GIS in GEOLOGICAL RESEARCH

Laboratory of Geodynamic and Geological hazardous of IGS of NAS RA

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Chair Gfoeller Renaissance Foundation

Yerevan, Armenia
**November 30 2018**

Old Geographic data
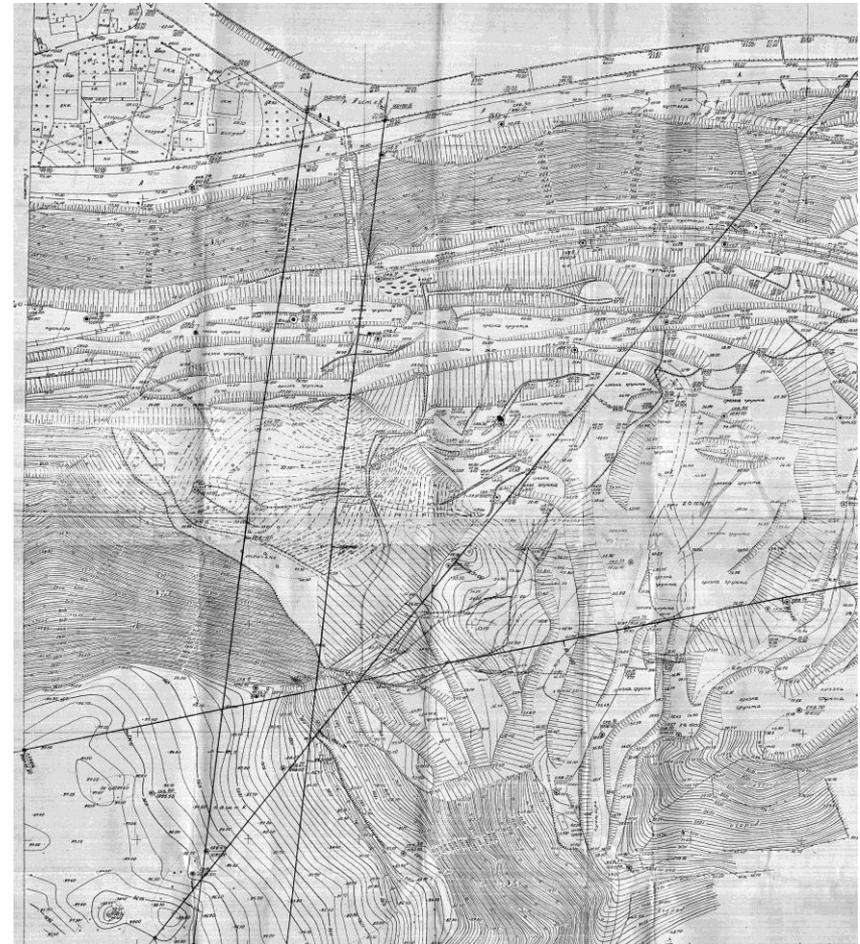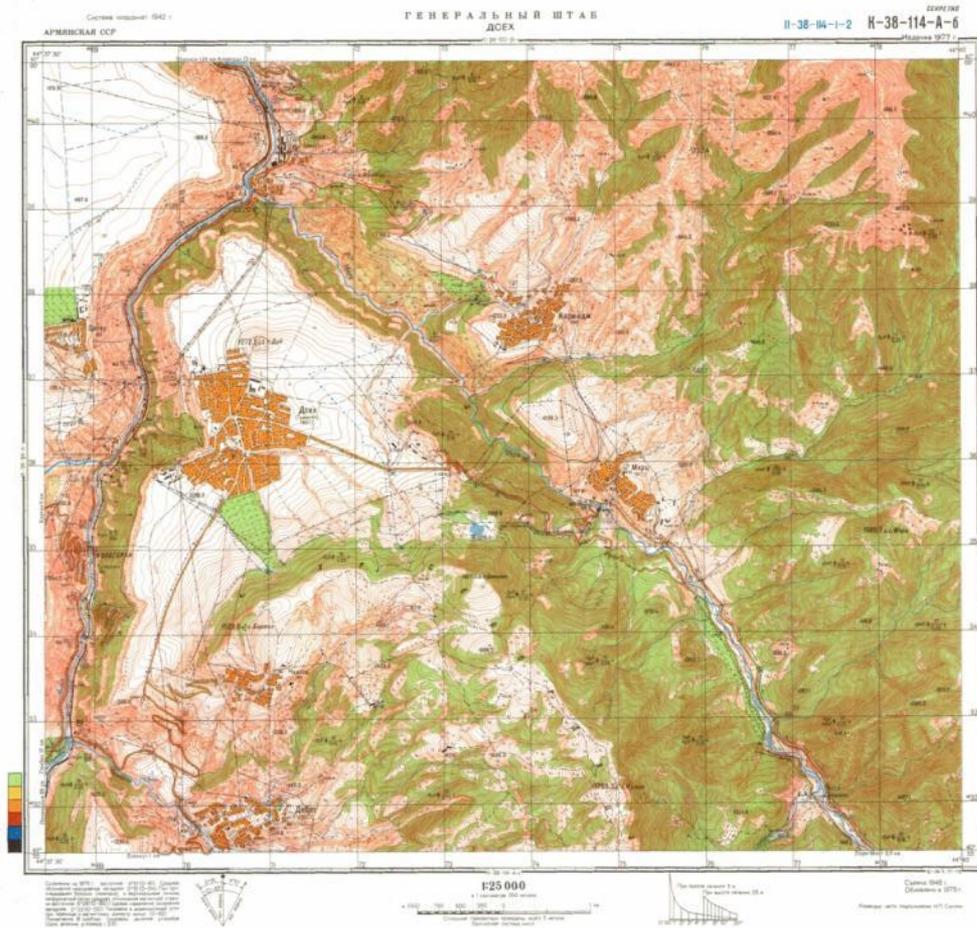
Old Geoligical data
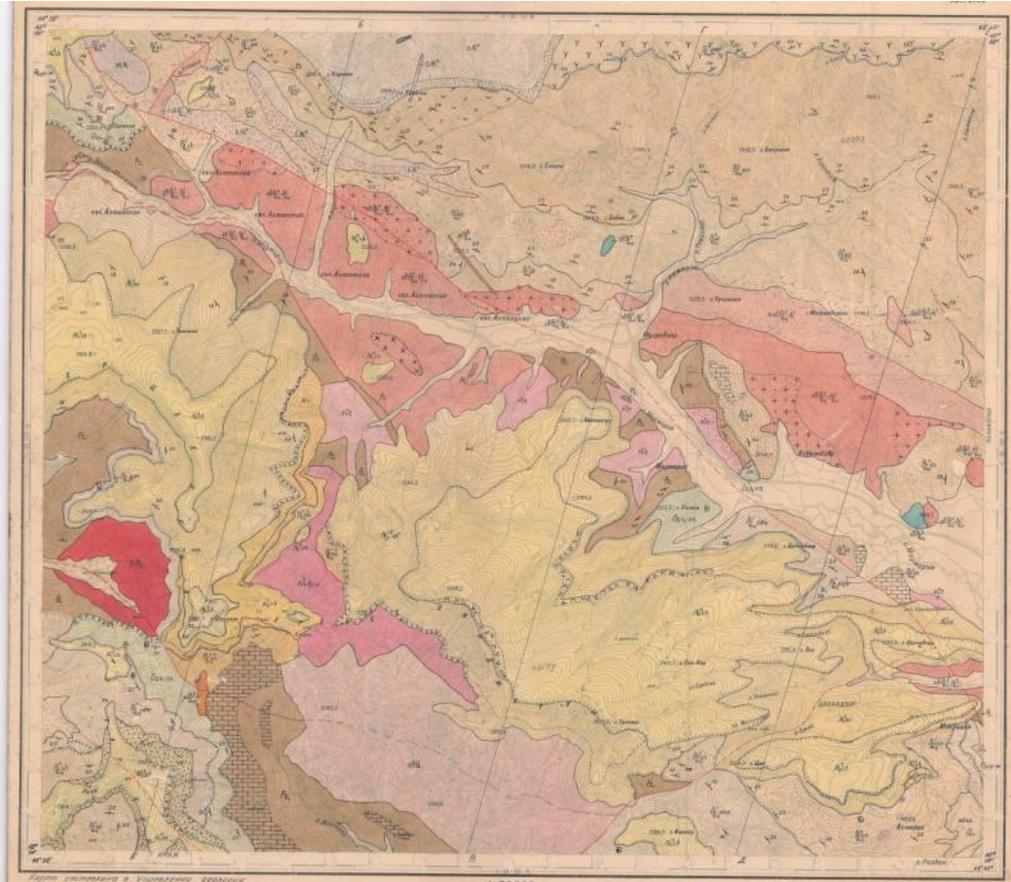
Digitizing and updating data

Tpo Fill application

TopoFill

Ընտրեք շերտը

Սկզբ. բարձ.

Աճման չափը

Գծել գիծը

Լցվել է 0 իզոգիծ

Լցնել արժեքները   ?

