those civilian structures responsible for oversight and control of the security forces and for the administration of justice.		DFID - Glossary of terms used by the Department for International Development
General	Security Sector Reform	The set of policies, plans, programs, and activities that a government undertakes to improve the way it provides safety, security, and justice.	SSR	USIP - Glossary of Terms for Conflict Management and Peacebuilding
Security Terminology	Standard Operating Procedures	Instructions which define the preferred or currently established method of conducting an operational task or activity. Their purpose is to promote recognizable and measurable degrees of discipline, uniformity, consistency and commonality within an organization, with the aim of improving operational effectiveness and safety. SOPs should reflect local requirements and circumstances.	SOP	IMAS - International Mine Action Standards IMAS 04.10 Glossary of mine action terms, definitions and abbreviations (Second Edition May 2013)
Security Terminology	Standard Operating Procedures	Formally established procedures for carrying out particular operations or dealing with particular situations, specifically regarding how to prevent an incident happening, survive an incident or follow up on an incident as part of the agency's crisis management planning.		HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
General	State-sponsored Terrorism	The support by a state for nonstate actors that commit terrorist acts.		USIP - Glossary of Terms for Conflict Management and Peacebuilding
Armed Conflict	Subversion	Actions designed to undermine the military, economic, psychological, or political strength or morale of a governing authority.		Joint Publication 3-24 - Counterinsurgency
Other	Suicide	Intentional killing of oneself.		iMMAP Security Glossary v2-2014
Security Terminology	Surveillance	The systematic observation of areas, places, persons, or things, by visual, aural, electronic, photographic, or other means.		iMMAP Security Glossary v2-2014
Security Terminology	Suspicious Activities	Any activity that is out of the ordinary, if that activity gives rise to a suspicion		iMMAP Security Glossary v2-2014
General	Terrorism	The the threatened or actual use of illegal force and violence, typically against civilians, perpetrated by a non-state actor for the purpose of attaining a political, economic, religious or social goal through fear, coercion or intimidation.		iMMAP Security Glossary v2-2015
Security Terminology	Threat	A danger in the operating environment.		HNI - GPD8 - Operational Security Management in Violent Environments - Glossary
Security Terminology	Threat Advisory			
Security Terminology	Threat Assessment	The process to systematically examine the nature, origin, frequency and geographical concentration of threats.		iMMAP Security Glossary v2-2014
ERW	Unexploded Ordnance	Explosive ordnance that has been primed, fuzed, armed or otherwise prepared for use or used. It may have been fired, dropped, launched or projected yet remains unexploded either through malfunction or design or for any other reason.	UXO	IMAS - International Mine Action Standards IMAS 04.10 Glossary of mine action terms, definitions and abbreviations (Second Edition May 2013)

Other	Unknown Explosion		
General	Weapon	Anything used, designed or intended for use in causing death or injury, or for the purposes of threatening or intimidating any person.	IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
General	Weapons Cache	A hidden store of weapons or explosives.	iMMAP Security Glossary v2-2014
Armed Conflict	Weapons of Mass Destruction	A term that typically refers to nuclear, biological, or chemical weapons.	USIP - Glossary of Terms for Conflict Management and Peacebuilding

14.3 Weapons definitions

Category	Label Full	Definition	Acronym	Source
Weapon Definitions	Adhesive IED	An IED which is attached to its target - often a vehicle - with tape, glue, a magnet or another adhesive material. Often also referred to as a limpit device.	AIED	iMMAP Security Glossary v2-2014
Weapon Definitions	Anti-handling Device	A device intended to protect a mine and which is part of, linked to, attached or placed under the mine and which activates when an attempt is made to tamper with or otherwise intentionally disturb the mine.		AAP-06 - NATO Glossary of Terms and Definitions
Weapon Definitions	Anti-personnel Mine	A mine designed to be exploded by the presence, proximity or contact of a person and that will incapacitate, injure or kill one or more persons.	APM	IMAS - International Mine Action Standards IMAS 04.10 Glossary of mine action terms, definitions and abbreviations (Second Edition May 2013)
Weapon Definitions	Anti-vehicle Mine	Mines designed to be detonated by the presence, proximity or contact of a vehicle.		UNMAS Explosive Hazards Lexicon
Weapon Definitions	Biological Weapon	A micro-organism that causes disease in personnel, plants, or animals or causes the deterioration of materiel.		Joint Publication 1-02, DOD Dictionary of Military and Associated Terms
Weapon Definitions	Body Borne IED	An IED worn, carried, or housed by a person, either willingly or unwillingly.	BBIED	UNMAS Explosive Hazards Lexicon
Weapon Definitions	Bomb	Explosive munitions, not subject to centrifugal forces and with a nearly vertical angle of descent, usually delivered from an aircraft or mortar.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Weapon Definitions	Bomblet	Any munitions that, to perform its task, separates from a parent munitions. [AAP-6] mines or munitions that form part of a Cluster Bomb Unit, artillery shell or missile payload.		AAP-06 - NATO Glossary of Terms and Definitions
Weapon Definitions	Booby Trap	An explosive or non-explosive device, or other material, deliberately placed to cause casualties when an apparently harmless object is disturbed or a normally safe act is performed.		AAP-06 - NATO Glossary of Terms and Definitions
Weapon Definitions	Chemical Weapon	A chemical substance which is intended for use in military operations to kill, seriously injure, or incapacitate mainly through its physiological effects.		Joint Publication 1-02, DOD Dictionary of Military and Associated Terms
Weapon Definitions	Cluster Munitions	A conventional munitions that is designed to disperse or release explosive submunitions each weighing less than 20 kilograms, and includes those explosive submunitions.		CCM - Convention on Cluster Munitions Glossary
Weapon Definitions	Command Wire IED	An IED which can be initiated by a switch at the firing point and a detonator which are separate but joined together by a length of wire.	CWIED	iMMAP Security Glossary v2-2014
Weapon Definitions	Explosive Ordnance	All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Weapon Definitions	Explosively Formed Projectile	Specially designed main charge configuration incorporating an explosive charge with a concave metal liner which by the force of the charge reshapes the plate into a high velocity metal slug capable of penetrating armor.	EFP	UNMAS Explosive Hazards Lexicon

