

Supplementary materials: Landslide susceptibility mapping of Central and Western Greece, combining NGI and WoE methods, with remote sensing and ground truth data.

Charalampos Kontoes, Constantinos Loupasakis, Ioannis Papoutsis, Stavroula Alatzas, Eleftheria Poyiadji, Athanassios Ganas, Christina Psychogiou, Mariza Kaskara, Sylvia Antoniadi, Natalia Spanou

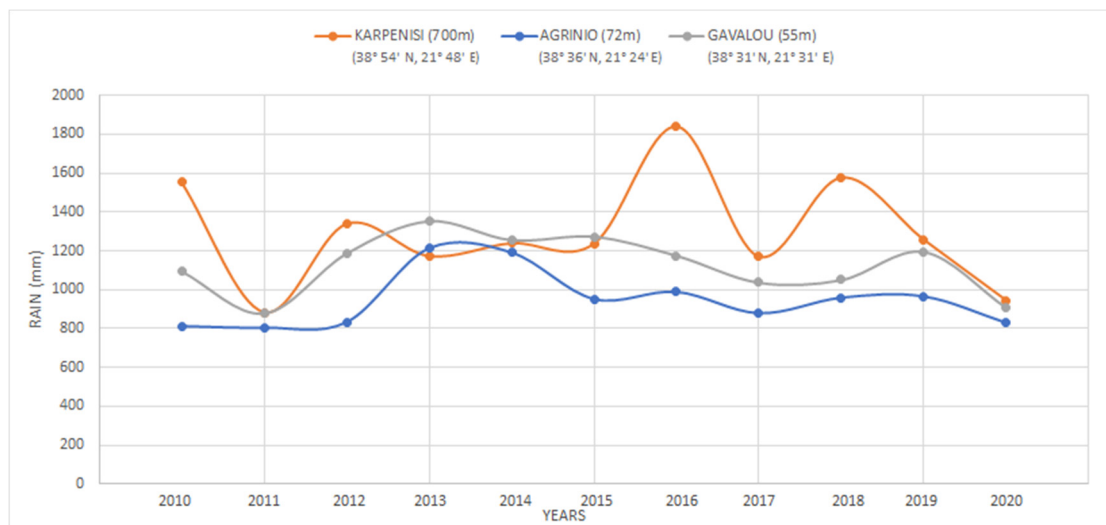


Figure S1. Plot of the sum of rainfall data per year for meteorological stations Karpensisi, Agrinio and Gavalou.

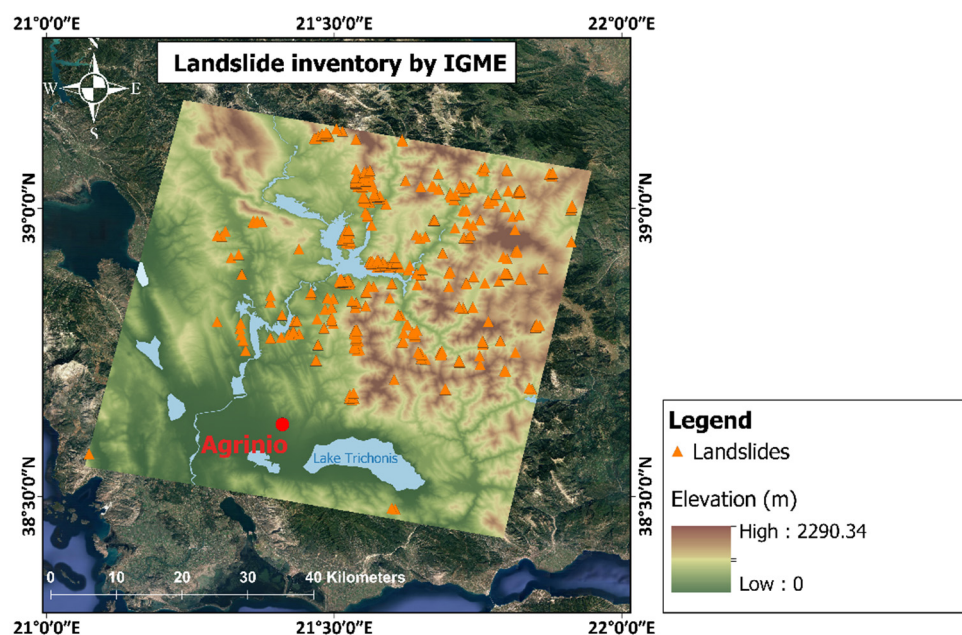


Figure S2. Landslide inventory provided by the Hellenic Survey of Geology and Mineral Exploration – HSGME (former IGME-GR) covering the period from 1965 to 2010.