20m/pix

5m/pix
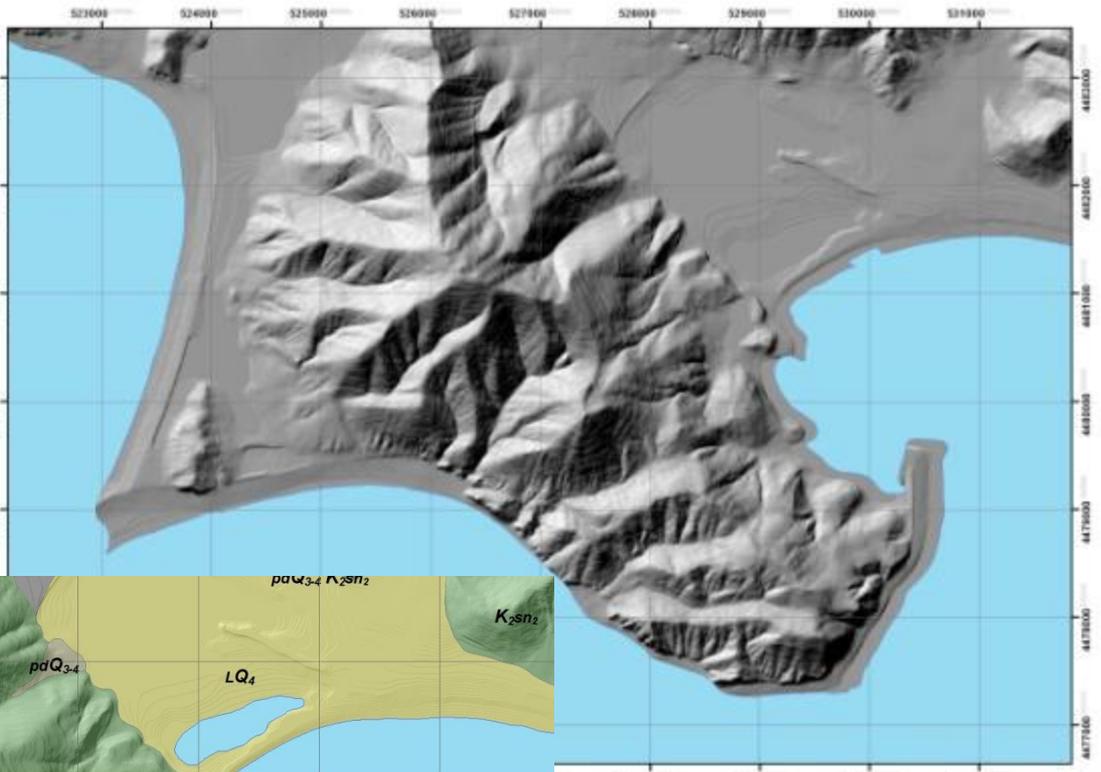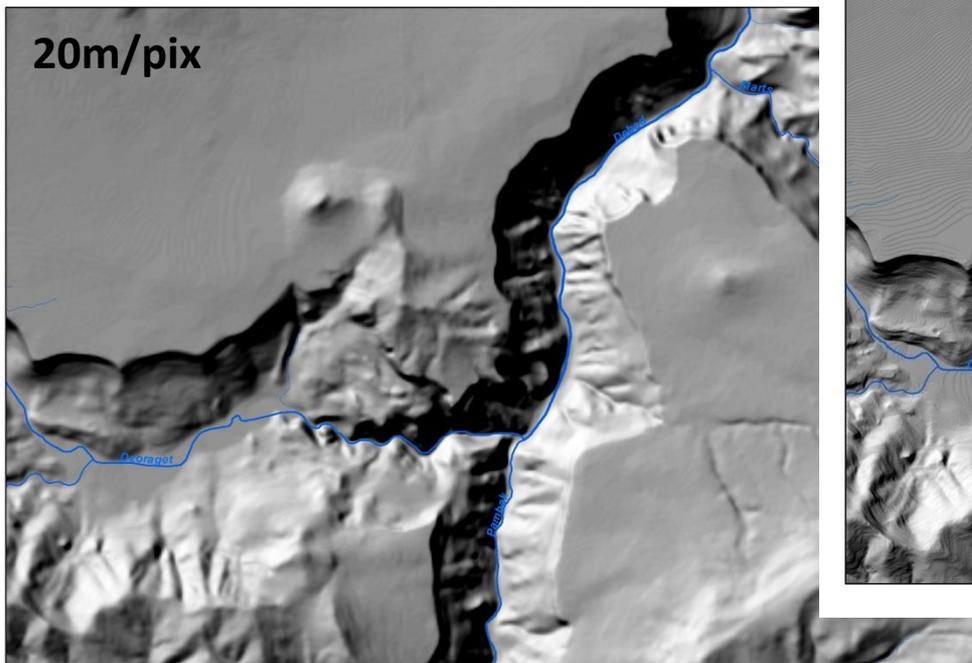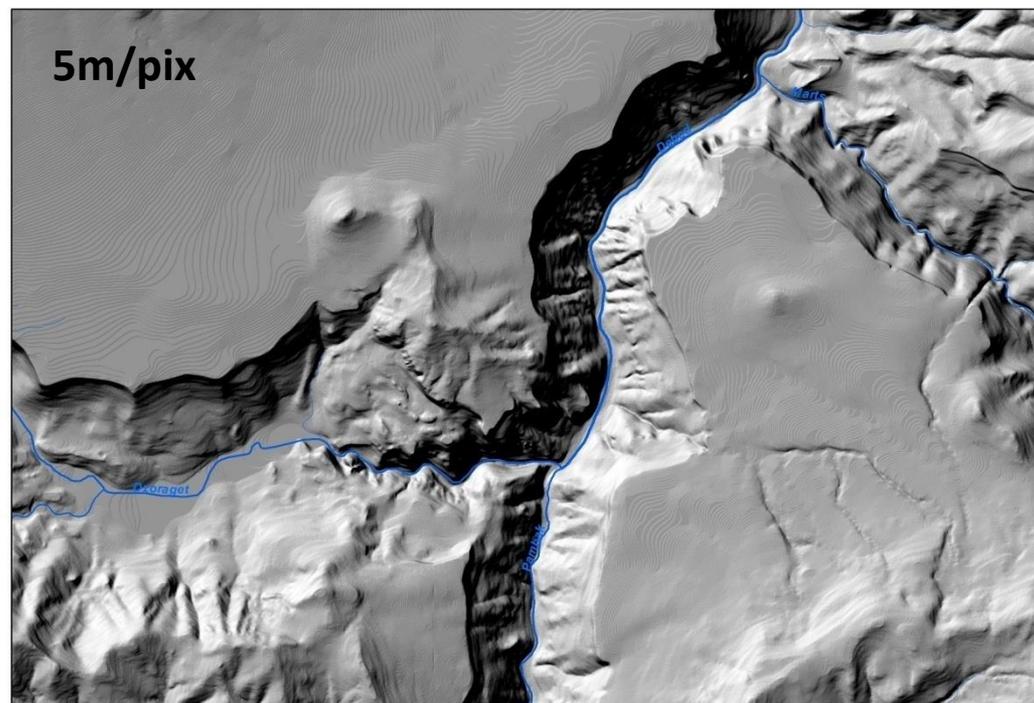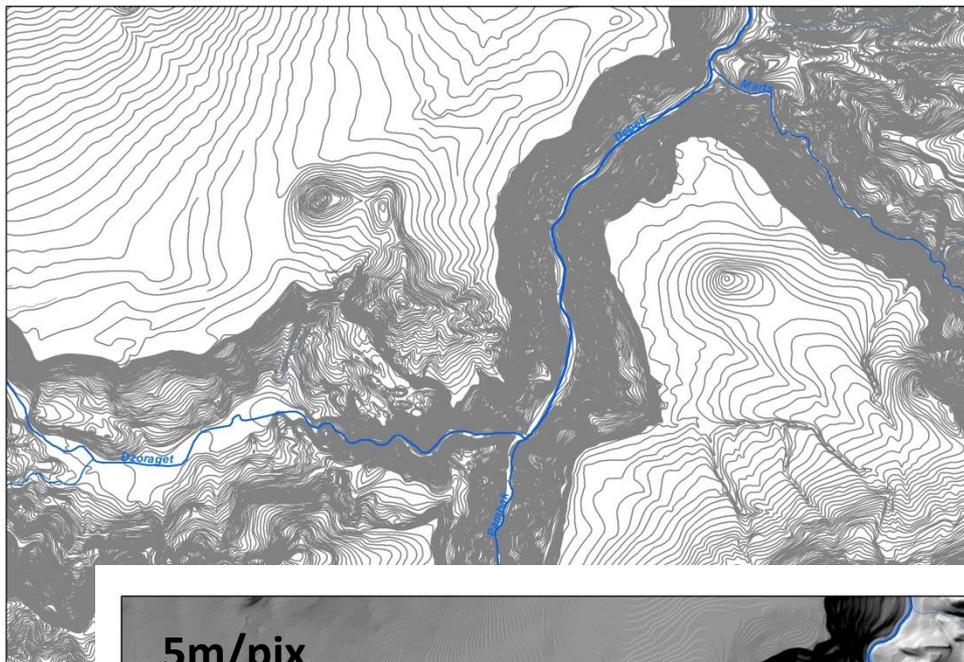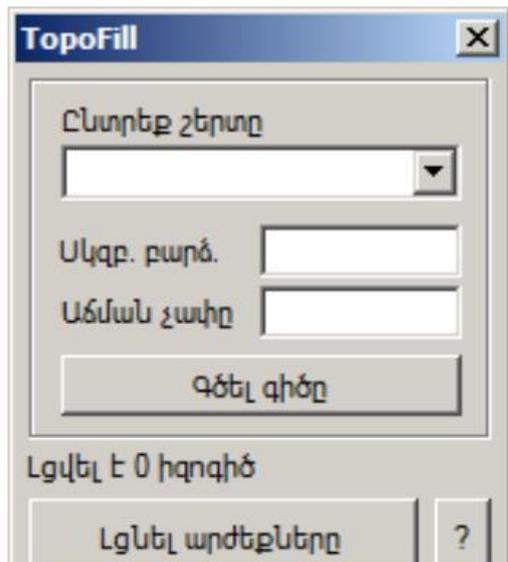
DEM in Geology
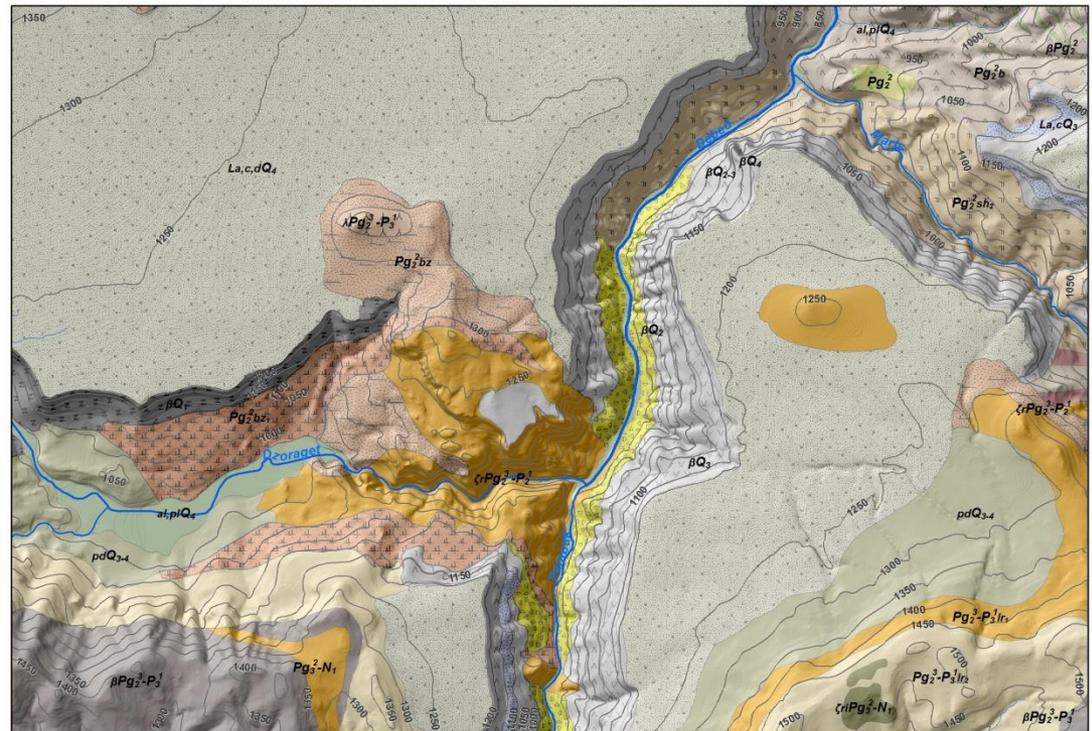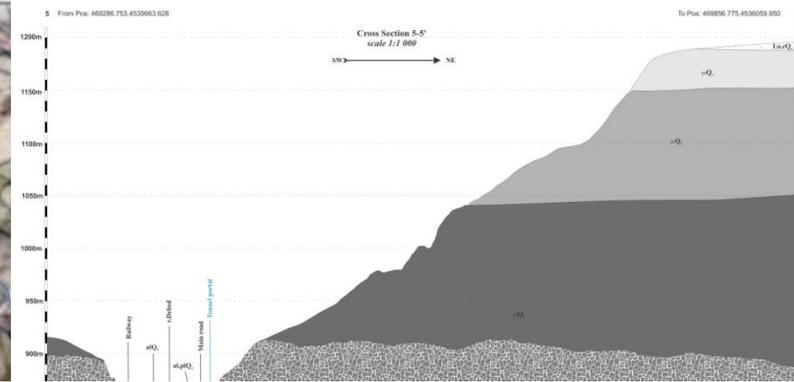
GIS data base creation
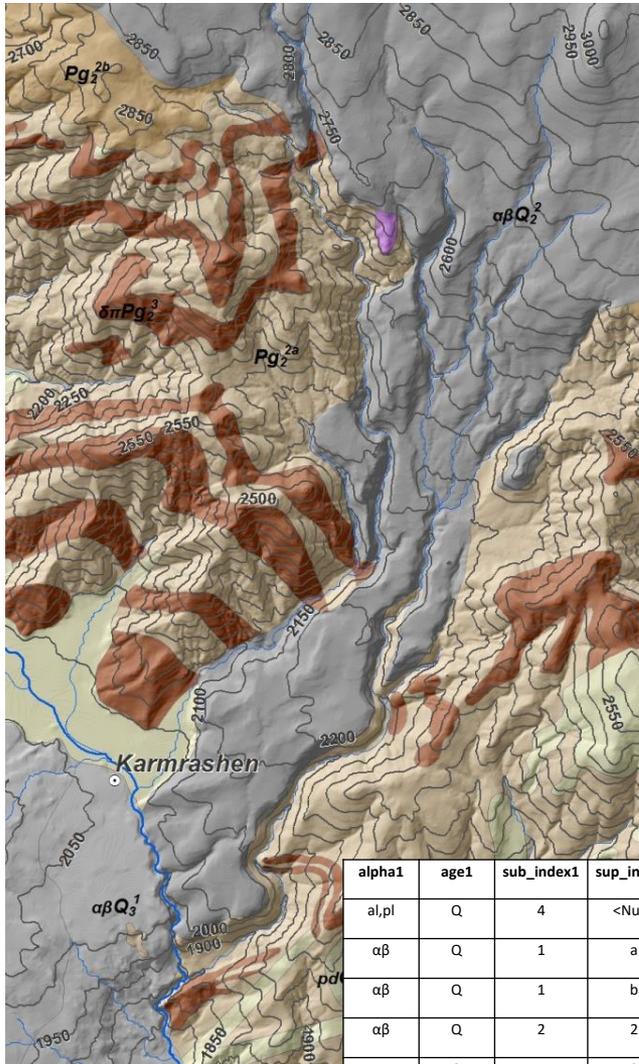
FID	Shape	OBJECTID	Method	Sample_N	Reference	Year	Materials	Age_Ma	POINT_X	POINT_Y
130	Point	131	Ar/Ar	OBS1	LeBourdonec et al., 2012	2012		2.79±0.06	405359.4274	4595139.811
131	Point	132	Ar/Ar	DL	DeLumley et al., 2002	2002		1.81±0.05	445230.8622	4578563.305
133	Point	134	Ar/Ar	SB	Schminke, Van den Bogaard, 1995	1995		1.95±0.22	445330.121	4578516.984
135	Point	136	Ar/Ar	SAM92	Messager et al., 2013	2013		0.315±0.02	395343.1838	4595034.152
136	Point	137	Ar/Ar	SAM97	Messager et al., 2013	2013		0.23±0.04	397630.0948	4591243.767
137	Point	138	Ar/Ar	BORD-C	Messager et al., 2013	2013		0.19±0.02	391899.5799	4600159.909
138	Point	139	Ar/Ar	OROZ4	Messager et al., 2011	2011		1.77±0.02	432930.4903	4575408.44
139	Point	140	Ar/Ar	OROZ6	Messager et al., 2011	2011		1.83±0.02	432996.6628	4575368.736
140	Point	141	Ar/Ar	SR-16	Caccavari et al., 2014	2014		1.73±0.03	356476.4826	4598081.029
152	Point	153	Ar/Ar	OBS 1	Le Bourdonnec et al., 2012	2012	Rhyolite	2.84 Ma	405706.4088	4595701.137
153	Point	154	Ar/Ar	OBS 6	Le Bourdonnec et al., 2012	2012	Rhyolite	2.73 Ma	406142.4181	4594829.907
154	Point	155	Ar/Ar	OBS 4	S. Nomade et al., 2015	2015		2.67 Ma	406190.3159	4594658.644
156	Point	157	Ar/Ar	TS 01-08	S. Nomade et al., 2015	2015	Basalt	2.32 Ma	429010.7745	4610949.406
158	Point	159	Ar/Ar	TS 01-09	S. Nomade et al., 2015	2015		2.17 Ma	439966.303	4614224.432
163	Point	164	Ar/Ar	OROZ 06	Messager et al., 2011	2011	Baslat	1.83 Ma	433021.7809	4575476.791
164	Point	165	Ar/Ar	OROZ 04	Messager et al., 2011	2011	Basaltic Trachy-Andesite	1.77 Ma	432740.829	4575207.875
165	Point	166	Ar/Ar	TS02-08	S. Nomade et al., 2015	2015	Basaltic Trachy-Andesite	1.52 Ma	428869.2231	4610704.887
168	Point	169	Ar/Ar	SAM 10-01	S. Nomade et al., 2015	2015	Andesite	1.08 Ma	395684.3403	4602023.094
176	Point	177	Ar/Ar	BORD-C1	Messager et al., 2013	2013	Dacite/Rhyolite	189 ka	392829.9197	4600268.951
198	Point	199	Ar/Ar	AM11-1	Ritz and et. 2015	2015	Dolerithic Basalt	2.09±0.05	398536.6583	4537025.233
201	Point	202	Ar/Ar		Fill	2016	Yer-Leninakan tuff	0.6	397612.6516	4467337.144
202	Point	203	Ar/Ar	AR-08-29	Marc Hassig 2013	2013	Amphibole	175.8+-3.9	393880.5523	4541842.166

