

Climate Risk Maps of Armenia

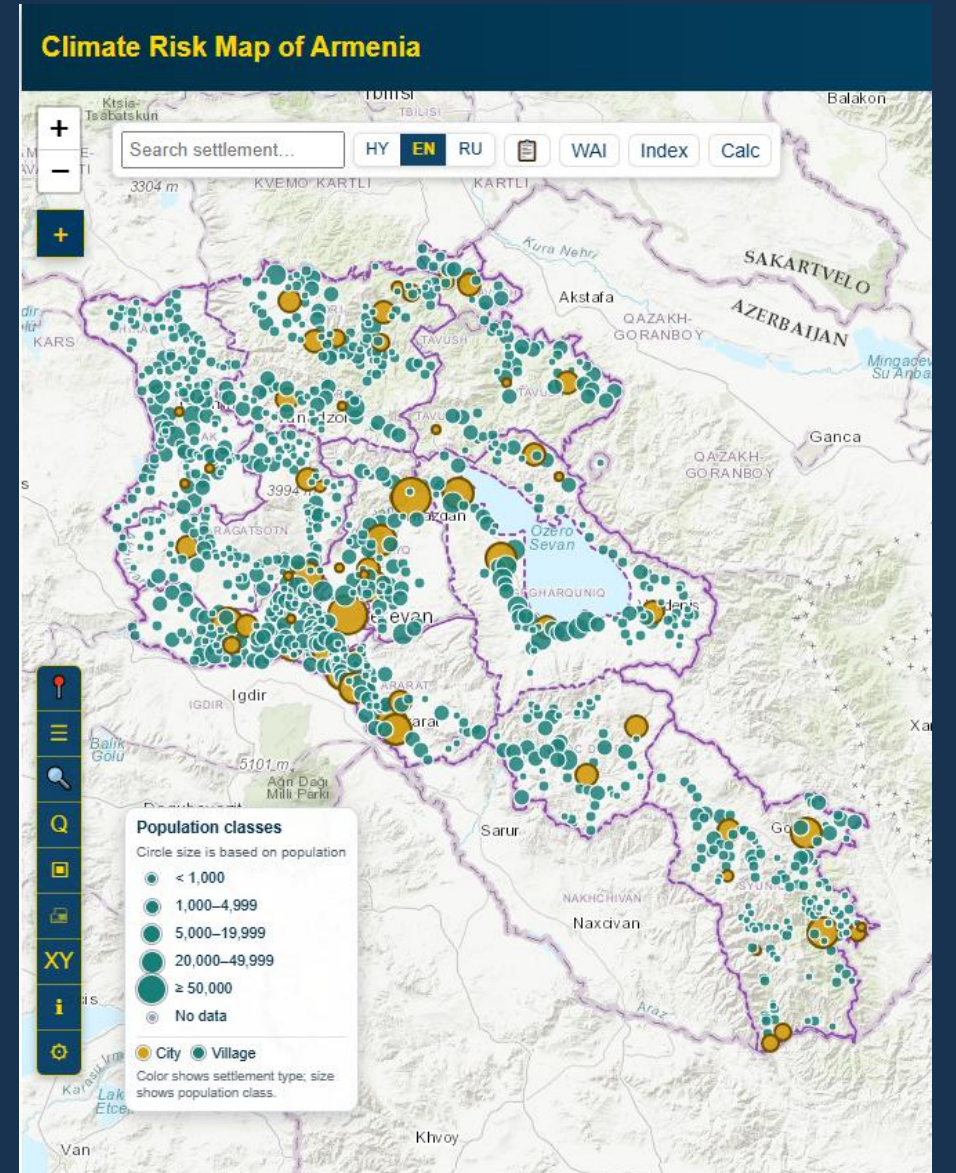
A settlement-level climate risk screening tool,
developed with the support of the Asian Development Bank.

Concept

Methodology

Water accessibility

Prepared from Central Bank of Armenia and Asian Development Bank project materials.



Why the map matters



Settlement-level evidence

Climate risk analysis moves from broad provincial averages down to individual settlements.



One integrated platform

Natural hazards, meteorological indicators, water context and administrative layers sit in a single interactive map.



Built for screening

Intended for rapid first-pass screening rather than a final credit decision, followed by deeper local analysis where needed.