Weapon Definitions	Explosives	A weapon composed of energetically unstable material undergoin g rapid decomposition and releasing a pressure wave that causes physical damage to the surrounding environment		National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2012). Global Terrorism Database Codebook
Weapon Definitions	Explosives	A substance or mixture of substances which, under external influences, is capable of rapidly releasing energy in the form of gases and heat.		AAP-06 - NATO Glossary of Terms and Definitions
Weapon Definitions	Firearm	A weapon which is capable of firing a projectile using an explosive charge as a propellant.		National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2012). Global Terrorism Database Codebook
Weapon Definitions	Hand Grenade	Explosive ordnance that is designed to be thrown by hand.		iMMAP Security Glossary v2-2014
Weapon Definitions	Hoax IED	An IED related incident that involves a device fabricated to look like an IED and that is intended to simulate one in order to elicit a response.		UNMAS Explosive Hazards Lexicon
Weapon Definitions	Homemade Explosive	Non-standard explosive mixtures / compounds which have been formulated / synthesized from available ingredients. Most often utilized in the absence of commercial / military explosives.	HME	UNMAS Explosive Hazards Lexicon
Weapon Definitions	Improvised Explosive Device	A device placed or fabricated in an improvised manner incorporating explosive material, destructive, lethal, noxious, incendiary, pyrotechnic materials or chemicals designed to destroy, disfigure, distract or harass. They may incorporate military stores, but are normally devised from non-military components.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Weapon Definitions	Incendiary Device	A weapon that is capable of catching fire, causing fire, or burning readily and produces intensely hot fire when exploded.		National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2012). Global Terrorism Database Codebook
Weapon Definitions	Indirect Fire	Fire delivered on a target without the weapon system having a direct line of sight at the point of aim. Commonly used to describe artillery, mortar and rocket fire.		iMMAP Security Glossary v2-2014
Weapon Definitions	Magnetic IED	See: Adhesive IED	MIED	iMMAP Security Glossary v2-2014
Weapon Definitions	MANPADS	Man-portable Air Defense System - An air defense system designed to be carried as an integral part of individual, crew-served, or team equipment.	MANPADS	iMMAP Security Glossary v2-2014
Weapon Definitions	Mine	Munitions designed to be placed under, on or near the ground or other surface area and to be exploded by the presence, proximity or contact of a person or a vehicle.		IMAS - International Mine Action Standards IMAS 04.10 Glossary of mine action terms, definitions and abbreviations (Second Edition May 2013)
Weapon Definitions	Mortar	A muzzle-loading, indirect fire weapon with either a rifled or smooth bore. It usually has a shorter range than a howitzer, employs a higher angle of fire, and has a tube with a length of 10 to 20 calibers.		Joint Publication 1-02, DOD Dictionary of Military and Associated Terms
Weapon Definitions	Munitions (Ammunition)	A complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions.		AAP-06 - NATO Glossary of Terms and Definitions
Weapon Definitions	Munitions / Ammunition	Explosive ordnance that has been primed, fuzed, armed or otherwise prepared for use or used. It may have been fired, dropped, launched or projected yet remains unexploded either through malfunction or design or for any other reason.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Weapon Definitions	Radiological Dispersal Device	A bomb in which conventional high explosives are surrounded with a highly radioactive material which, when dispersed in an explosion, would create fallout and could contaminate large urban areas. The radiological isotopes used to produce radiological dispersal devices are found in waste from medical facilities, industrial plants, and nuclear power plants.	RDD	UNTERM - United Nations Multilingual Terminology Database

Weapon Definitions	Remote Controlled IED	An IED initiated electronically by wireless means consisting of a transmitter / receiver.	RCIED	UNMAS Explosive Hazards Lexicon
Weapon Definitions	Rocket	Munitions consisting of a rocket motor and a payload, which may be an explosive warhead or other device. The term often includes both guided and unguided missiles, although it traditionally referred to unguided missiles.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Weapon Definitions	Rocket Propelled Grenade	A type of grenade propulsed by a rocket motor which is fired from the shoulder; a shoulder-launched anti-tank weapon.	RPG	iMMAP Security Glossary v2-2014
Weapon Definitions	Small Arms	Any man-portable lethal weapon designed for individual use that expels or launches, is designed to expel or launch, or may be readily converted to expel or launch a shot, bullet or projectile by the action of an explosive. Includes, inter alia, revolvers and self-loading pistols, rifles and carbines, sub-machine guns, assault rifles and light machine guns.		IATG - International Ammunition Technical Guidelines 01.40:2011 Terms, Glossary and Definitions
Weapon Definitions	Suicide IED	A Body Borne IED which is carried by an individual committed to conduct the attack and who is aware that the event will result in death.	SIED	iMMAP Security Glossary v2-2014
Weapon Definitions	Suicide Vehicle Borne IED	An IED delivered by or concealed in a ground-based vehicle driven by an individual committed to conduct the attack and who is aware that the event will result in death.	SVBIED	iMMAP Security Glossary v2-2014
Weapon Definitions	Surface to Air Weapon System	A surface-launched weapon for use against airborne targets. Examples include missiles, rockets, and air defense guns.		Joint Publication 3-09.3 - Close Air Support
Weapon Definitions	Vehicle Borne IED	An IED delivered by or concealed in a ground-based vehicle.	VBIED	UNMAS Explosive Hazards Lexicon
Weapon Definitions	Victim Operated IED	An IED that is activated by the actions of an unsuspecting individual. These instruments rely on the intended target to carry out some form of action that will cause it to function.	VOIED	UNMAS Explosive Hazards Lexicon