Age
Genesis
Type
Name

| alpha1	age1	sub_index1	sup_index1	LEG	Shape_length
al,pl	Q	4	<Null>	Alluvia, diluvia, eluvia, proluvia deposits, pebble, sand, sandy-loam, loam, rubble	9287.54637
αβ	Q	1	a	Andesite-basalts and andesites of Jermuk plateau volcanoes (first flow)	88854.4793
αβ	Q	1	b	Andesite-basalts and andesites of Jermuk plateau volcanoes (second flow)	1552.00978
αβ	Q	2	2	Andesite-basalts of Muradsar and Karmirgluh volcanoes	1403.98215
tr	Q	4	2	Calcareous tuffs (travertines)	3409.4758
δπ	Pg	2	3	Diorites	3168.30156
δπ	Pg	2	3	Diorites	1623.65793
νδ	Pg	3	3	Gabbro diorite	1651.0311
<Null>	Pg	2	2a	Tuff-aleurovoliths, tuff-sandstones, tuff-conglomerates with pades of andesite-basalts and andesites	2815.0092

# Digitization, field correlation, mapping data

Data field correction

Landslides Research

Factor of Slope Damage GIS modeling
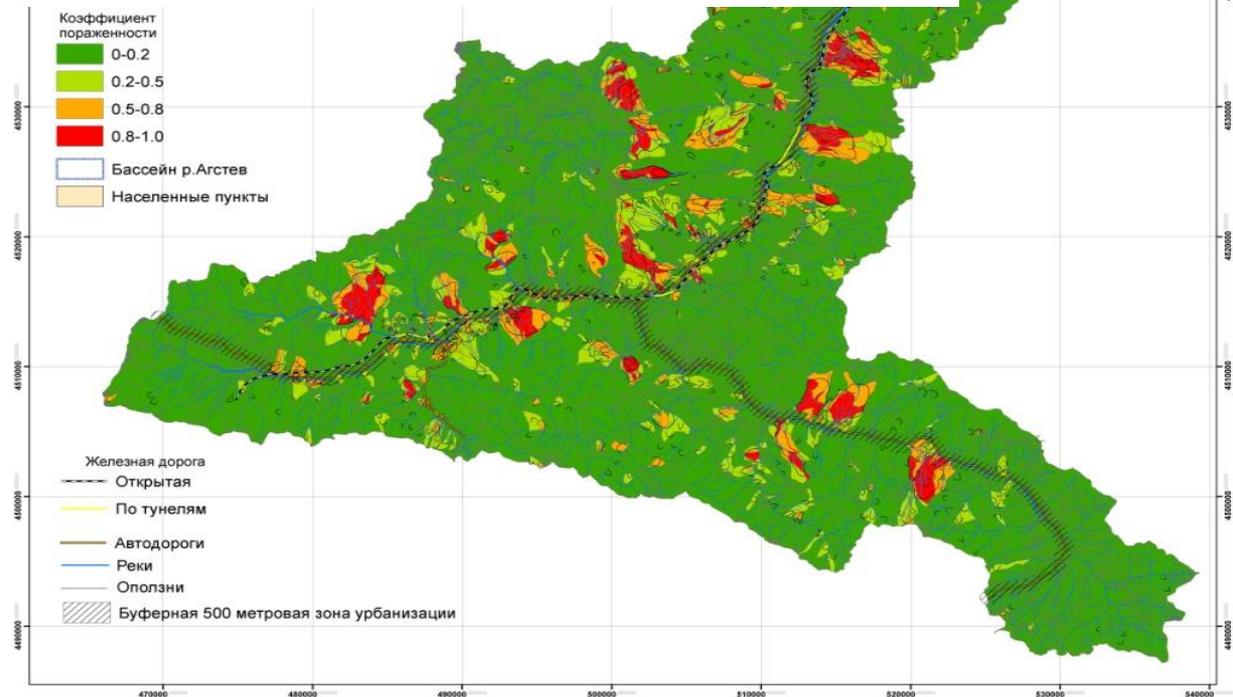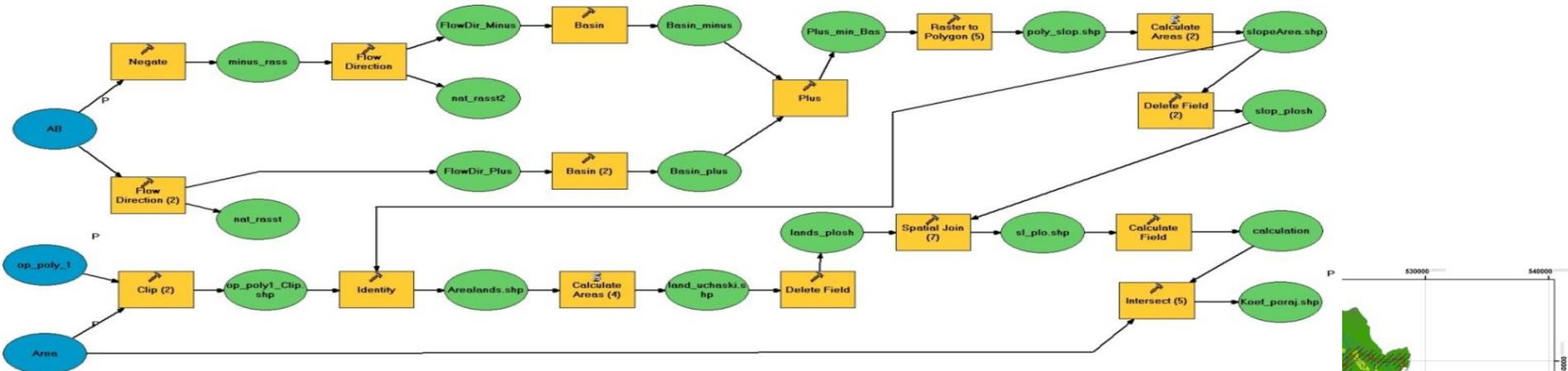
3D Factor of stability of Landslides

Векторные слои → 3D модели

Топография территории

Данные литологических слоев

слой-1

слой-2

Параметры уровня грунтовых вод

Параметры конфигурации зеркала скольжения
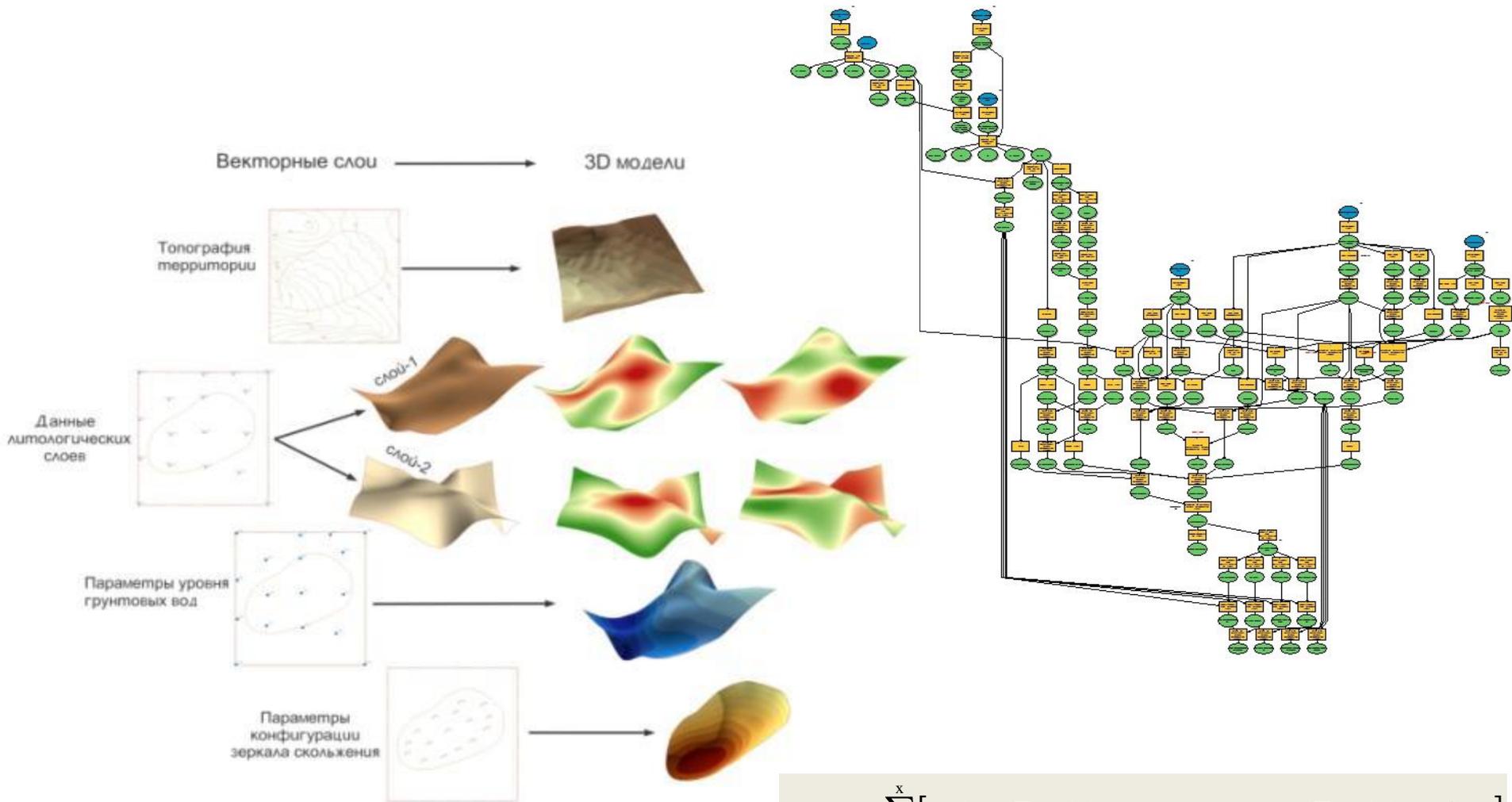
$$3DKy = \frac{\sum\limits_{y}^{x}\left[c_w A + (Z-z)A\gamma_{sb}\cos\alpha\tan\varphi_w + (Z-z)A\gamma_{sb}\sin\alpha\right]}{\sum\limits_{y}^{x}\left[(Z-z)A\gamma_{sb}\sin\alpha\right]}$$