950

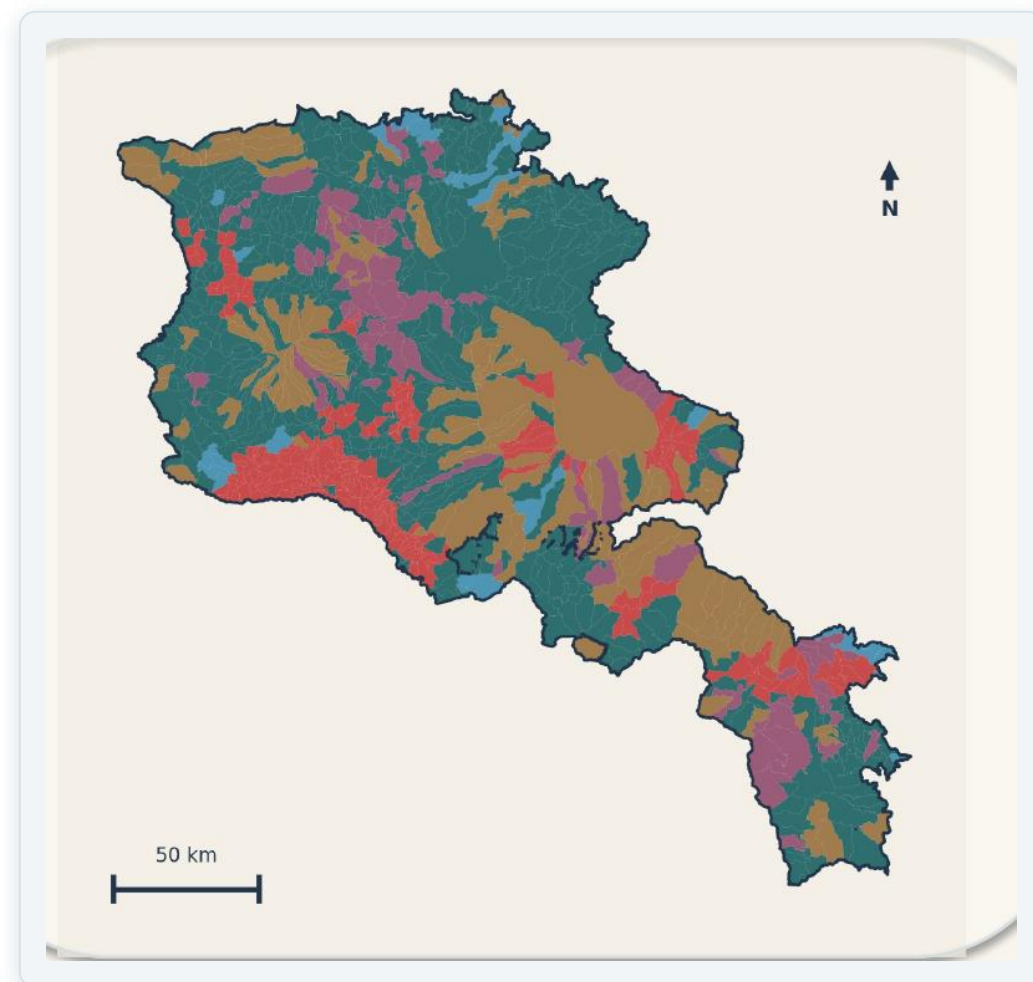
settlements

4+

layer groups

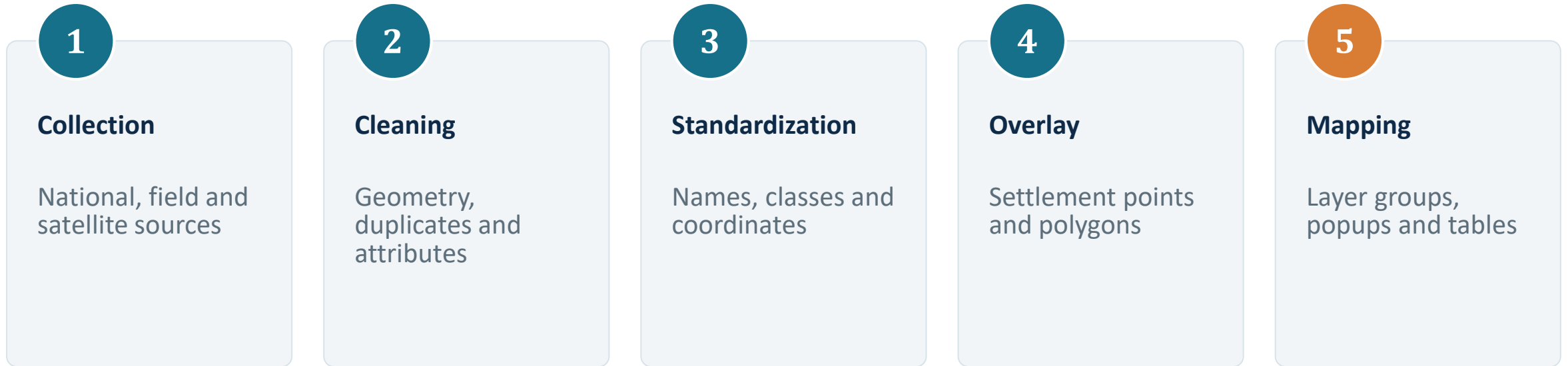
3

languages



Settlement coverage across every province of Armenia

From raw data to an interactive screening layer



The goal at every stage: make heterogeneous data layers comparable and readable inside one map.

DATA SOURCES

Where the data come from

Source group	What it supplies	Role in the map
National atlas layers	Core basis for the climate, water and hazard layers	Base
Administrative and settlement layers	Country boundary, provinces, settlements, settlement polygons	Base
Hydrometeorological data	Temperature, precipitation, hail, freezing, duration	Index input
Natural-hazard layers	Landslides, mudflows, flood events, avalanches	Index input
Water and management layers	Rivers, lakes, reservoirs, canals, drainage, irrigation	Supporting factor
Remote sensing	Drought, burned areas, thermal and vegetation signals	Context and cross-check

NAMED SATELLITE SOURCES

Sentinel-1 Radar; flood and surface-water checks	Sentinel-2 Optical and infrared; vegetation, water, moisture	Sentinel-3 Land-surface temperature, burned areas	MODIS Vegetation and thermal; drought and heat	GPM IMERG Satellite precipitation estimates
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Remote sensing does not replace national and field data; it strengthens their spatial interpretation.

Where the nine inputs come from

The calculation separates primary source/provider, processing role and validation or cross-checking evidence.

Family	Component	Primary source / provider	Use in calculation and checking
Physical hazards	Landslides	JICA landslide analysis, provided through the National Disaster Risk Reduction Platform; GIS harmonisation by the consultant.	Weighted hazard input, w=1.20; checked against settlement overlay and local/sector review.