14.4 Security Acronyms

Acronym	Term
AIED	Adhesive IED
AOG	Armed Opposition Group
AOG	Armed Opposition Group
AOR	Area of Responsibility
APM	Anti-personnel Mine
AXO	Abandoned Explosive Ordnance
BBIED	Body Borne Improvised Exploding Device
BBIED	Body Borne IED
CAS	Casualty
CIMIC	Civil-Military Cooperation
CPX	Complex Attack
CWIED	Command Wire IED
DRR	Disarmament, Demobilization and Reintegration
ECP	Entry Control/ Check Point
EFP	Explosively Formed Projectile
EOD	Explosive Ordnance Disposal
EOF	Escalation Of Force
ERW	Explosive Remnants of War
FN	Foreign National(s)
FOB	Forward Operating Base
HME	Homemade Explosive
HVT	High Value Target
IDF	Indirect Fire
IDF	Indirect Fire
IED	Improvised Explosive Device
IMF	International Military Forces
	International Organization
IVO	In The Vicinity Of
KIA	Killed In Action
LN	Local National(s)
MANPADS	Man Portable Air Defense System
MIED	Magnetic IED
NC	No Casualties
NFI	No Further Information
NFTR	Nothing Further To Report
NGO	Nongovernmental Organization
NSTR	Nothing Significant To Report
NTR	Nothing To Report
PPE	Personal Protective Equipment
PRP	Previous Reporting Period
PSAF	Precise Small Arms Fire (Sniper)
PSC	Private Security Company
PSD	Private Security Detail
RCIED	Remote Controlled Improvised Explosive Device
RCIED	Remote Controlled IED
RDD	Radiological Dispersal Device
ROE	Rules of Engagement
RPG	Rocket Propelled Grenade
RPG	Rocket Propelled Grenade
RPG	Rocket Propelled Grenade
RTA	Road Traffic Accident
SAF	Small Arms Fire
SIED	Suicide IED

SOP	Standard Operating Procedures	UXO	Unexploded Ordnance
SSR	Security Sector Reform	VBIED	Vehicle Borne Improvised Explosive Device
SVBIED	Suicide Vehicle Borne IED	VBIED	Vehicle Borne IED
TTP	Tactics Techniques & Procedures	VOIED	Victim Operated IED
UK	Unknown	WIA	Wounded In Action

15 Annex B: Data sources

Data Title	Source/Citation	Description | Accuracy
Afghanistan and neighboring countries	Afghanistan and neighboring countries. Afghanistan Geodesy and Cartography Head Office (AGCHO) (2012)	Boundaries of the world with the boundaries of Afghanistan adjusted to match the AGCHO boundaries. Added Dari and Pashto names for neighboring countries. | Accuracy: Scale of Afghan boundary 1:50K, neighboring countries 1:1M
Afghanistan country		Boundary line of Afghanistan and neighboring countries, Adjusted to match the AGCHO 2012 boundaries. | Accuracy: Scale of Afghan boundary 1:50K, neighboring countries 1:1M
Afghanistan country boundary		Boundary area of Afghanistan, matches the AGCHO boundaries. | Accuracy: Scale of Afghan boundary 1:50K
Afghanistan GSM Coverage	Afghanistan GSM Coverage. Emlyn Hagen, iMMAP (2016)	GSM/Mobile phone coverage modelled for entire Afghanistan. Using this data, it is possible to assess which villages/infrastructure and which population have GSM coverage. The data was modelled by the DRR team, after digitization of all mobile phone towers. One Afghan operator shared their coverage data with iMMAP, which was used to calibrate the coverage methodology for other operators. | Accuracy: The data which was provided by an Afghan operator should be very accurate. The iMMAP modeled data can contain errors, as the exact tower location can be incorrectly placed, nor is information about tower transmission wattage known nor if it is a directional tower.
Airports	Airports of Afghanistan. iMMAP (2015)	Airports visually confirmed and digitised in satellite imagery by iMMAP staff. Runway length, width estimated from digitised runways. Other attributes NGA/WFP | Accuracy: Accuracy: 10K
Airports area		
Avalanche areas	Emlyn Hagen, iMMAP (2015) Avalanche Areas of Afghanistan v.1 Scale: 1:150.000	iMMAP has modelled 340.000 avalanche areas for entire Afghanistan. The modelling process was conducted in two major components, at one hand the identification of the Avalanche trigger areas, and at the other hand modelling the avalanche chute and run-out areas. The iMMAP data is modelled, and utilizes as a main input dataset 30m resolution ASTER DEM. - The avalanche areas were only computed for areas which had snow cover of the past 9 years. - The trigger areas were calculated using established methodologies | Accuracy: Scale: 150K
Avalanche risk at district level		
Avalanche risk at province level		
Avalanche risk at settlement level	Emlyn Hagen, iMMAP (2015) Avalanche Areas of Afghanistan v.1 Scale: 1:150.000	iMMAP has modelled 340.000 avalanche areas for entire Afghanistan. The modelling process was conducted in two major components, at one hand the identification of the Avalanche trigger areas, and at the other hand modelling the avalanche chute and run-out areas. The iMMAP data is modelled, and utilizes as a main input dataset 30m resolution ASTER DEM. - The avalanche areas were only computed for areas which had snow cover of the past 9 years. - The trigger areas were calculated using established methodologies | Accuracy: Scale: 150K
Average snow and ice cover Jan-Dec	IMS NSIDC (2016) and WMO-FFGS (2016)	The current snow coverage extent is updated daily, and is extracted from a 1km resolution "Snow and ice cover". The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS) at 1km resolution. The snow coverage gives no approximation on depth by itself. It can range from a few mm of snow and ice to multiple meters of snow. The snow depth is based on the Snow Water Equivalent (SWE), which gives how much water a snow pack would contain in melted form (in mm depth). The depth is approximated from the snow compactness ratio, with a minimum of 1/10 (fluffy snow) to 1/2 for very dense/compact snow (heavy/wet snow). The Snow Water Equivalent (SWE) is extracted from the SNOW-17 snow accumulation and ablation model, aggregated at the Flash Flood Guidance System Basis level. Snow-17 was first described by Anderson (1973) as a component of the National Weather Service River Forecast System (NWSRFS) | Accuracy: Resolution: 1km.
Average snow and ice cover Jan-Dec	Average snow and ice cover Jan-Dec 2006-2015. Emlyn Hagen, iMMAP (2015) and IMS NSIDC 2006-2015	This data provide average snow and ice cover for Afghanistan from February 2006 until October 2015. In the attribute table the average coverage for each month can be found, as well as a total maximum coverage. The data was aggregated from more than 3500 daily 4km resolution observations grouped by month. The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS). It is derived from a variety of data products including satellite imagery and in situ data. Source: National Ice Center. 2008, updated daily. IMS Daily Northern Hemisphere Snow and Ice Analysis at 4 km Resolutions, Version 1 (February 2006-31st October 2015). Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center