Haghartcin Landslide
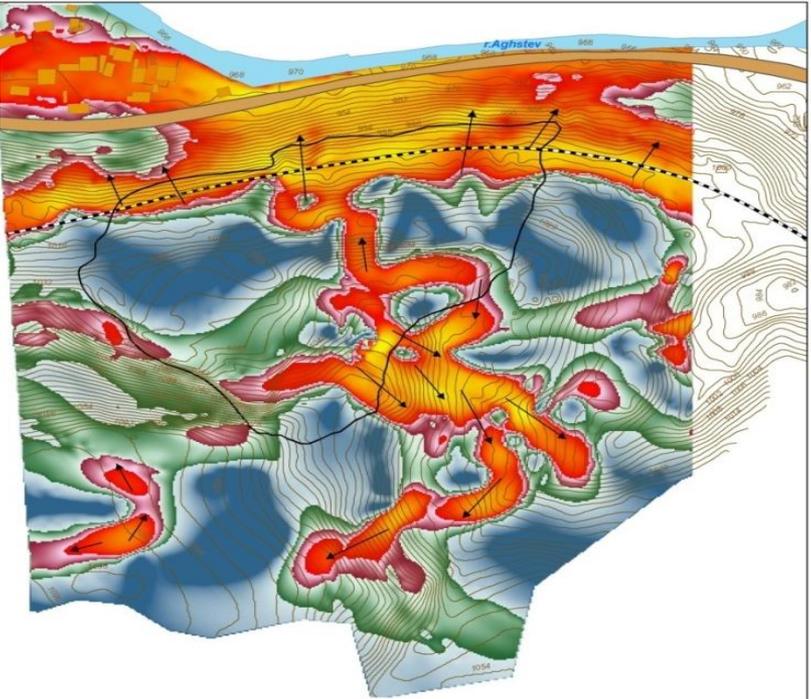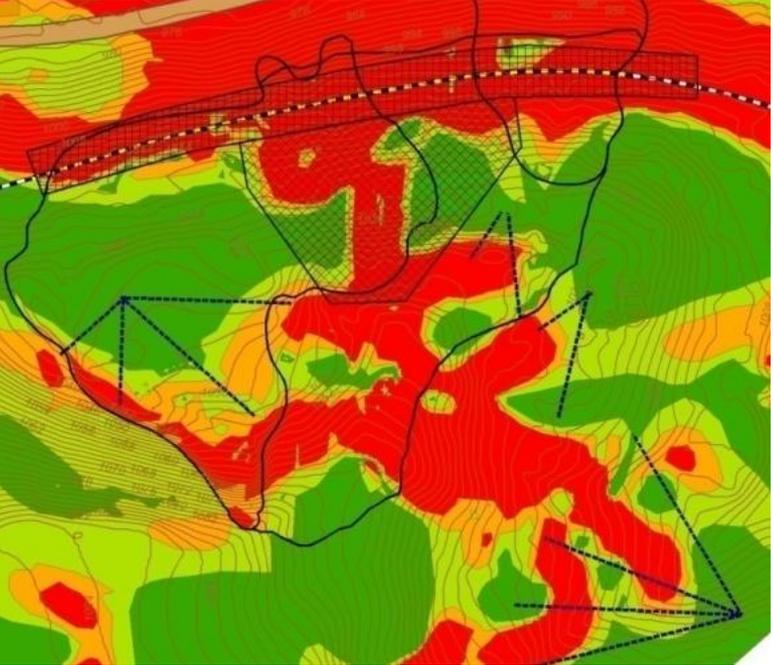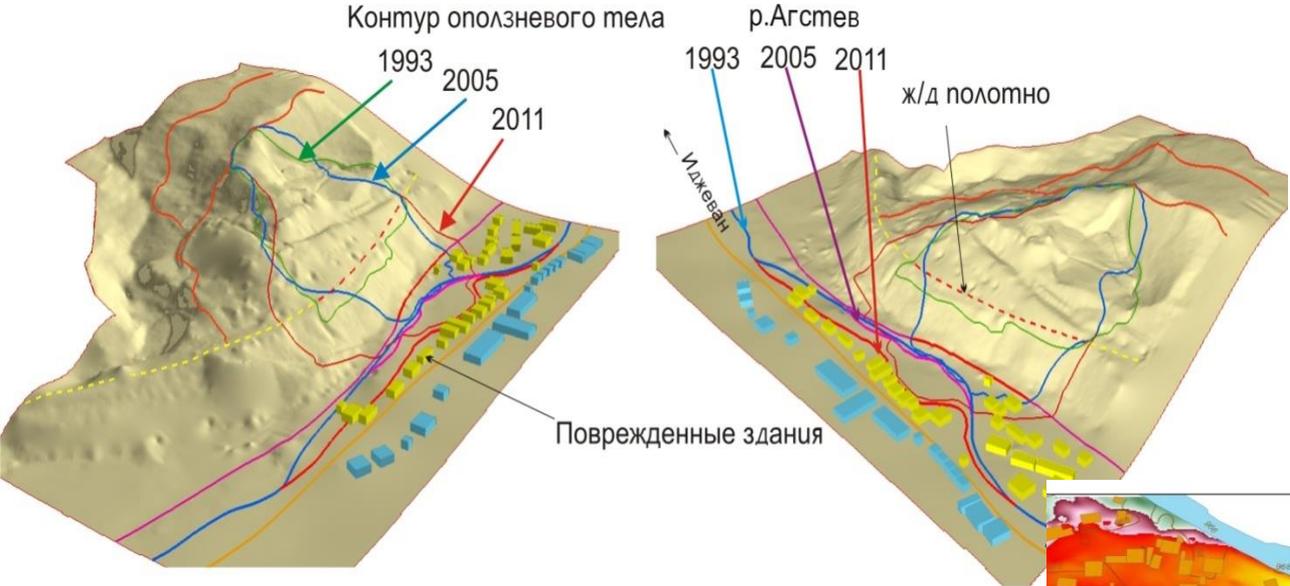
Kapan Landslide

Jrvezh Landslide

ИНЖЕНЕРНО-ГЕОЛОГИЧЕСКАЯ КАРТА
ОПОЛЗНЕВОГО УЧАСТКА ДЖРВЕЖ
(М 1:2000)
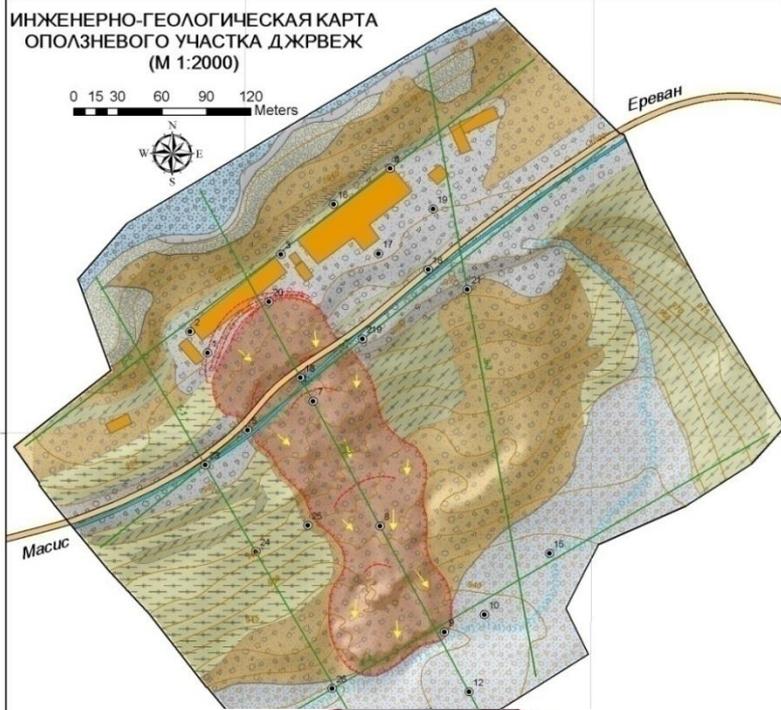
Условные обозначения

Техногенные покровные рыхлые образования состоящие из супесчаных, щебенистых и обломочных грунтов

Оползневые и обвальные образования представленные измененными породами Ереванской соленосной толщи, глинами, алевролитами, суглинками

Делювиально-колювиальные образования
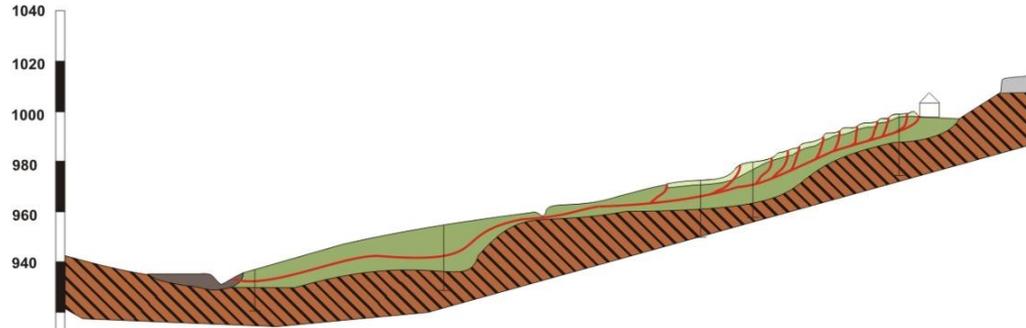
Номер скв	Скв-9	Скв-8	Скв-7	Скв-18	Скв-20
Глубина (м)	12.0	17.0	18.0	17.0	17.0
Абс. Высота (м)	936.6	956.2	976.6	980.8	1000.10
Расстояние между скв (м)		82	97	12	74

Базальты
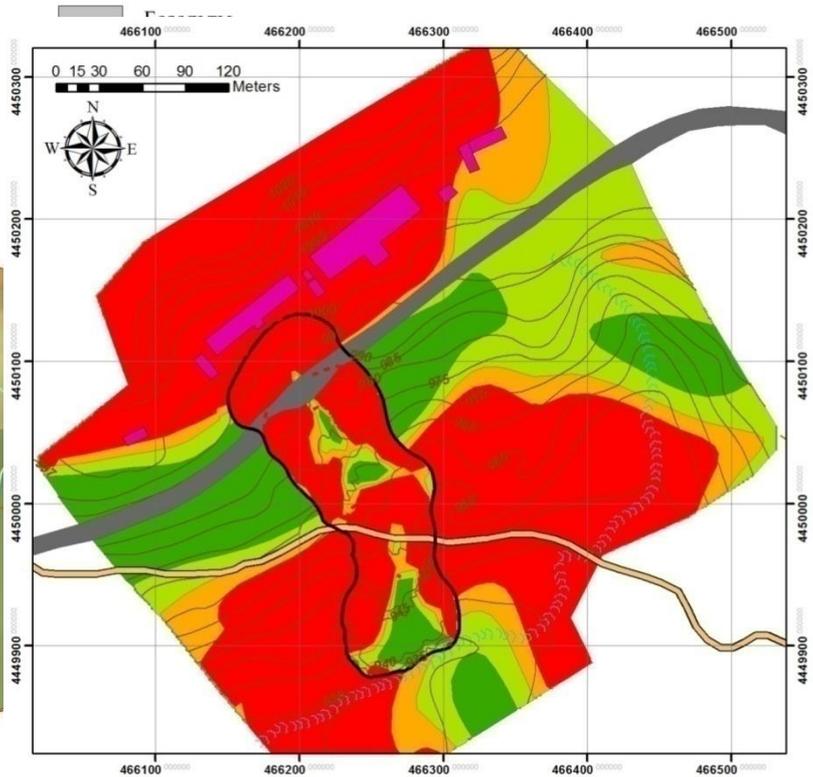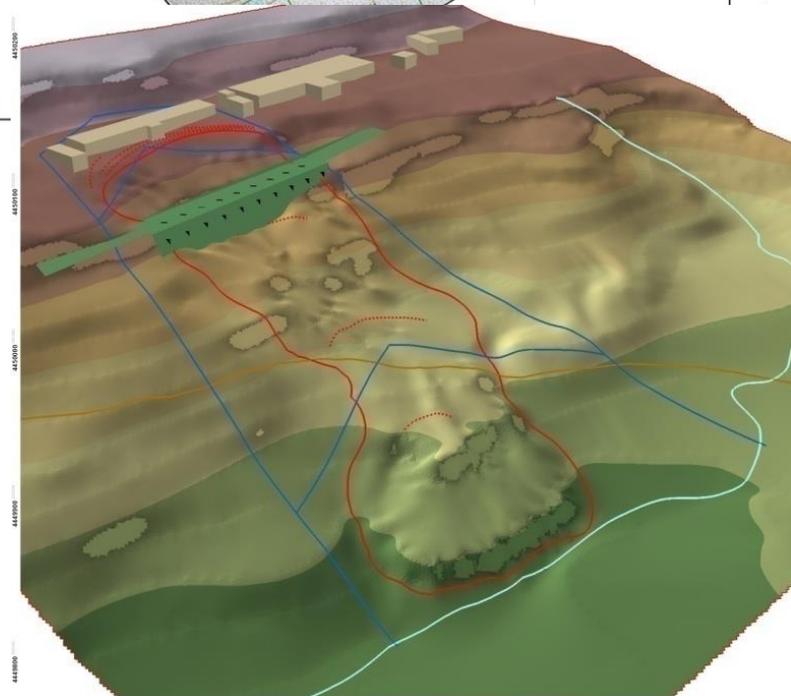
Условные обозначения

Районирование по коэффициенту устойчивости И.

Весьма неустойчивы (0.019-0.8)

Неустойчивые (0.8-1.0)

Устойчивые (1.0-1.5)

Весьма устойчивые (1.5-2.0)