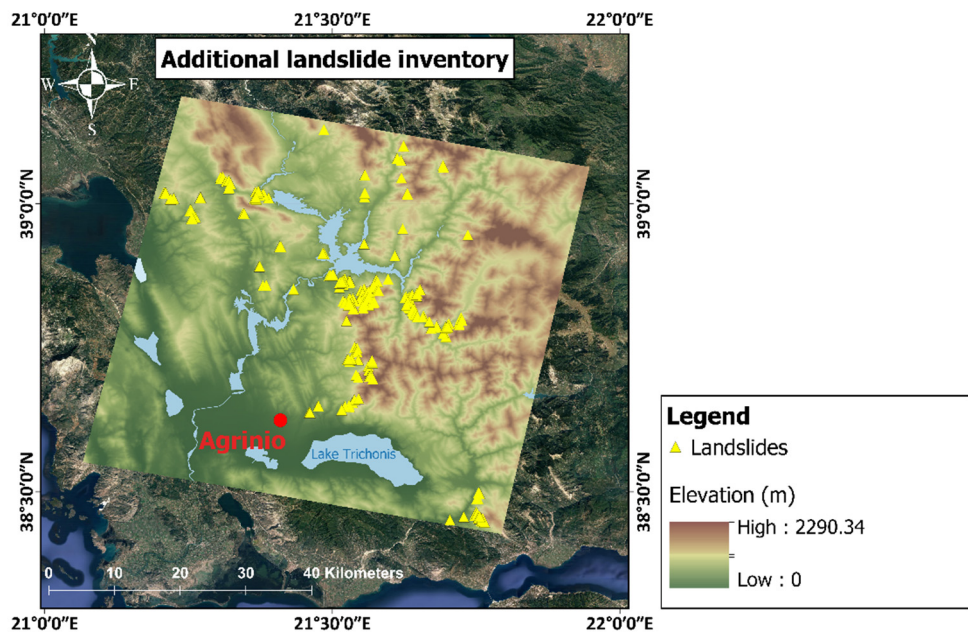


Figure S3. Additional landslide inventory by SAR, visual photo interpretation and field visits.

1. Calculate Weights of evidence maps

Table S1. Statistics for slope evidential theme.

Class	Slope (%)	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CL ASS
1	0-20	1679,14	56	-1,00	0,13	0,31	0,05	-1,31	0,14	-9,11	1
2	20-40	1556,25	163	0,15	0,08	-0,08	0,06	0,23	0,10	2,31	2
3	40-60	904,28	113	0,33	0,09	-0,10	0,06	0,42	0,11	3,84	3
4	60-80	386,02	66	0,64	0,12	-0,09	0,05	0,73	0,13	5,40	4
5	>80	98,04	20	0,82	0,23	-0,03	0,05	0,85	0,23	3,68	5

Table S2. Statistics for faults evidential theme.

Class	Faults	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CL ASS
1	Inside faults zone (buffer 350m)	643,6925	134	0,838	0,0869	-0,2372	0,0595	1,0752	0,1053	10,2087	1
2	Outside faults zone	3965,265	284	-0,2372	0,0595	0,838	0,0869	-1,0752	0,1053	-10,2087	2

Table S3. Statistics for curvature evidential theme.

Class	Curvature	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CL ASS
1	Concave (negative)	2266,04	255	0,22	0,06	-0,27	0,08	0,48	0,10	4,78	1
2	Flat	200,17	0	0	0	0	0	0	0	0	99
3	Convex (positive)	2136,49	163	-0,18	0,08	0,13	0,06	-0,31	0,10	-3,04	3

Table S4. Statistics for LS factor evidential theme.

Class	LS factor	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CL ASS
1	0 to 4	1211,02	20	-1,70	0,22	0,26	0,05	-1,96	0,23	-8,55	1
2	4 to 8	710,73	39	-0,50	0,16	0,07	0,05	-0,57	0,17	-3,39	2
3	8 to 12	724,95	70	0,07	0,12	-0,01	0,05	0,08	0,13	0,60	99
4	12 to 16	622,08	81	0,37	0,11	-0,07	0,05	0,44	0,12	3,53	4
5	16 to 20	482,50	68	0,45	0,12	-0,07	0,05	0,51	0,13	3,87	5
6	20 to 24	371,46	46	0,32	0,15	-0,03	0,05	0,35	0,16	2,23	6
7	24 to 28	264,02	41	0,54	0,16	-0,04	0,05	0,59	0,17	3,57	7
8	>28	236,96	53	0,91	0,14	-0,08	0,05	1,00	0,15	6,74	8

Table S5. Statistics for aspect evidential theme.