Physical hazards	Mudflows	GIS Laboratory, Institute of Geological Sciences, NAS RA; supported by DEM and flow-path interpretation.	Weighted hazard input, w=1.20; localized by terrain and catchment context.
Physical hazards	Flood events ≤5 km	Institute of Geological Sciences GIS Laboratory + public information + May 2024 Lori/Tavush PDNA report.	Weighted event input, w=1.10; validated with recorded events and satellite flood evidence.
Hydrometeorological	Hail frequency	Water Resources Atlas / national hydrometeorological hazard layer; Hydromet open information where available.	Weighted input, w=0.70; cross-checked with convective/precipitation satellite signals.
Hydrometeorological	Freezing / frost	Water Resources Atlas and national hydrometeorological layers; Hydromet open information for interpretation.	Weighted input, w=0.80; localized by elevation and climate zone.
Hydrometeorological	Precipitation deficit	Water Resources Atlas / precipitation layer; Hydromet open data and GPM IMERG as cross-check.	Weighted input, w=0.90; interpreted as climate-stress component.
Temperature stress	Maximum air temperature	Water Resources Atlas / temperature layer; MODIS and Sentinel-3 thermal signals for cross-check.	Weighted input, w=0.80; localized by DEM, altitude and climate conditions.
Temperature stress	Minimum air temperature	Water Resources Atlas / temperature layer; MODIS/Sentinel-3 and terrain context.	Weighted input, w=0.60; supports frost and cold-stress interpretation.
Water & production pressure	Lack of irrigation	Water Resources Atlas irrigation layer, cadastral/settlement overlay and field verification where available.	Supporting weighted factor, w=0.50; indicates production and water-access constraint, not a standalone natural hazard.

Hazard, exposure and vulnerability are treated separately

HAZARD — in the score

9 weighted components across physical, hydrometeorological, temperature and water/production pressure.

Based on national layers, Hydromet/open information, geological hazard layers and atlas products.