		The data is represented in 5 classes, minimum and maximum coverage extent observed between 2006 and 2015. The monthly average, and high and low average coverage extent observed. The main map depicts the maximum extend of each of the classes. Source: Provincial/District boundaries, AGCHO (2012). iMMAP E. Hagen, Land cover-Settlement-Population (2015), MRRD, Road network (2014). USAID MISTI Settlements (2014) | Accuracy: Resolution: 4km.
Building outlines (OSM)	OpenStreetMap (2016)	The POI's of Afghanistan created by OpenStreetMaps | Accuracy: Positional accuracy 1:25K. However the dataset is not complete, but will improve over time by OSM contributors. Occasionally incorrect POI's will present, these will over time be removed by the user community. Some specific POI's such as hospital locations have been removed from his list, as the iMMAP uses more reliable and more complete data sources for these.
Contour lines (dynamic)	Dynamically generated from ASTER DEM	Shows the countour lines at various intervals | Accuracy: Scale: 50K
Current snow cover extent	IMS NSIDC (2016)	The current snow coverage extent is updated daily, and is extracted from a 1km resolution "Snow and ice cover". The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS) at 1km resolution. The snow coverage gives no approximation on depth by itself. It can range from a few mm of snow and ice to multiple meters of snow. The snow depth is based on the Snow Water Equivalent (SWE), which gives how much water a snow pack would contain in melted form (in mm depth). The depth is approximated from the snow compactness ratio, with a minimum of 1/10 (fluffy snow) to 1/2 for very dense/compact snow (heavy/wet snow). The Snow Water Equivalent (SWE) is extracted from the SNOW-17 snow accumulation and ablation model, aggregated at the Flash Flood Guidance System Basis level. Snow-17 was first described by Anderson (1973) as a component of the National Weather Service River Forecast System (NWSRFS) | Accuracy: Resolution: 1km.
Current snow depth	IMS NSIDC (2016) and WMO-FFGS (2016)	The current snow coverage extent is updated daily, and is extracted from a 1km resolution "Snow and ice cover". The source data originates from the US National Ice Center's Interactive Multisensor Snow and Ice Mapping System (IMS) at 1km resolution. The snow coverage gives no approximation on depth by itself. It can range from a few mm of snow and ice to multiple meters of snow. The snow depth is based on the Snow Water Equivalent (SWE), which gives how much water a snow pack would contain in melted form (in mm depth). The depth is approximated from the snow compactness ratio, with a minimum of 1/10 (fluffy snow) to 1/2 for very dense/compact snow (heavy/wet snow). The Snow Water Equivalent (SWE) is extracted from the SNOW-17 snow accumulation and ablation model, aggregated at the Flash Flood Guidance System Basis level. Snow-17 was first described by Anderson (1973) as a component of the National Weather Service River Forecast System (NWSRFS) | Accuracy: Resolution: 1km.
District Avalanche forecast risk	Emlyn Hagen, iMMAP (2015) Avalanche Areas of Afghanistan v.1 Scale: 1:150.000 and WHO/FFGS (2016)	The avalanche forecast risk is based on solely on the Current Snow Coverage and Depth extent and the presence of avalanche areas. This is a very rudimentary risk forecast as there are no accurate/sufficient ground observation stations available. With proper observations the stability condition of the snowpack, can be assessed. The avalanche risk is based on the following categories of snow water equivalent (SWE): Low: SWE > 60 and <= 100 mm ; Moderate: SWE > 100 and <= 140 mm: High: SWE > 140 mm. iMMAP has modelled 340.000 avalanche areas for entire Afghanistan. The modelling process was conducted in two major components, at one hand the identification of the Avalanche trigger areas, and at the other hand modelling the avalanche chute and run-out areas. The iMMAP data is modelled, and utilizes as a main input dataset 30m resolution ASTER DEM. - The avalanche areas were only computed for areas which had snow cover of the past 9 years. - The trigger areas were calculated using established methodologies | Accuracy: Scale: 150K
District boundaries	Afghanistan Geodesy and Cartography Head Office (AGCHO) (2012)	Shows the 399 district boundary lines of Afghanistan. Dari and Pashto names were added by iMMAP. Source: Afghanistan Geodesy and Cartography Head Office (AGCHO). AGCHO and the Independent Directorate for Local Governance (IDLG) are recognized as the sole authoritative source for legal and technical issues related to the delimitation of administrative boundaries, composition, and division of the administrative units of Afghanistan as per the following