Class	Aspect	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CL ASS
1	Flat	197,67	0	0	0	0	0	0	0	0	99
2	North	412,28	27	-0,33	0,19	0,03	0,05	-0,36	0,20	-1,78	99

3	Northeast	534,84	28	-0,55	0,19	0,05	0,05	-0,61	0,20	-3,10	3
4	East	650,79	35	-0,53	0,17	0,07	0,05	-0,59	0,18	-3,53	4
5	Southeast	499,76	36	-0,23	0,17	0,03	0,05	-0,26	0,17	-1,48	99
6	South	498,03	57	0,23	0,13	-0,03	0,05	0,26	0,14	1,85	99
7	Southwest	666,60	88	0,38	0,11	-0,08	0,06	0,46	0,12	3,79	7
8	West	664,12	102	0,53	0,10	-0,12	0,06	0,65	0,11	5,72	8
9	Northwest	477,84	45	0,04	0,15	0,00	0,05	0,04	0,16	0,26	99

Table S6. Statistics for precipitation evidential theme.

Class	Precipitation (mm) T=50 years d=24h	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CLASS
1	< 120	12188,00	18,00	-1,31	0,24	0,13	0,05	-1,44	0,2412	-5,9693	1
2	120-160	38721,02	255,00	0,19	0,06	-0,24	0,08	0,43	0,1005	4,2803	2
3	160-200	20513,02	136,00	0,20	0,09	-0,08	0,06	0,28	0,1047	2,6730	3
4	200-240	4189,97	9,00	-0,93	0,33	0,03	0,05	-0,97	0,3374	-2,8724	4
5	>240	1083,77	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	99

Table S7. Statistics for land use land cover evidential theme.

Class	Corine Land Cover Categories	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast	GEN_CLASS
1	Urban fabric	41,75	18	1,58	0,24	-0,04	0,05	1,61	0,24	6,61	1
2	Industrial, commercial and transport units	6,63	0	0	0	0	0	0	0	0	99
3	Mine, dump and construction sites	2,77	1	1,40	1,01	0	0,05	1,40	1,01	1,38	99
4	Arable land	222,74	0	0	0	0	0	0	0	0	99
5	Permanent crops	86,24	0	0	0	0	0	0	0	0	99
6	Pastures	5,94	0	0	0	0	0	0	0	0	99
7	Heterogeneous agricultural areas	767,88	160	0,84	0,08	-0,30	0,06	1,14	0,10	11,27	7
8	Forests	1681,76	106	-0,37	0,10	0,16	0,06	-0,53	0,11	-4,71	8
9	Scrub and/or herbaceous vegetation associations	1410,94	116	-0,10	0,09	0,04	0,06	-0,14	0,11	-1,29	99

10	Open spaces with little or no vegetation	126,96	17	0,39	0,24	-0,01	0,05	0,40	0,25	1,63	99
11	Inland wetlands	6,16	0	0	0	0	0	0	0	0	99
12	Maritime wetlands	0,10	0	0	0	0	0	0	0	0	99
13	Inland waters	237,26	0	0	0	0	0	0	0	0	99
14	Artificial, non-agricultural vegetated areas	0,25	0	0	0	0	0	0	0	0	99
15	Marine waters	5,32	0	0	0	0	0	0	0	0	99

Table S8. Statistics for geological formations evidential theme.

