High Mountain Asia Multitemporal Landslide Inventories, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Amatya, P. and D. Kirschbaum. 2021. *High Mountain Asia Multitemporal Landslide Inventories, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/1VSYYGQHJXIT. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/HMA_MTLI

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

Landslides, or downslope movements of rock, debris, earth or soil are associated with initiation points. These are the locations of origin of landslides and in this data set they are associated with the year of occurrence.

1.2 File Information

1.2.1 Format

This data set contains four ESRI shapefiles (.shp, .shx, .dbf, .prj, .sbn, .sbx, .cpg) compressed into one .zip file.

1.2.2 File Contents

Three of the shapefiles contain landslide initiation point information and their year of occurrence over one of three major highway areas in Nepal respectively. The fourth shapefile is a footprint shapefile containing the outline of the underlying images used for the landslide mapping, the satellite and related highway.

1.2.3 Naming Convention

The .zip file containing all data files is named: `hma_mtli_v01_landslide_inventory.zip`
The files inside the .zip file are named according to the following convention, which is described in detail in Table 1:

`HMA_MTLI_v01_[highway-name].[ext]`

Table 1: File Naming Convention

Variable	Description
`HMA_MTLI`	High Mountain Asia Multitemporal Landslide Inventories
`v01`	Data set version number
`[highway-name]`	Indicates the highway or footprint file. Available options are: Arniko Highway Karnali Highway Pasang Lhamu Highway Footprint

Variable	Description
.[ext]	File name extension. An ESRI shapefile consists of a set of files with the following file name extensions: .shp, .shx, .dbf, .prj, .sbn, .sbx, .cpg

1.3 Spatial Information

1.3.1 Coverage

This data set includes landslide inventories along three important highways in Nepal: the Arniko, Karnali, and Pasang Lhamu highway. The spatial boundaries are:

Arniko highway:

Northernmost latitude: 28.0° N
Southernmost latitude 27.5° N
Easternmost longitude: 86.0° E
Westernmost longitude: 85.5° E

Karnali highway:

Northernmost latitude: 29.3° N
Southernmost latitude 28.6° N
Easternmost longitude: 82.2° E
Westernmost longitude: 81.2° E

Pasang Lhamu highway:

Northernmost latitude: 28.4° N
Southernmost latitude 27.8° N
Easternmost longitude: 85.5° E
Westernmost longitude: 85.0° E

The spatial boundaries of the **footprint** file are:

Northernmost latitude: 29.3° N
Southernmost latitude 27.5° N
Easternmost longitude: 86.0° E
Westernmost longitude: 81.2° E

1.3.2 Resolution

N/A

1.3.3 Geolocation

The following table provide information for geolocating this data set:

Table 2. Geolocation Details

Geographic coordinate system	WGS 84
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs
Reference	https://epsg.io/4326

1.4 Temporal Information

1.4.1 Coverage

01 December 2009 to 31 December 2018

1.4.2 Resolution

Yearly

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The mountains of Nepal are one of the most hazardous environments in the world, with frequent landslides caused by tectonic activity, extreme rainfall and infrastructure development. As a landlocked country, Nepal relies on proper functioning of major transportation networks such as the highways to sustain and improve the livelihoods of the population. Every year there are reports of landslides blocking the highways, especially during the rainy season; however, the frequency and location of landslides along the highway corridors are not well reported. RapidEye satellite imagery was used to create annual landslide initiation point inventories along three important highways in Nepal: the Arniko, Karnali, and Pasang Lhamu highway.

2.2 Acquisition and Processing

Yearly RapidEye imagery were processed using the Semi-Automatic Landslide Detection (SALaD) system (Amatya et al. 2021), which combines object-oriented image analysis and machine learning. Annual initiation point landslide inventories were created using images acquired in December of each year, covering the highways. These landslide areas were manually inspected to

remove false positives, resolve landslide amalgamation, and add some missing areas. Time-consuming area corrections were not done.

This landslide initiation point library spans from 2009 to 2018. Landslides detected in a particular year that intersected with landslides detected in previous years were removed to differentiate landslide inventories of each year. Landslides found in the first year of the RapidEye imagery are associated with that first year in the inventory, but could have occurred any time before or in the year 2009.

All workflows were carried out in an open source framework, using a number of free libraries available in Python.

2.3 Quality, Errors, and Limitations

Before the production of initiation points, landslide polygons were manually inspected. Other steps included false positive removal, amalgamation resolution, and addition of missing areas. Some positional inaccuracy related to satellites might exist.

3 SOFTWARE AND TOOLS

Shapefiles files can be opened using software that recognizes the shapefile format, such as QGIS and ArcMap.

4 RELATED DATA SETS

High Mountain Asia Landslide Catalog

High Mountain Asia at NSIDC | Data Sets

5 RELATED WEBSITES

High Mountain Asia at NSIDC | Overview

NASA High Mountain Asia Project

RapidEye Satellite Mission and Sensor Description

6 CONTACTS AND ACKNOWLEDGMENTS

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7 REFERENCES

Amatya P., Kirschbaum D., Stanley T., & Tanyas H. (2021). Landslide mapping using object-based image analysis and open-source tools. Engineering Geology, 282: 106000. https://doi.org/10.1016/j.enggeo.2021.106000.

8 DOCUMENT INFORMATION

8.1 Publication Date

24 May 2021

8.2 Date Last Updated

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