		references: 1) Letter between AGCHO and the President's Office (dated 5 March 2007); and 2) Joint statement from IDLG and AGCHO (dated 26 March 2012). | Accuracy: 0
District Flash Flood Forecast Estimates	WHO/FFGS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. | Accuracy: Basin level
District Flood Forecast Estimates	WHO/FFGS (2016), Global Flood Monitoring System - GFMS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Combination of the Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. The other flood risk are typical river floods, these are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS). As base system it used the Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 12km
District Flood risk estimates	Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Final Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 0
District River Flood Forecast Estimates	Global Flood Monitoring System - GFMS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	River floods are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS). As base system it used the Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 12km
Districts	Afghanistan Geodesy and Cartography Head Office (AGCHO) (2012)	Shows the 399 district boundary areas of Afghanistan. Dari and Pashto names were added by iMMAP. Source: Afghanistan Geodesy and Cartography Head Office (AGCHO). AGCHO and the Independent Directorate for Local Governance (IDLG) are recognized as the sole authoritative source for legal and technical issues related to the delimitation of administrative boundaries, composition, and division of the administrative units of Afghanistan as per the following references: 1) Letter between AGCHO and the President's Office (dated 5 March 2007); and 2) Joint statement from IDLG and AGCHO (dated 26 March 2012). | Accuracy: Scale: 50k officially, though 150k is more likely
Epicenter data	USGS. Earthquake program (2016)	Magnitude and Intensity measure different characteristics of earthquakes. Magnitude measures the energy released at the source of the earthquake. Magnitude is determined from measurements on seismographs. Intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined from effects on people, human structures, and the natural environment.
Epicenter data of the past day		
Epicenter data of the past month		
Epicenter data of the past week		
Epicenter data of the past year		
Faults (CAFD)	Mohadjer, S., Strube, T., Ehlers, T.A., Bendick, R., 2015, Central Asia Fault Database.	Geological faults of Afghanistan | Accuracy: Unknown
Faults (USGS)	By Oliver S. Boyd, Charles S. Mueller, and Kenneth S. Rukstales (2007). Earthquake Hazard Map for Afghanistan. USGS	Geologic faults used or considered in calculating the seismic hazard of Afghanistan | Accuracy: Unknown