Class	Formation	Area(sqkm)	Number of landslide points	W+	σ_w+	W-	σ_w-	C	σ_c	Studentized contrast	GEN_CLASS
1	Debris & debris cones	79,12	6	-0,18	0,41	0	0	0	0	0	99
2	Terraces	124,46	0	0	0	0	0	0	0	0	99
3	Terra rossa	315,61	4	-1,97	0,50	0,06	0,05	-2,04	0,50	-4,05	3
4	Landslides	5,12	42	5,18	0,22	-0,11	0,05	5,28	0,22	23,72	4
5	Lacustrine & sea sediments	4,96	0	0	0	0	0	0	0	0	99
6	Marsh deposits	16,99	0	0	0	0	0	0	0	0	99
7	Gavrovo flysch	612,73	104	0,63	0,10	-0,14	0,06	0,77	0,11	6,81	7
8	Ionian Zone Flysch:sandstones, clay pelite	711,31	17	-1,34	0,24	0,13	0,05	-1,47	0,25	-5,92	8
9	Pindos Zone Flysch	545,56	64	0,26	0,13	-0,04	0,05	0,30	0,14	2,19	9
10	Dam	0,76	0	0	0	0	0	0	0	0	99
11	Watercourses	243,87	0	0	0	0	0	0	0	0	99
12	Volcanic rocks	8,81	5	1,86	0,46	-0,01	0,05	1,87	0,46	4,09	12
13	Cherts & Radiolarite	300,31	60	0,80	0,13	-0,09	0,05	0,88	0,14	6,30	13
14	Olonos-Pindos zone limestones	347,80	7	-1,51	0,38	0,06	0,05	-1,57	0,38	-4,12	14
15	Ionian zone limestones	306,22	9	-1,13	0,33	0,05	0,05	-1,18	0,34	-3,50	15
16	Olistolith	0,05	0	0	0	0	0	0	0	0	99
17	Glacial moraine	25,34	12	1,67	0,29	-0,02	0,05	1,70	0,30	5,72	17
18	Carbonate breccia	132,81	0	0	0	0	0	0	0	0	99
19	Buffer of debris & debris cones	50,65	11	0,88	0,30	-0,02	0,05	0,90	0,31	2,91	19

20	Buffer of Olonos-Pindos zone Limestones	770,30	77	0,10	0,11	-0,02	0,05	0,12	0,13	0,93	99
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2. Calculate Weights of reclassified evidence maps

Table S9. Statistics for reclassified LS factor evidential theme.

Class	LS factor	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast
1	<8	1910,08	58	-1,10	0,13	0,39	0,05	-1,49	0,14	-10,51
2	8 to 16	1340,73	150	0,21	0,08	-0,10	0,06	0,31	0,10	3,04
3	16 to 24	851,73	118	0,43	0,09	-0,13	0,06	0,55	0,11	5,07
4	>24	500,15	92	0,71	0,10	-0,13	0,06	0,85	0,12	7,13

Table S10. Statistics for reclassified aspect evidential theme.

Class	Aspect	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast
1	Flat	210,04	0	0	0	0	0	0	0	0
2	North/Northeast	954,53	61	-0,35	0,13	0,08	0,05	-0,43	0,14	-3,08
3	East/Southeast	1143,77	63	-0,50	0,13	0,12	0,05	-0,63	0,14	-4,56
4	South	490,74	59	0,28	0,13	-0,04	0,05	0,32	0,14	2,28
5	Southwest	668,76	89	0,38	0,11	-0,08	0,06	0,47	0,12	3,90
6	West	643,96	89	0,42	0,11	-0,09	0,06	0,51	0,12	4,27
7	Northwest	490,91	57	0,25	0,13	-0,03	0,05	0,28	0,14	1,97

Table S11. Statistics for reclassified precipitation evidential theme.

Class	Precipitation (mm) T=50 years d=24h	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast
1	< 120	12188,00	18,00	-1,31	0,24	0,13	0,05	-1,44	0,24	-5,97
2	120-160	38721,02	255,00	0,19	0,06	-0,24	0,08	0,43	0,10	4,28
5	>160	25786,76	145,00	0,03	0,08	-0,02	0,06	0,05	0,10	0,46

Table S12. Statistics for reclassified land use land cover evidential theme.

Class	Corine Land Cover Category	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast
1	Artificial surfaces	51,43	19	1,4199	0,232	-0,0355	0,0502	1,4554	0,2374	6,1314
2	Agricultural areas	1082,36	157	0,47	0,08	-0,20	0,06	0,68	0,10	6,66
3	Forest	1682,28	110	-0,33	0,10	0,15	0,06	-0,48	0,11	-4,32
4	Open space with little or no vegetation / Shrubs	1537,21	132	-0,06	0,09	0,03	0,06	-0,08	0,11	-0,79
5	Wetlands / Water bodies	248,69	0	0	0	0	0	0	0	0

Table S13. Statistics for reclassified geological formations evidential theme.