Здания и постройки с прогнозируемыми

Khndzorut Landslide

Tumanyan landslide
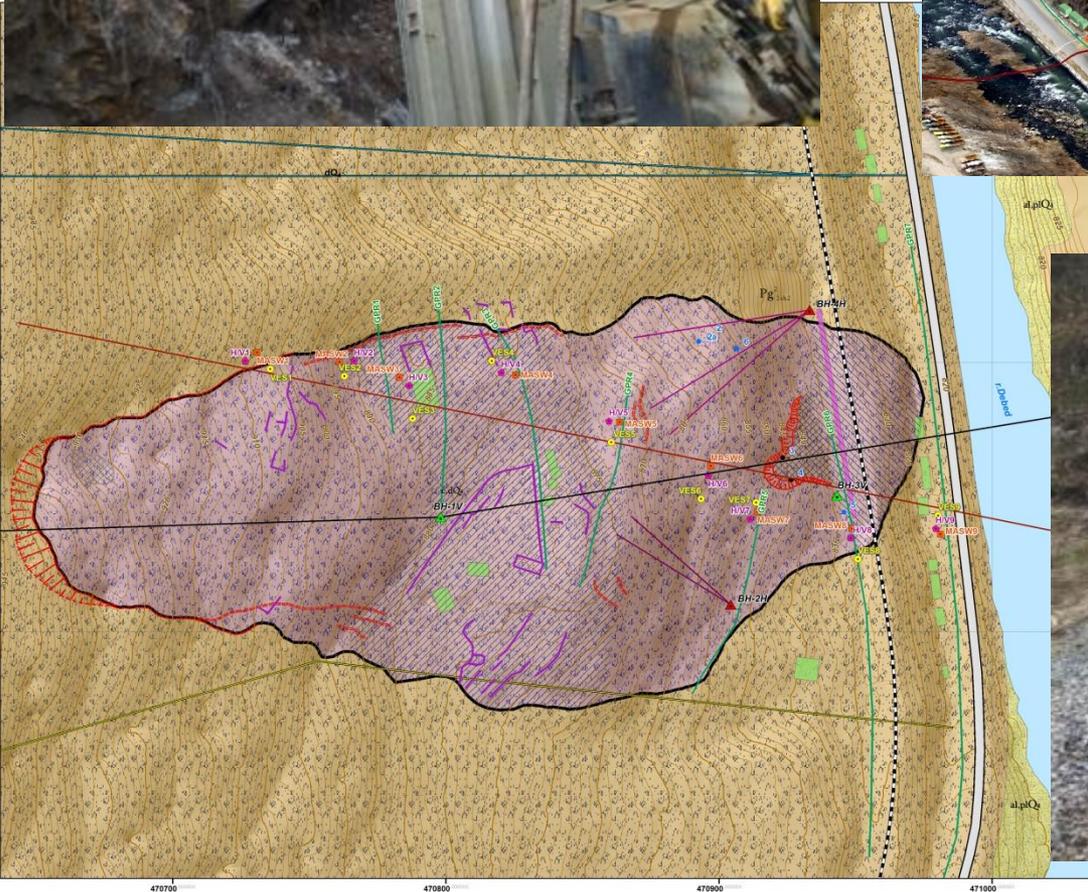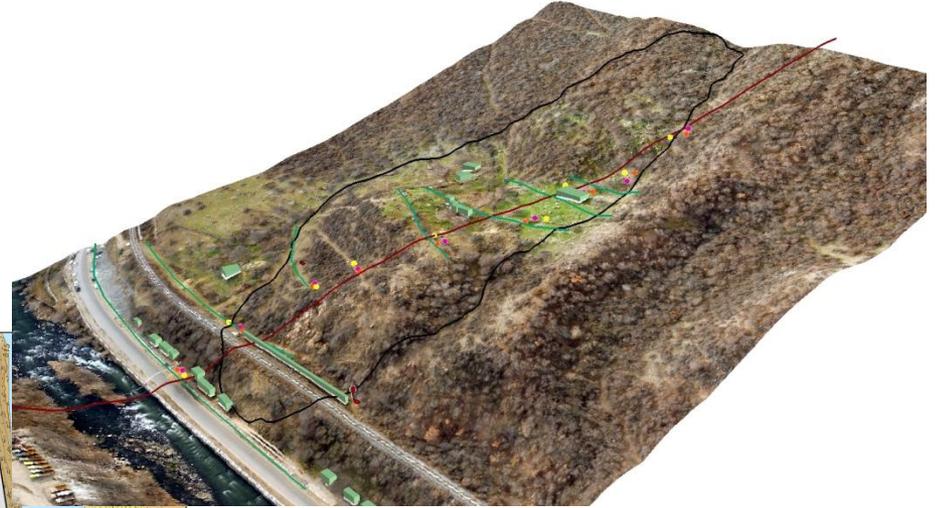
Zoning of geological hazard
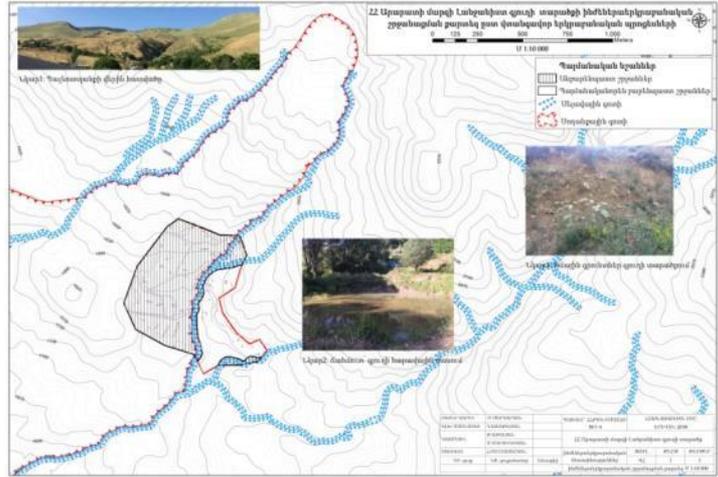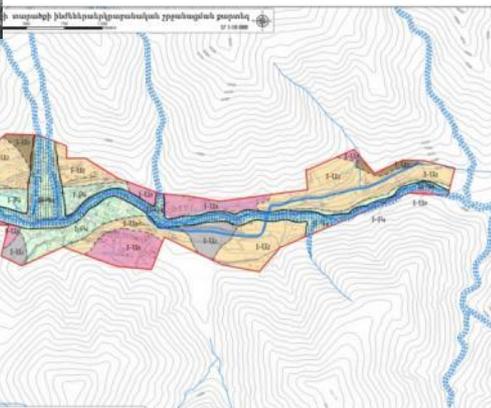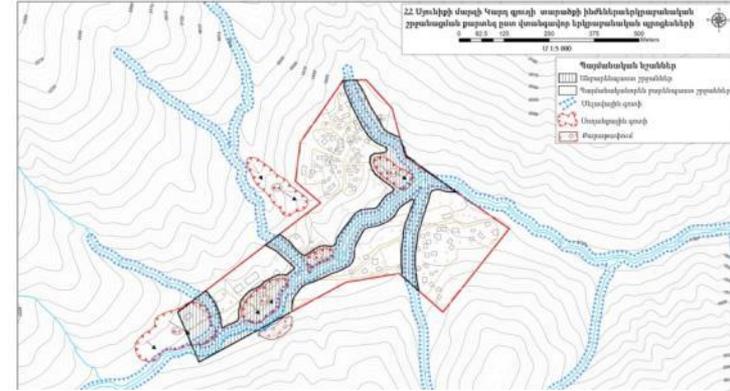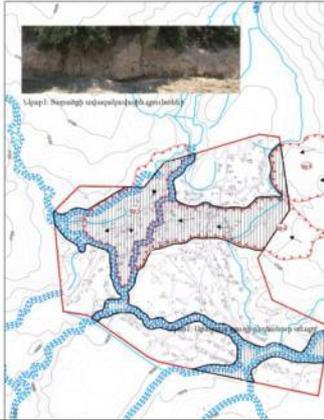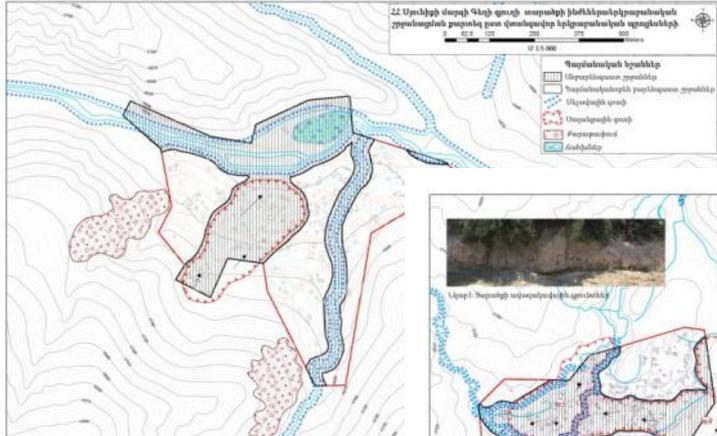
120 vilages
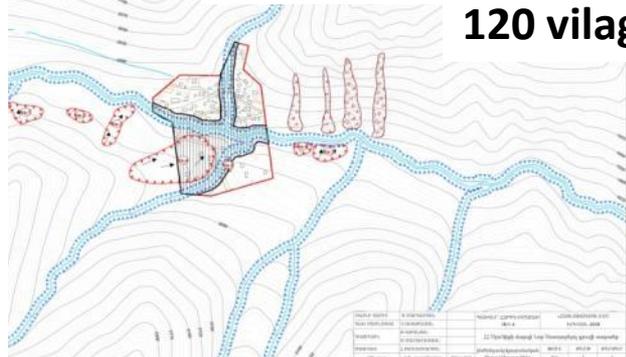
Application of 3D borehole

Planing and draw 3D Borehols

# Result of driling survey

Modeling erosion risk and Sensitivity model

Calculation Stages

- Create DEM (Slope, Aspect)
- Remote sensing process (NDVI, SAVI)
- RUSLE calculation (K, C, R, LS factors)
- Susceptibility to Erosion Index (SEI)
- Pasture Degradation Index (PDI)
- Pasture Management Recommendation (PMU)

Sensitivity model in GIS Model Builder
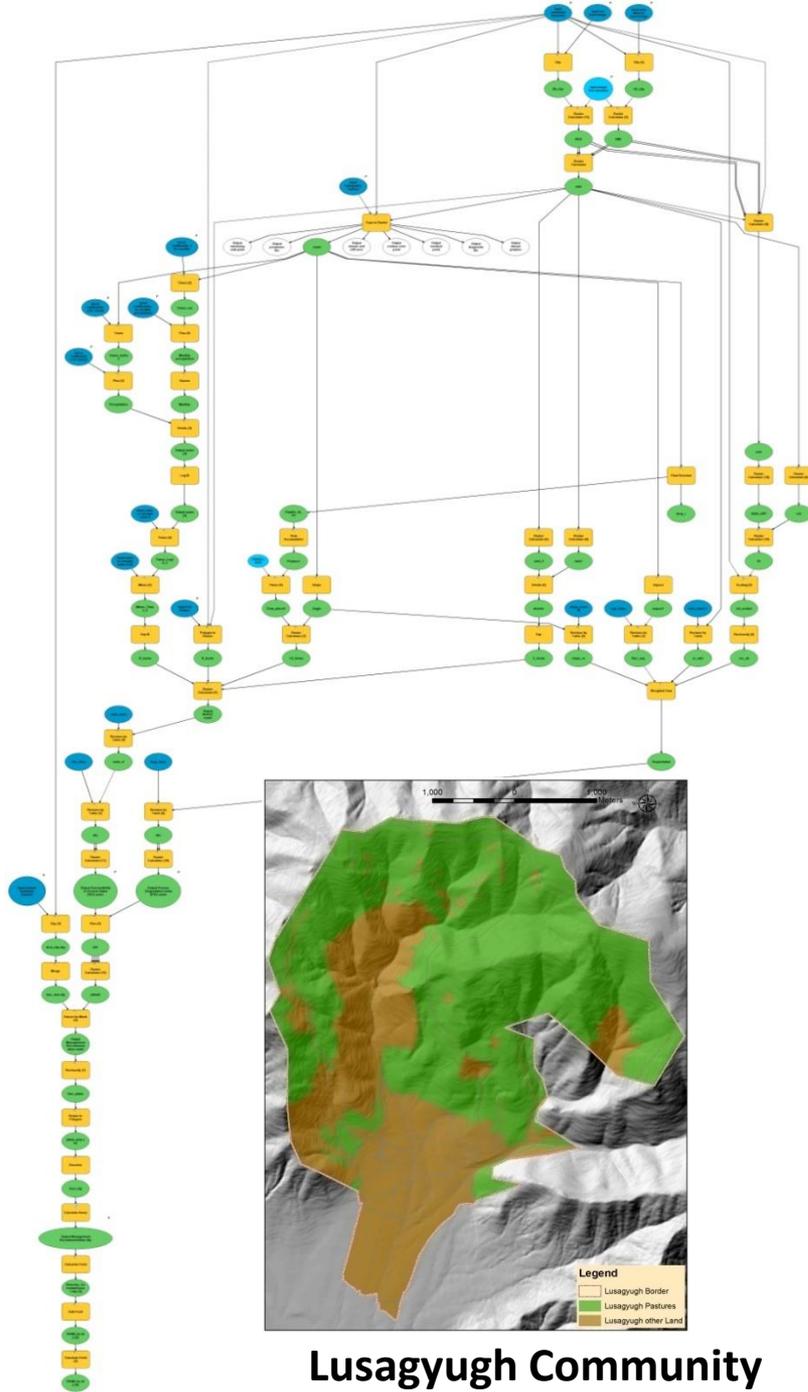
Lusagyugh Community

graz_mod

Input community boundary features
Borders\Lusagyugh_Border

Input pasture boundary features
Pastur\Lusagyugh_Pastur

Input Soil feature
Aragats_Soil

linear coefficients. a for annual presipitation
0.278

linear coefficients c for annual presipitation
30.25

linear coefficients. a for monthly presipitation
0.025

linear coefficients.c for monthly presipitation
28.14

Input topography contour features
Topography

Input image Sun elevation
66.01477417

Input near infrared band image
LC09.05.2014\LC81700322014160LGN00_B5.TIF

Input red band image
LC09.05.2014\LC81700322014160LGN00_B4.TIF

Output Management Recommendation.shp
C:\Aragatc_gr\output\mu.shp

Output Susceptibility to Erosion Index (SEI) raster
C:\Aragatc_gr\output\sei

Output Pasrure Degradation Index (PDI) raster
C:\Aragatc_gr\output\pdi

OK   Cancel   Environments...   Show Help >>

# Classification of Elevation, Slopes and Aspects
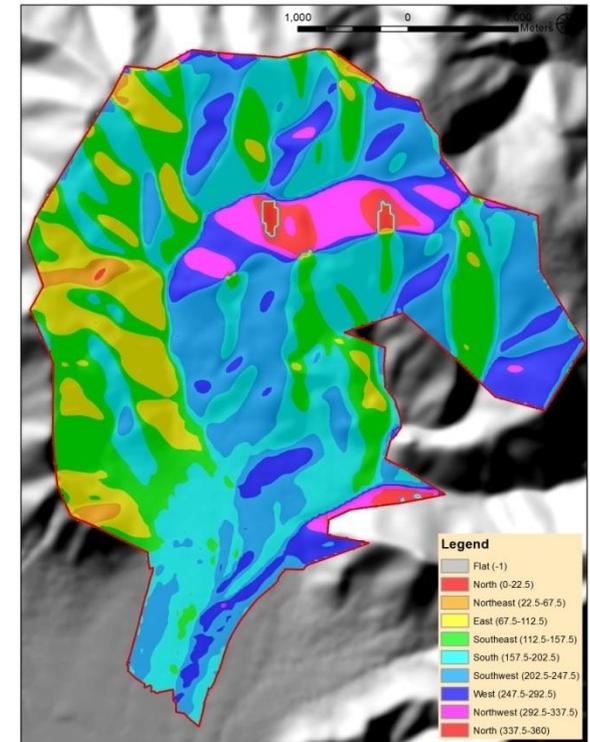
Atmospheric Correction of MS Bands by using ArcGIS