Flood exposure risk	Flood exposure risk, 100 year inundation interval (Emlyn Hagen, iMMAP 2016)	Estimates the population and land cover at flood risk, based upon the NATO Flood Hazard Map and the FAO Land cover population enhanced dataset. | Accuracy: Scale: 100K
Flood risk zones (100 year interval - depth >1.2m) Flood risk zones (100 year interval - depth >2.7m) Flood risk zones (100 year interval - depth >29cm) Flood risk zones (100 year interval)	Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Final Flood Hazard Map of Afghanistan. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: Scale: 1:100K The Afghanistan Flood Hazard Maps were created by the NATO Consultation, Command and Control Agency ("NC3A"), Geo-Team. Some flaws and limitations of the data are described below. However, a degree of error is inherent in all maps, especially modeled maps and maps of dynamic events such as floods. Accordingly, the maps are distributed "AS-IS" without warranties of any kind, either express or implied. NC3A shall not accept any liability or warranties for damages incurring from the use of these maps, including but not limited to warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government. The map is intended for use only at the published scale.
Health Facilities	Health Facilities HMIS and HPRO survey. Emlyn Hagen, iMMAP (Oct 2015)	Contains the health facilities of Afghanistan, it is a combination of a cleaned MoPH-HMIS (October 2015) and WHO-HPRO Survey 2015. | Accuracy: At present the most accurate health facility dataset in Afghanistan. This data has been cleaned and the information thouroughly investigated, also using sattelite imagery. Some facilities will be at a scale of 1:10K others will only be possitioned in or near the settlement coordinates. Though it is not unlikely that some facilities will be located in an incorrect settlement/district or even province.
Land cover Land cover (simplified)	Land cover of Afghanistan (FAO, 2012)	Land cover data set of Afghanistan (FAO), enhanced with population estimates and village names (by iMMAP) | Accuracy: Scale: 50k officially, though 150k is more likely
Main basins	Main basins of Afghanistan, Emlyn Hagen (2009)	5 main basins in Afghanistan, created and simplified from 10 sqkm watershed | Accuracy: Scale: 200K
Mitigated areas	Mitigated areas (iMMAP, 2015)	The areas have been mitigated either by physical constructions such as gabion walls or avalanche protection, alternatively it can indicate areas which have received preparedness training. These areas can be mapped, or be utilized to reduce e.g. Flood risk | Accuracy: Scale 150K
Oasis_Settlements	iMMAP (2016)	Settlements database used by the obsolete Oasis Incident management system | Accuracy:
POI's (OSM)	OpenStreetMap (2016)	The POI's of Afghanistan created by OpenStreetMaps | Accuracy: Positional accuracy 1:25K. However the dataset is not complete, but will improve over time by OSM contributors. Occasionally incorrect POI's will present, these will over time be removed by the user community. Some specific POI's such as hospital locations have been removed from his list, as the iMMAP uses more reliable and more complete data sources for these.
Population at district level Population at province level Population at settlement level	iMMAP (2016)	The population is aggregated from settlement and landcover dataset | Accuracy:
Population density at district level Population density at province level Population density at settlement level	iMMAP (2016)	The population is density is calculated based upon the area size and the total population | Accuracy:
Province Avalanche forecast risk	Emlyn Hagen, iMMAP (2015) Avalanche Areas of Afghanistan v.1 Scale: 1:150.000 and WHO/FFGS (2016)	The avalanche forecast risk is based on solely on the Current Snow Coverage and Depth extent and the presence of avalanche areas. This is a very rudimentary risk forecast as there are no accurate/sufficient ground observation stations available. With proper observations the stability condition of the snowpack, can be assessed. The avalanche risk is based on the following categories of snow water equivalent (SWE): Low: SWE > 60 and <= 100 mm ; Moderate: SWE > 100 and <= 140 mm: High: SWE > 140 mm. iMMAP has modelled 340.000 avalanche areas for entire Afghanistan. The modelling process was conducted in two major components, at one hand the identification of the Avalanche trigger areas, and at the other hand modelling the avalanche chute and run-out areas. The iMMAP data is modelled, and utilizes as a main input dataset 30m resolution ASTER DEM. - The avalanche areas were only computed for areas which had snow cover of

		the past 9 years. - The trigger areas were calculated using established methodologies | Accuracy: Scale: 150K
Province boundaries	Afghanistan Geodesy and Cartography Head Office (AGCHO) (2012)	Shows the 34 provincial boundary lines of Afghanistan. Dari names were added by iMMAP. Source: Afghanistan Geodesy and Cartography Head Office (AGCHO). AGCHO and the Independent Directorate for Local Governance (IDLG) are recognized as the sole authoritative source for legal and technical issues related to the delimitation of administrative boundaries, composition, and division of the administrative units of Afghanistan as per the following references: 1) Letter between AGCHO and the President's Office (dated 5 March 2007); and 2) Joint statement from IDLG and AGCHO (dated 26 March 2012). | Accuracy: Scale: 50k officially, though 150k is more likely
Province Flash Flood Forecast Estimates	WHO/FFGS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. | Accuracy: Basin level
Province Flood Forecast Estimates	WHO/FFGS (2016), Global Flood Monitoring System - GFMS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Combination of the Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. The other flood risk are typical river floods, these are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS). As base system it used the Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 12km
Province Flood risk estimates	Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Final Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 0
Province River Flood Forecast Estimates	Global Flood Monitoring System - GFMS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	River floods are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS). As base system it used the Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 12km
Provinces	Afghanistan Geodesy and Cartography Head Office (AGCHO) (2012)	Shows the 34 provincial boundary areas of Afghanistan. Dari names were added by iMMAP. Source: Afghanistan Geodesy and Cartography Head Office (AGCHO). AGCHO and the Independent Directorate for Local Governance (IDLG) are recognized as the sole authoritative source for legal and technical issues related to the delimitation of administrative boundaries, composition, and division of the administrative units of Afghanistan as per the following references: 1) Letter between AGCHO and the President's Office (dated 5 March 2007); and 2) Joint statement from IDLG and AGCHO (dated 26 March 2012). | Accuracy: Scale: 50k officially, though 150k is more likely
Rivers (50K)	50K rivers, Emlyn Hagen (2009)	Rivers modelled from 10 square kilometer catchment areas, extracted from a hydrological corrected DEM. | Accuracy: Scale 50K, though the rivers will be inside the main floodplain/flood zone. They will not following the same path as the actually rivers where these are braiding or within alluvial fans.
Road network	Afghanistan roads. Emlyn Hagen, iMMAP (2016).	Routable road network of Afghanistan from a variety of sources, including digitization by iMMAP. Road speed is calculated based on slope, sinuosity, elevation, type, number of river crossings, length through water and or build-up areas. | Accuracy: Scale: 1:25K. Completeness of road network coverage