Class	Formation	Area(sqkm)	Number of landslide points	W+	σ_{w+}	W-	σ_{w-}	C	σ_c	Studentized contrast
1	Debris & debris cones/ Buffer of debris & debris cones	129,77	17	0,37	0,24	-0,01	0,05	0,38	0,25	1,54
2	Flysch	1869,60	185	0,09	0,07	-0,06	0,07	0,15	0,10	1,52
3	Terra rossa/ Lacustrine & sea sediments/Marsh deposits/Sand, clay, marl/alluvial deposit	337,57	4	-2,04	0,50	0,07	0,05	-2,11	0,50	-4,19
4	Landslides	5,12	42	5,18	0,22	-0,11	0,05	5,28	0,22	23,72
5	Volcanic rocks	8,81	5	1,86	0,46	-0,01	0,05	1,87	0,46	4,09
6	Cherts & Radiolarite/Schists with posidonia fossils & cherts/Limestones & cherts	300,31	60	0,80	0,13	-0,09	0,05	0,88	0,14	6,30
7	Olonos-Pindos zone limestones/Ionian zone limestones/Gavrovo zone limestones/Limestones with silex	654,02	16	-1,32	0,25	0,11	0,05	-1,43	0,26	-5,61
8	Glacial moraine	25,34	12	1,67	0,29	-0,02	0,05	1,70	0,30	5,72
9	Carbonate breccia/Olistolith/Gypsum	132,86	0	0	0	0	0	0	0	0
10	Buffer of Olonos-Pindos zone limestones	770,30	77	0,10	0,11	-0,02	0,05	0,12	0,13	0,93
11	Terraces	124,46	0	0	0	0	0	0	0	0
12	Dam/Watercourses	244,63	0	0	0	0	0	0	0	0

2. Calculate Weights of NGI maps

Table S14: Slope factor S_r for varying slope angles.

Range of slopes angle (unit 1/100 degrees)	Classification	S_r
0000-0100	Very low	0
0101-0600	Low	1
0601-1200	Moderate	2
1201-1800	Medium	3
1801-2400	High	4
2401-3000	Very high	5
3001-3500	Probably stiff soil	4
3501-4000	Probably rock	3
4001-4500	Probably hard rock	2
>4500	Stable hard rock	1
No Data	No Data	No Data

Note: For slopes with angles of is less than 1° (i.e., for flat or nearly flat areas), S_r is set to zero because the resulting landslide hazard is null even if the other factors are favourable.

Table S15: Susceptibility and lithology factor S_l for varying types of rock.

Lithology and stratigraphy	Susceptibility	S_l
Extrusive volcanic rocks-Precambrian, Proterozoic and Archean	Low	1
Endogenous rocks (plutonic and/or metamorphic)-Precambrian, Proterozoic, Paleozoic and Archean.		
Old sedimentary rocks-Precambrian, Archean, Proterozoic, Paleozoic.	Moderate	1
Extrusive volcanic rocks-Paleozoic, Mesozoic.		
Endogenous rocks-Paleozoic, Mesozoic, Triassic, Jurassic, Cretaceous.		
Sedimentary rocks-Paleozoic, Mesozoic, Triassic, Jurassic, Cretaceous.	Medium	2
Extrusive volcanic rocks- Mesozoic, Triassic, Jurassic, Cretaceous.		
Endogenous rocks-Meso-Cenozoic, Cenozoic.		
Sedimentary rocks-Cenozoic, Quaternary.	High	

Extrusive volcanic rocks- Meso-Cenozoic.	3
Extrusive volcanic rocks- Cenozoic.	

Table S16: Susceptibility and soil moisture factor S_h for different soil moisture indices.

Soil moisture index (NCEP/CPC)	Susceptibility	S_h
0 → 80	Low to moderate	1
80 → 160	Medium	2
160 → 250	High to very high	3

Table S17: Non-resistance to landslides and vegetation cover categories.

Description	Category of vegetation cover w.r.t. non-resistance to landslides	Vegetation cover index S_v for rainfall-induced-slides
Sclerophyllous vegetation	1	0.8
Agro forestry systems	2	0.9
Natural herbaceous vegetation	3	1.0
Construction zones	4	1.2
Continuous urban area	5	1.2

Table S18. Precipitation factor T_p for varying monthly rainfall values.

100-year extreme monthly rainfall (mm)	Susceptibility	T_{pl}
0000-0330	Low	1
0331-0625	Moderate	2
0626-1000	Medium	3
1001-1500	High	4
>1500	Very high	5