- In ArcGIS raster calculator:
   **(0.00002 * "%B5_clip%" - 0.1) / Sin(Float (%Input image Sun elevation%))**


RED band

NIR band
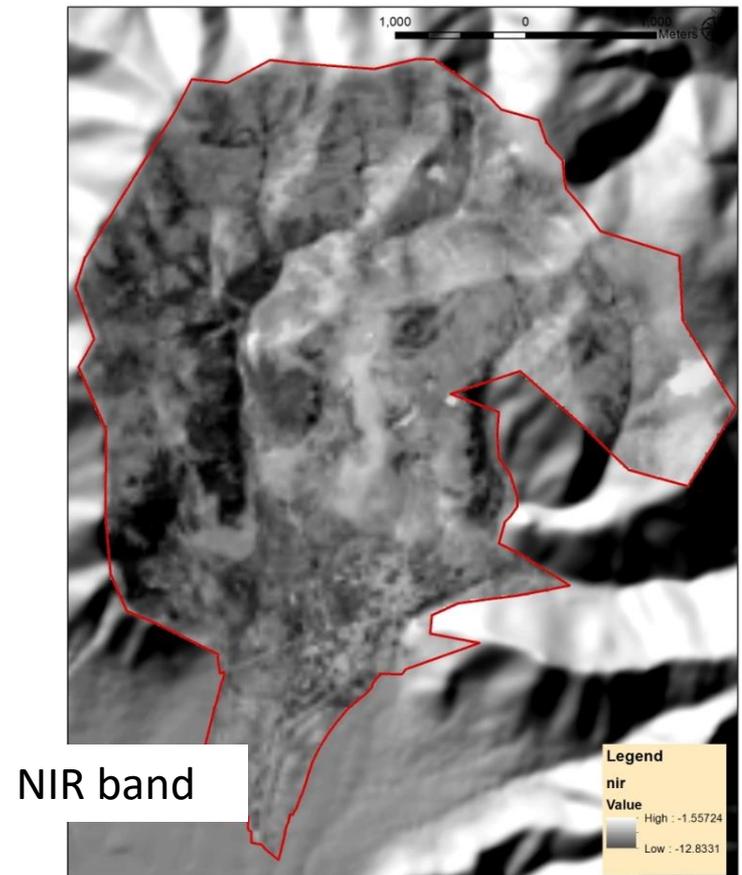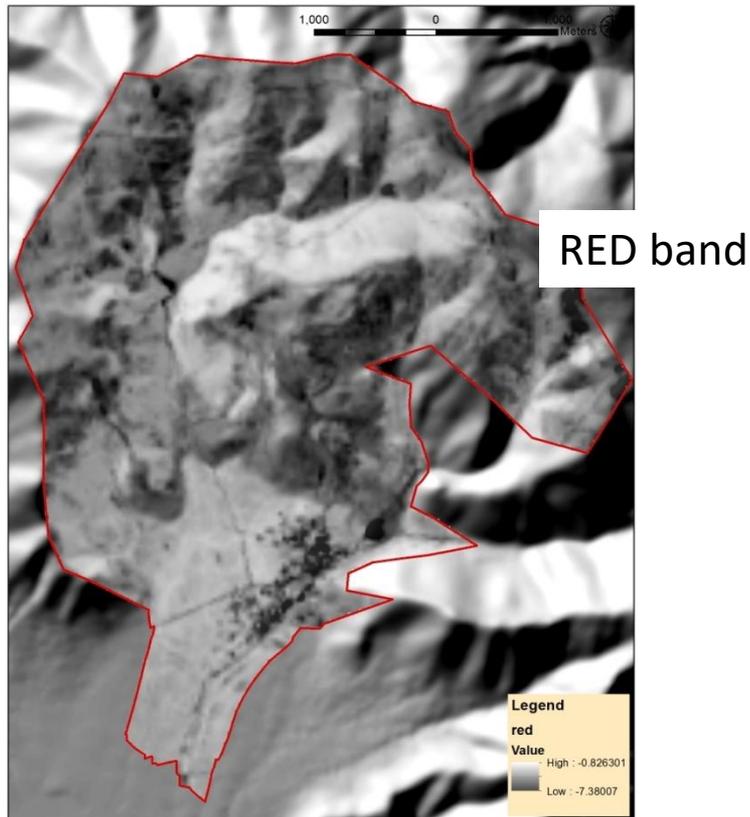
Normalized Difference Vegetation Index (NDVI)
Soil Adjusted Vegetation Index (SAVI)

Legend
ndvi
Value
High : 0.843293
Low : 0.137523

Legend
savi
Value
High : 1.31425
Low : 0.212493
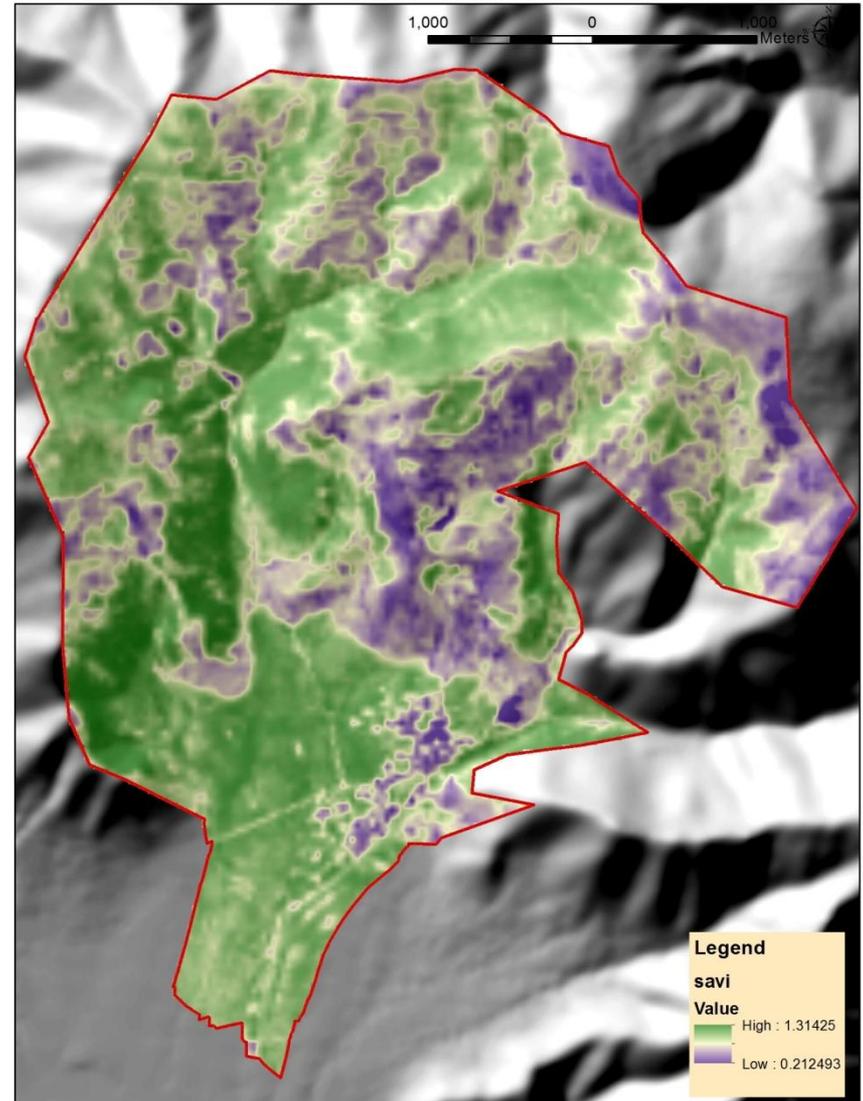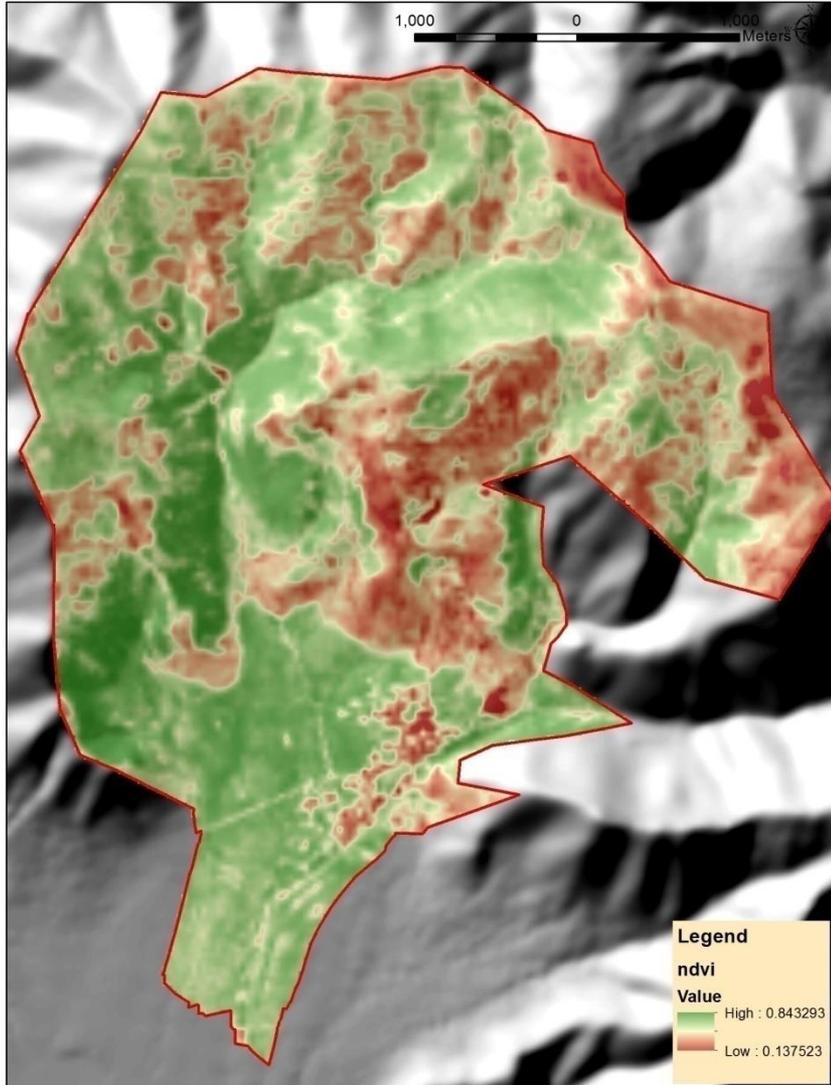
Calculation of Degradation
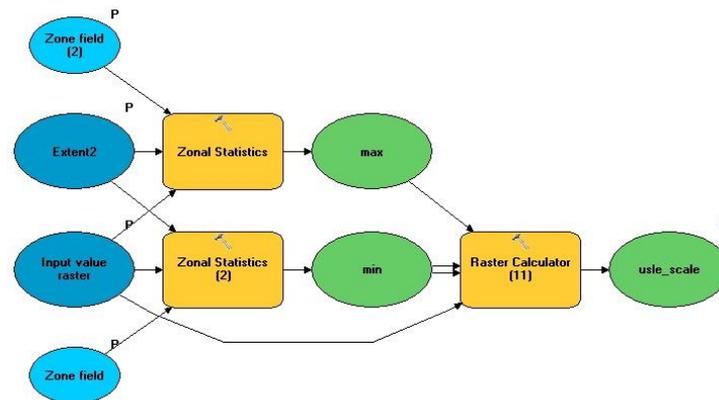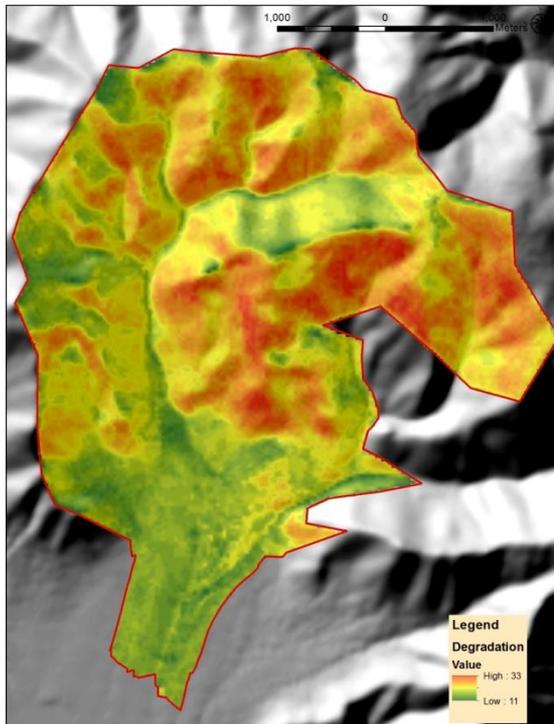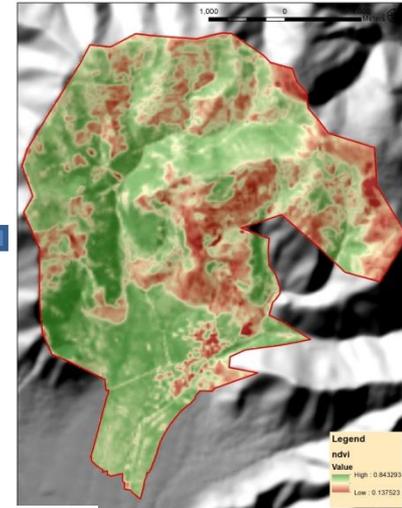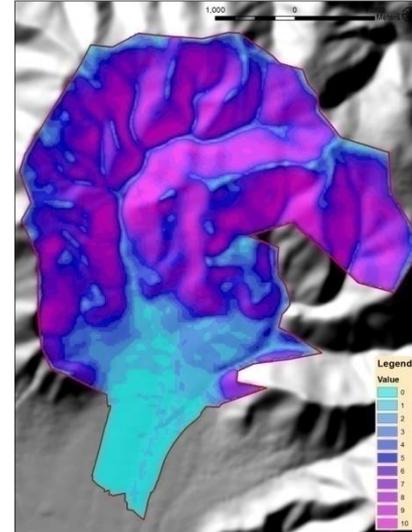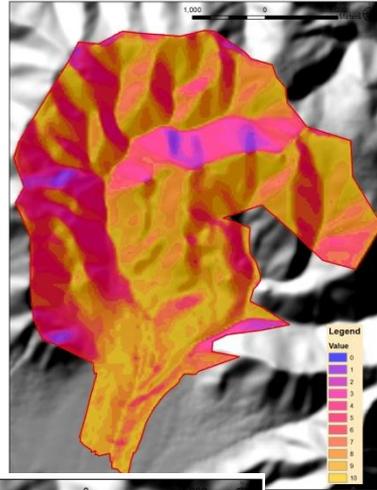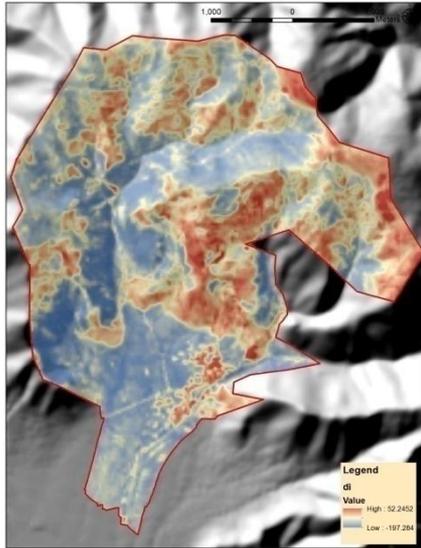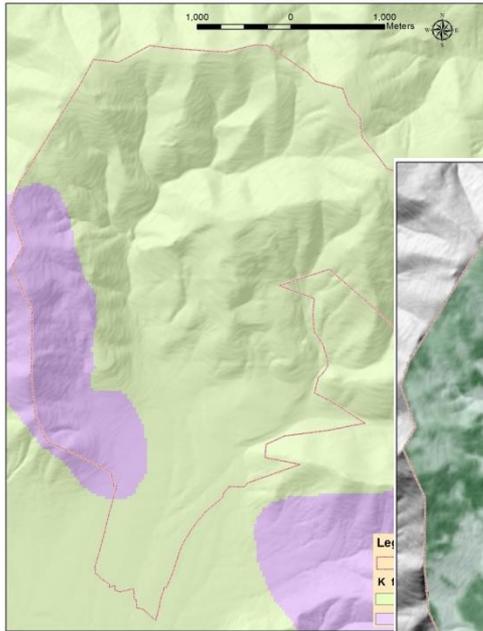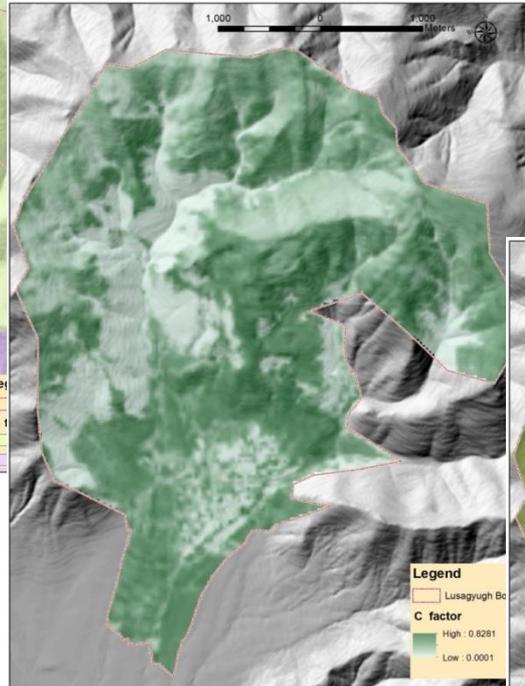
RUSLE model
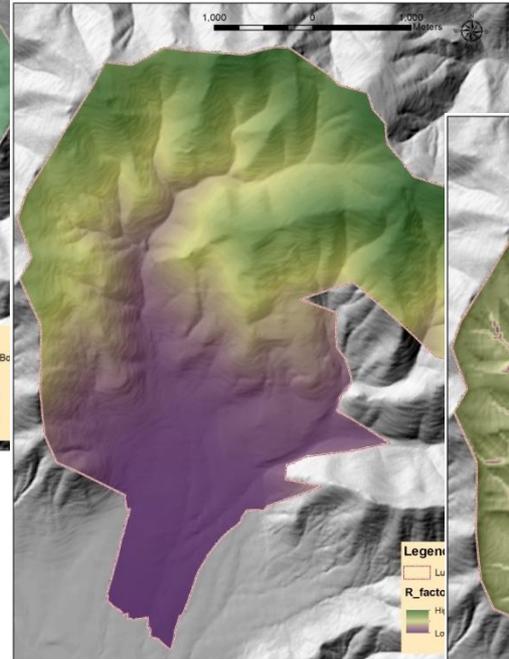
K factor
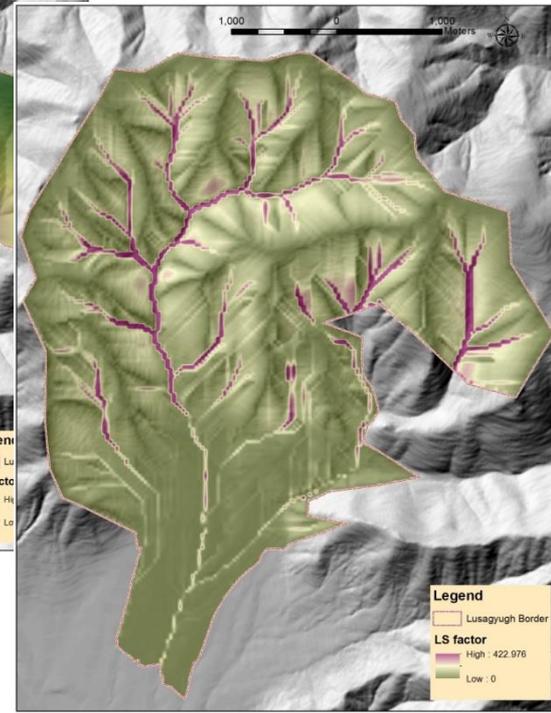
C factor