		varies throughout the country. Especially the central highland areas are less densely covered.
Seismic intensity	Seismic intensity data and classes. USGS Earthquake Hazard Map for Afghanistan, by Oliver S. Boyd, Charles S. Mueller, and Kenneth S. Rukstales (2007)	Peak Horizontal Acceleration with 2 Percent Probability of Exceedance in 50 years. The seismic intensity data and classes originate from the USGS Earthquake Hazard Map for Afghanistan (2007), by By Oliver S. Boyd, Charles S. Mueller, and Kenneth S. Rukstales | Accuracy: A 2 percent probability of exceedance in 50 years corresponds to a ground-motion return time of approximately 2500 years, or approximately a 10% probability of exceedance in 250 years.
Seismic intensity settlements	Seismotectonic Map of Afghanistan. By Russell L. Wheeler, Charles G. Bufe, Margo L. Johnson, and Richard L. Dart. (2005)	Shows for each of the settlements the potentail seismic intensity. Based upon Peak Horizontal Acceleration with 2 Percent Probability of Exceedance in 50 years. The seismic intensity data and classes originate from the USGS Earthquake Hazard Map for Afghanistan (2007), by By Oliver S. Boyd, Charles S. Mueller, and Kenneth S. Rukstales | Accuracy: A 2 percent probability of exceedance in 50 years corresponds to a ground-motion return time of approximately 2500 years, or approximately a 10% probability of exceedance in 250 years.
Settlement accessibility	Settlement accessibility data. Emlyn Hagen, iMMAP (2016)	Shows for each settlement the travel time (in seconds) and distance (in m) to multiple features of interest, e.g. Health facilities or airport. It also shows the GSM coverage, as well as the distance and time to the nearest road. | Accuracy: Travel time: Overall the accuracy is acceptable, likely with approx. 30mins deviation where the road network is complete. This accuracy will improve over time, as additional attribute and calibration data of the roads is released. However the accuracy of the travel time depends largely on the completeness of the road network. If a road segment is missing, be it a long road in a valley or a connecting bridge, the impact on the travel time will be substantial. Adding the missing road and recalculating the model will correct this. The destination feature must be positioned accurately as well. GSM Coverage: The data which was provided by an Afghan operator should be very accurate. The iMMAP modeled data can contain errors, as the exact tower location can be incorrectly placed, nor is information about tower transmission wattage known nor if it is a directional tower.
Settlement Avalanche forecast risk	Emlyn Hagen, iMMAP (2015) Avalanche Areas of Afghanistan v.1 Scale: 1:150.000 and WHO/FFGS (2016)	The avalanche forecast risk is based on solely on the Current Snow Coverage and Depth extent and the presence of avalanche areas. This is a very rudimentary risk forecast as there are no accurate/sufficient ground observation stations available. With proper observations the stability condition of the snowpack, can be assessed. The avalanche risk is based on the following categories of snow water equivalent (SWE): Low: SWE > 60 and <= 100 mm ; Moderate: SWE > 100 and <= 140 mm: High: SWE > 140 mm. iMMAP has modelled 340.000 avalanche areas for entire Afghanistan. The modelling process was conducted in two major components, at one hand the identification of the Avalanche trigger areas, and at the other hand modelling the avalanche chute and run-out areas. The iMMAP data is modelled, and utilizes as a main input dataset 30m resolution ASTER DEM. - The avalanche areas were only computed for areas which had snow cover of the past 9 years. - The trigger areas were calculated using established methodologies | Accuracy: Scale: 150K
Settlement Flash Flood Forecast Estimates	WHO/FFGS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. | Accuracy: Basin level
Settlement Flood Forecast Estimates	WHO/FFGS (2016), Global Flood Monitoring System - GFMS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Combination of the Flash Flood are based on the WMO Flash Flood Guidance System (FFGS), and it enables the iMMAP DRR program to integrate Imminent Flash Flood Threats, Persistence Flash Flood Threat and Forecast Flash Flood Threats. In combination with the Afghanistan Flood Hazard Map, iMMAP modelled population and land use estimates it allows to assess the potential number of persons or productive land area at risk of flash flood for the next 6 hours. The other flood risk are typical river floods, these are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS). As base system it used the Flood Hazard Map of Afghanistan. Merged risk

		categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 12km
Settlement River Flood Forecast Estimates	Global Flood Monitoring System - GFMS (2016) and Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	River floods are at present forecasted using the low resolution data from the Global Flood Monitoring System (GFMS) and will early 2016, pending on data availability, be complemented with the EU JRC Global Floods Awareness System (GLOFAS). As base system it used the Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 12km
Settlements (MISTI)	Settlements. Emlyn Hagen, iMMAP (2015), MISTI (2014).	This dataset improved the MISTI settlement data with correct administrative settlements of Afghanistan (Provincial and District Centers), correcting and verifying their location. In addition it contains the calculated area of influence size and population estimates (population estimates originate from land-use-village population estimates). Settlements were allocated to the new (AGCHO, 2012) Administrative province and district regions. The MISTI data was as collected by the Measuring Impacts of Stabilization Initiatives (MISTI) USAID program. The MISTI Village dataset was compiled between March 2012 – June 2013 in support of USAID programs and consolidates village level data from sources: 1) Yale University Population Survey (2011); 2) US Agency for International Development (USAID Village View Dataset); 3) Central Statistics Office, Afghanistan (CSO); 4) Afghanistan Information Management Services (AIMS); 5) Collaborating USAID Implementing Partners. | Accuracy: Positional accuracy is generally within e.g. 100-200 meters of buildup areas/hoses visible in satellite imagery. However, no categorization was made on the original data (differentiation between hamlet or major urban center). The lack of differentiation can lead to grossly overestimated population numbers for a small hamlet, which might be categorized as an urban center or visa versa. Some settlements positions, even for major centers, was incorrect by multiple kilometers, which reduces the confidence of the data. It must be noted the data itself is very similar as the AGCHO settlement data, whereas MISTI is positional slightly better.
Settlements area of influence	Settlements area of influence. Emlyn Hagen, iMMAP (2015)	The Settlement Area of Interest/Influence, indicates the areas which are designated to be closed and/or associated to the settlement. Settlement names originate from the MISTI settlement dataset. | Accuracy: It would be incorrect to considered it as an virtual administrative/cadastral boundary layer. The settlement boundary layers are modelled have no reflection on any real administrative/political boundaries. E.g. A small hamlet/village at the end of a valley with population of 50 persons, could be assigned the hinterland mountain range of multiple hundred square km. Simply as it is the nearest settlement, however the actual settlement and how the local population assess the village might only be 1-2 square km. This association is generally not entirely incorrect, settlements are generally located near productive land where the closest village will be the custodian of the area. Barenland however will not have any villages.
Settlements Flood risk estimates	Emlyn Hagen, NC3A (2008). Afghanistan Flood Hazard Map v.2. 1:100 000. From NATO Consultation, Command and Control Agency, CAT-6, Geo Team. NATO C3 Agency, The Hague, November 2008.	Final Flood Hazard Map of Afghanistan. Merged risk categories including 25m buffer. Created with hydraulic modeling from high Resolution DEM data. For more information on methodology, contact NC3A Geo. | Accuracy: 0
ShakeMap	USGS. Worden et al. (2016) ShakeMap	ShakeMap, developed by the U.S. Geological Survey (USGS), facilitates communication of earthquake information beyond just magnitude and location. By rapidly mapping out earthquake ground motions, ShakeMap portrays the distribution and severity of shaking. This information is critical for gauging the extent of the areas affected, determining which areas are potentially hardest hit, and allowing for rapid estimation of losses. Key to ShakeMap's success, algorithms were developed that take advantage of any high-quality recorded ground motions—and any available macroseismic intensity data—to provide ground-truth constraints on shaking. Yet ShakeMap also utilizes best practices for both interpolating recordings and—critically—providing event-specific estimates of shaking in areas where observations are sparse or nonexistent. Thus, ShakeMap portrays the best possible description of shaking by employing a combination of recorded and estimated shaking values. | Accuracy: UNK

Sub-basin Watersheds	Sub-basin Watersheds, Flash Flood Guidance System. HRC (2014)	These are the level 4 watersheds used and created by the Flash Flood Guidance System (HRC, WMO). These basins watersheds are also used for snow depth, flash flooding and river flood forecasting. | Accuracy: Scale: 100K
Sub-basins	Sub-basins of Afghanistan, Emlyn Hagen (2009)	33 sub-basins in Afghanistan, created and simplified from 10 sqkm watershed | Accuracy: Scale: 200K
Tectonic regions	By Oliver S. Boyd, Charles S. Mueller, and Kenneth S. Rukstales (2007). Earthquake Hazard Map for Afghanistan. USGS	Central Asia Fault Database. Locations of faults shown in the interactive map come from previously published literature and databases. A large number of fault traces are taken from the HimaTibetMap which is an open-source digital database of active faults located in the Indo-Asian collision zone. The faults taken from the HimaTibetMap are based on field observations and interpretations of satellite images and digital topographic data by Taylor et al. (2003) and Taylor and Yin (2009) as well as other previously published work. When digitized data are not available, we digitally captured individual fault traces from maps and figures using ArcMap software. This step required a comprehensive review of published literature that led to the selection of over 20 different scientific manuscripts from which fault traces were captured. To digitize a fault, a map is first aligned to available datasets (e.g., country boundaries) and then georeferenced using more accurate data layers such as ASTER GDEM2 (30-meter resolution). The fault traces are then digitized and linked to an attribute table in ArcMap. The attribute table contains information about each fault including its name, sense of movement, references, and other important remarks such as variations in fault name or location. Fault location accuracy depends on the scale of observation used in previous investigations. When there are discrepancies in fault locations, we slightly adjusted the position of previously mapped faults to coincide with surface features visible in satellite imagery or digital topography data that are indicative of their trace. | Accuracy: Unknown
Travel time to administrative provincial capital	Travel time to administrative provincial capital. Emlyn Hagen, iMMAP (2016)	Shows the travel time in hours and number of population to the destination feature. Travel time is calculated using the iMMAP Road Network layer, which assess average driving speed along roads based on road category, slope, sinuosity, the number of river crossings, travel distance through water ways (river bed), the total length through build-up areas and the population density of these build up areas. Further taken into account it the number of turns, intersections between road categories. | Accuracy: Overall the accuracy is acceptable, likely with approx. 30mins deviation where the road network is complete. This accuracy will improve over time, as additional attribute and calibration data of the roads is released. However the accuracy of the travel time depends largely on the completeness of the road network. If a road segment is missing, be it a long road in a valley or a connecting bridge, the impact on the travel time will be substantial. Adding the missing road and recalculating the model will correct this. The destination feature must be positioned accurately as well.
Travel time to administrative provincial capital		
Travel time to nearest airport		
Travel time to nearest airport		
Travel time to nearest health facility (all)		
Travel time to nearest health facility (all)		
Travel time to nearest health facility (Tier 1)		
Travel time to nearest health facility (Tier 1)		
Travel time to nearest health facility (Tier 2)		
Travel time to nearest health facility (Tier 2)		
Travel time to nearest health facility (Tier 3)		
Travel time to nearest health facility (Tier 3)		
Travel time to the nearest district center		
Travel time to the nearest district center		
Travel time to the nearest provincial capital		
Travel time to the nearest provincial capital		
Water wells	Water wells. DACAAR (2015)	Water wells as recorded and verified by DACAAR. | Accuracy: Accuracy for surveyed wells very high, likely 10K-25K. Wells included in the database from other sources, accuracy unknown.