R factor

LS factor

Calculation of RUSLE
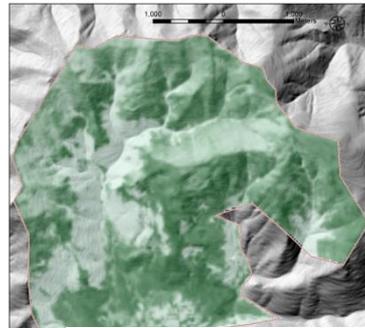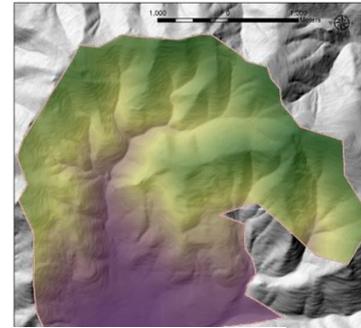
K factor
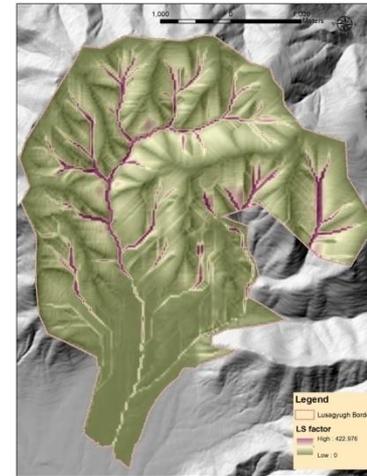
C factor

R factor

LS factor
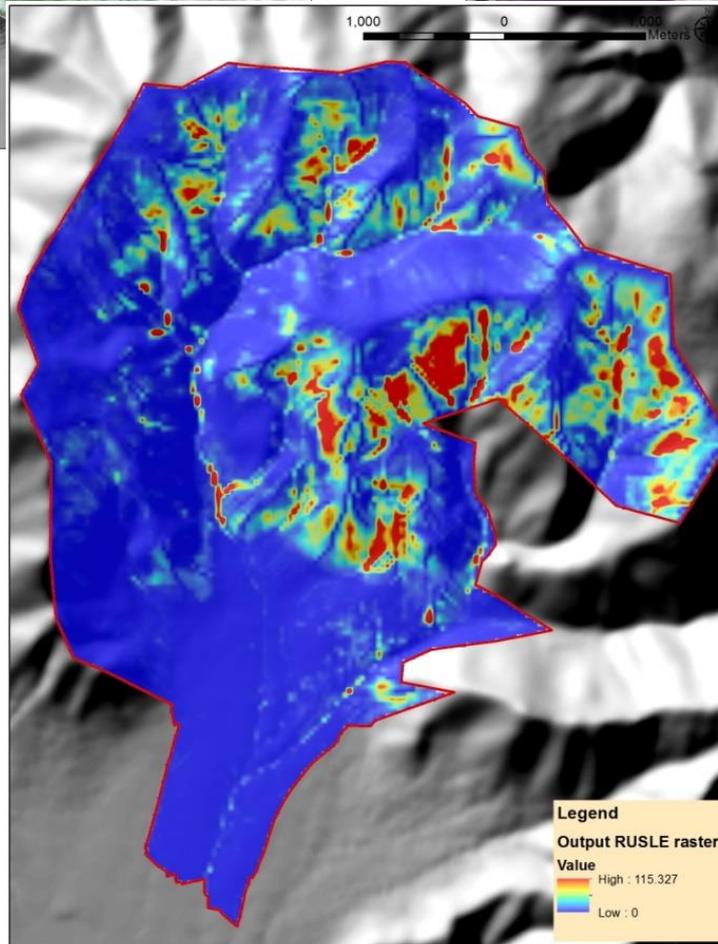
RUSLE t/ha per year

14.05.2014
47.767t/ha per year

Susceptibility to Erosion Index
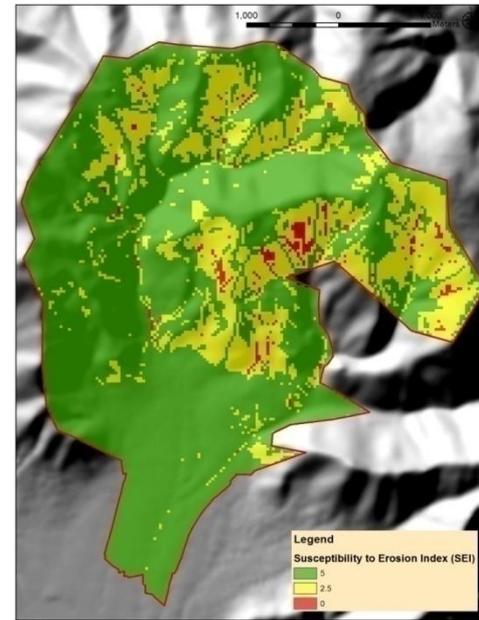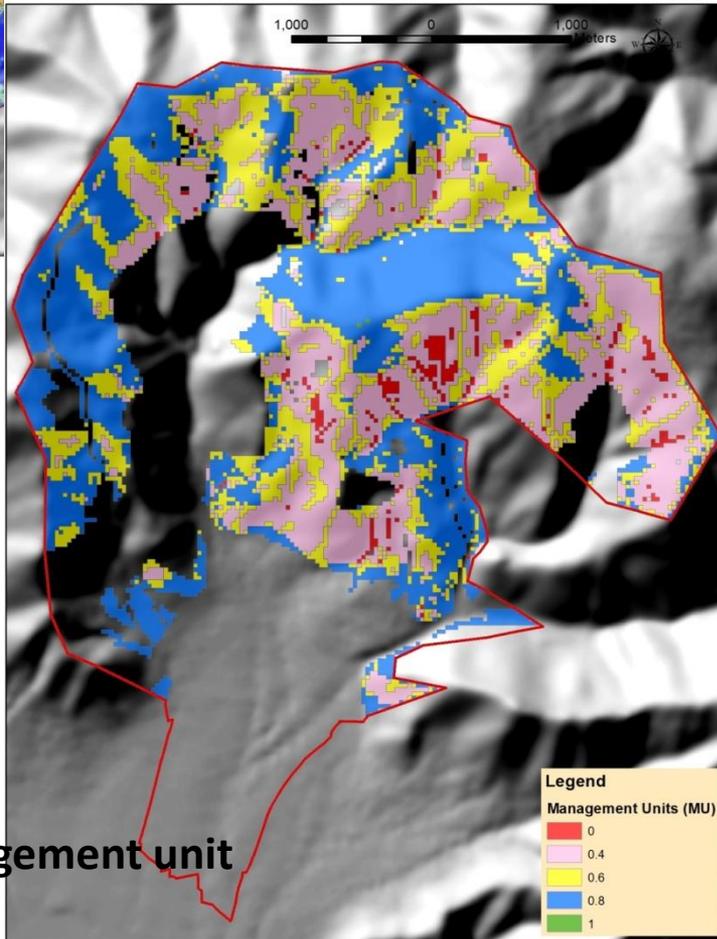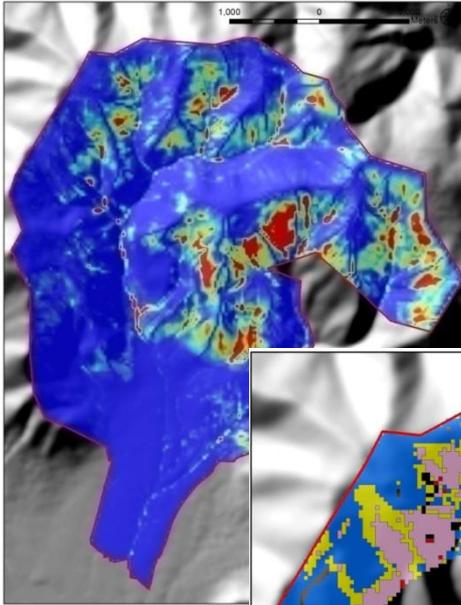
Management Recommendation unit

Pasture Management unit

Legend
Management Units (MU)
- 0
- 0.4
- 0.6
- 0.8
- 1

Legend
Susceptibility to Erosion Index (SEI)
- 5
- 2.5
- 0

Legend
Pasture Degradation Index (PDI)
- 5
- 2.5
- 0
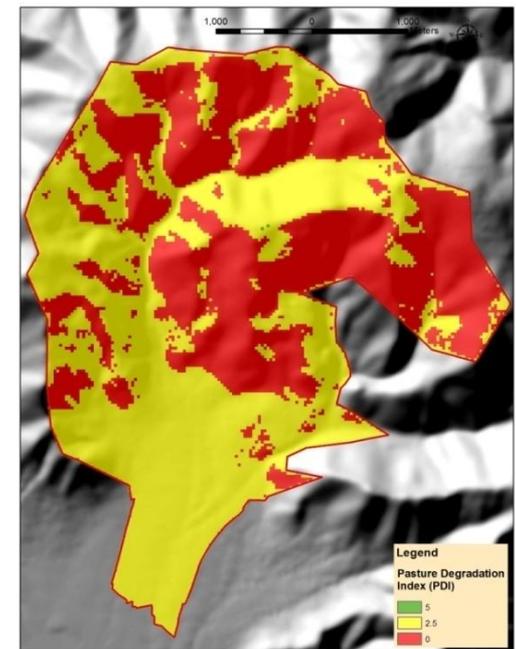
# GIS in GEOARCHAEOLOGICAL RESEARCH

Areni caves excavation

Haghtanak excavation

HAGHTANAK-3 OPEN-AIR STE.LONGITUDINAL SECTION

Legend
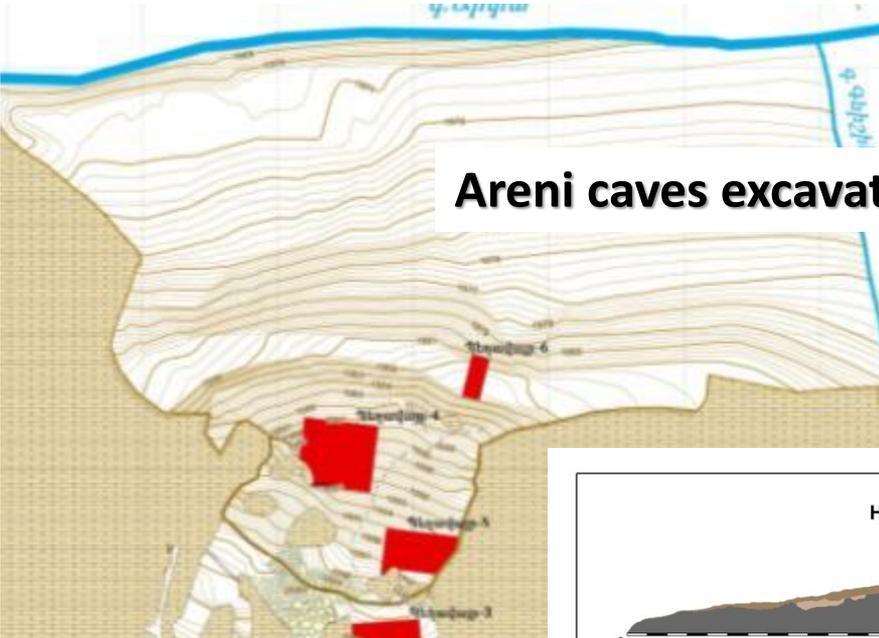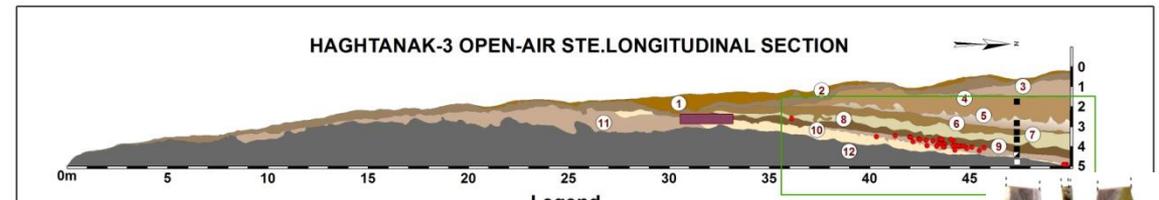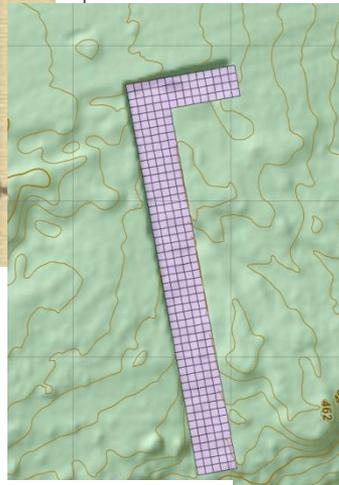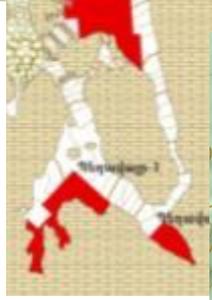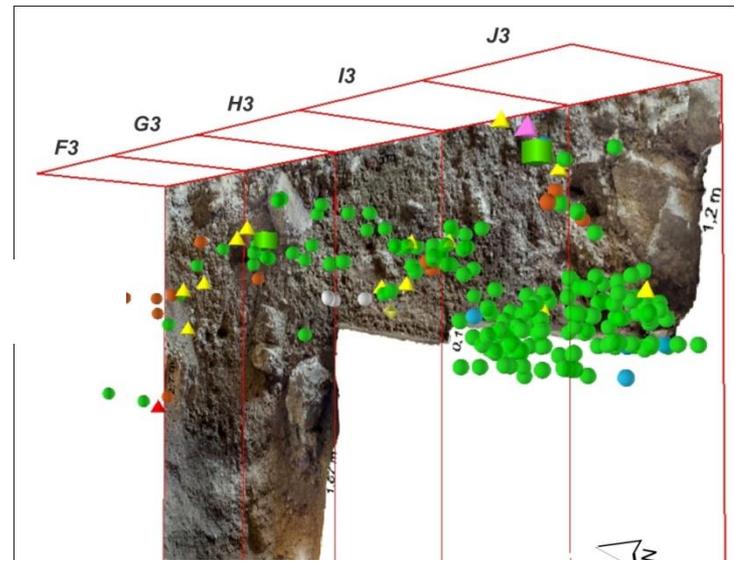
rated in result of last years excavations

including pieces of different sediments from lower stratums (cultivated soil)

brown aleurite with fine sand including limited humus (heavily modified paleosoil)

n loam including very limited humus, low carbonated (heavily modified paleosoil)

n aleurite with fine sand, carbonated (heavily modified paleosoil)

brown aleurite including limited fine sand (aeolian sediments)

brown aleurite with fine sand partly including clayey sediments, heavily carbonated (Cryogenic changed paleoso

am carbonated (heavily modified paleosoil)

n aleurite including fine sand, Cryogenic changed and carbonated (heavily modified paleosoil)

wn aleurite including limited fine sand and very limited sub-angular debris, heavily carbonated (aeolian sediments)

brown alluvial small pebbles with sub-arounded debris including fine sand silt and big andesite-basaltic blocs, he
olluvial deposits)
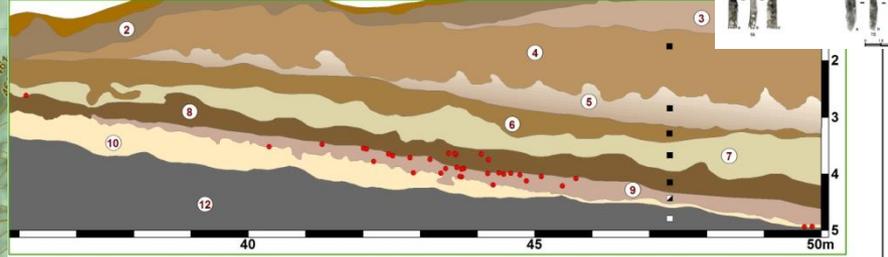
North-South project
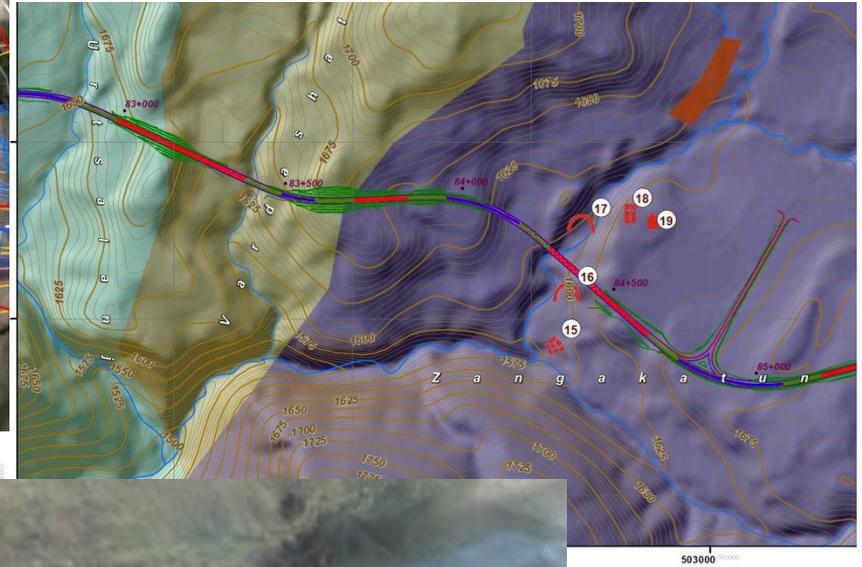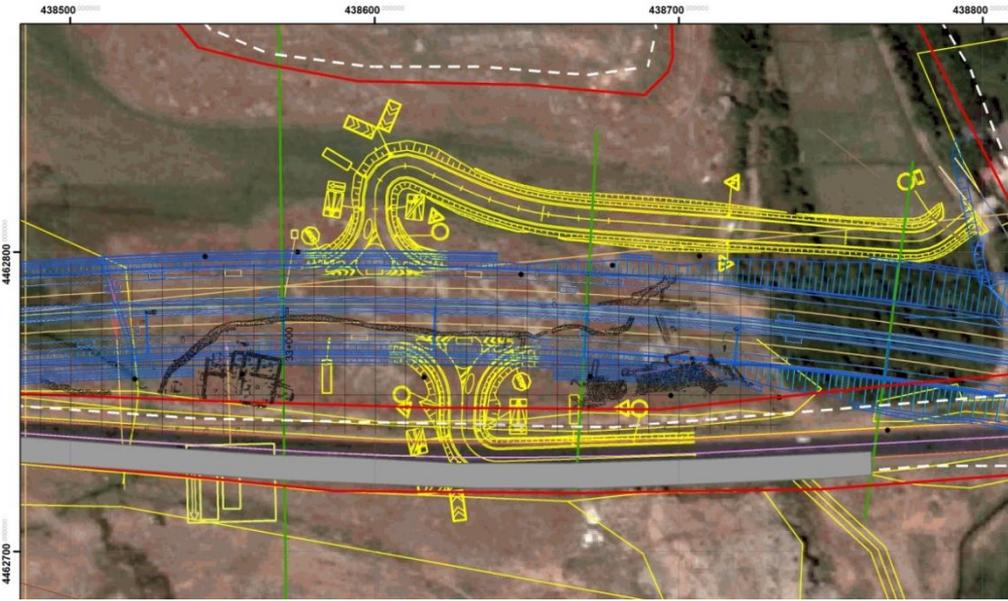
Thank you

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**Laboratory of Geodynamic and Geological hazardous
of Institute of Geological Sciences of NAS RA**