Localized with DEM, slope/elevation, climate zones and remote-sensing cross-checks.

EXPOSURE — on the map and in exports

Settlement point and boundary/polygon are the exposure frame.

Symbol size reflects population class from Statistical Committee / official statistical data. Cadastral/administrative geodata are used to align settlement names, geometry and boundaries.

VULNERABILITY — priority data gap

Building stock by construction year and material. Dwelling and asset registers; georeferenced businesses.

Small-area population updates between censuses. These would allow the next version to move beyond screening toward official exposure/vulnerability statistics.

Hazard exposure and water vulnerability screening

The index is designed for transparent first-pass screening; each settlement-level score can be traced back to weighted drivers.

Calculation logic

Each hazard is classified or scored on a common 0–5 scale.
Scores are multiplied by expert-defined weights and normalised to 0–100.
Water Accessibility Index (WAI / ՋՀԻ) is converted into water vulnerability: $1 - \text{WAI}/100$.
Final screening index = hazard exposure score × water-vulnerability multiplier.

Component	Weight
Landslides	1.20
Mudflows	1.20
Flood events	1.10
Hail	0.70
Freezing	0.80
Precipitation deficit	0.90
Tmax	0.80
Tmin	0.60
No irrigation	0.50

Current database

1,001 settlement records in the latest map database; score coverage is transparent in exports and flagged where input data are incomplete.

Exposure is visible, not confused with hazard

Population class controls settlement symbol size; it helps read exposure but does not replace detailed vulnerability data.

Interpretation rule

A low final score does not mean “no hazard”; it may mean only one hazard is present, or water vulnerability and other drivers are low.

Calculated layers and context layers

Not every visible map layer enters the calculation in the same way.

Calculated layers

- Form part of an index or hazard score
- Have classification or weighting rules
- Can be explained through settlement-level drivers

Context layers

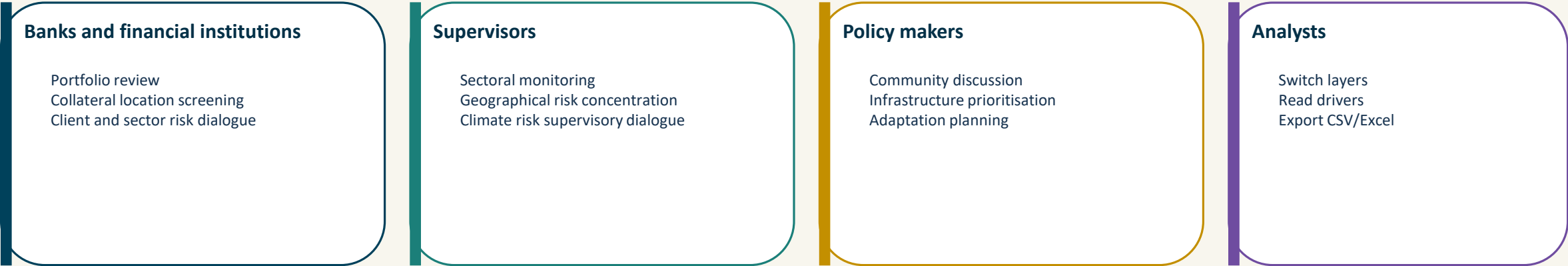
- Help interpret and cross-check spatial patterns
- Receive no separate weight, to avoid double counting
- Remain important for explanatory mapping

Treated as context, not as weighted hazard:

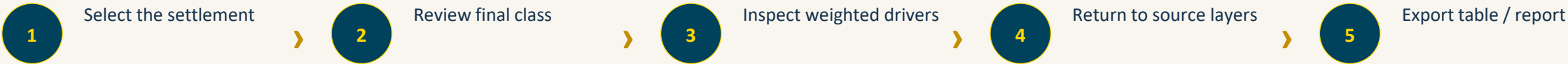
historical drought · burned areas 2018–2025 · climate zones · vegetation response · flood embankments · drainage network

How users can work with the map

The platform is intended as a screening and prioritisation tool, not a final credit or investment decision model.



Practical reading sequence



Hazards and exposure index

What the index combines



Physical hazards

Landslides, mudflows and flood events within 5 km



Hydrometeorological hazards

Hail, freezing events and precipitation deficit



Temperature stress

Maximum and minimum air temperature indicators



Water and production pressure

Lack of irrigation as a supporting factor

9

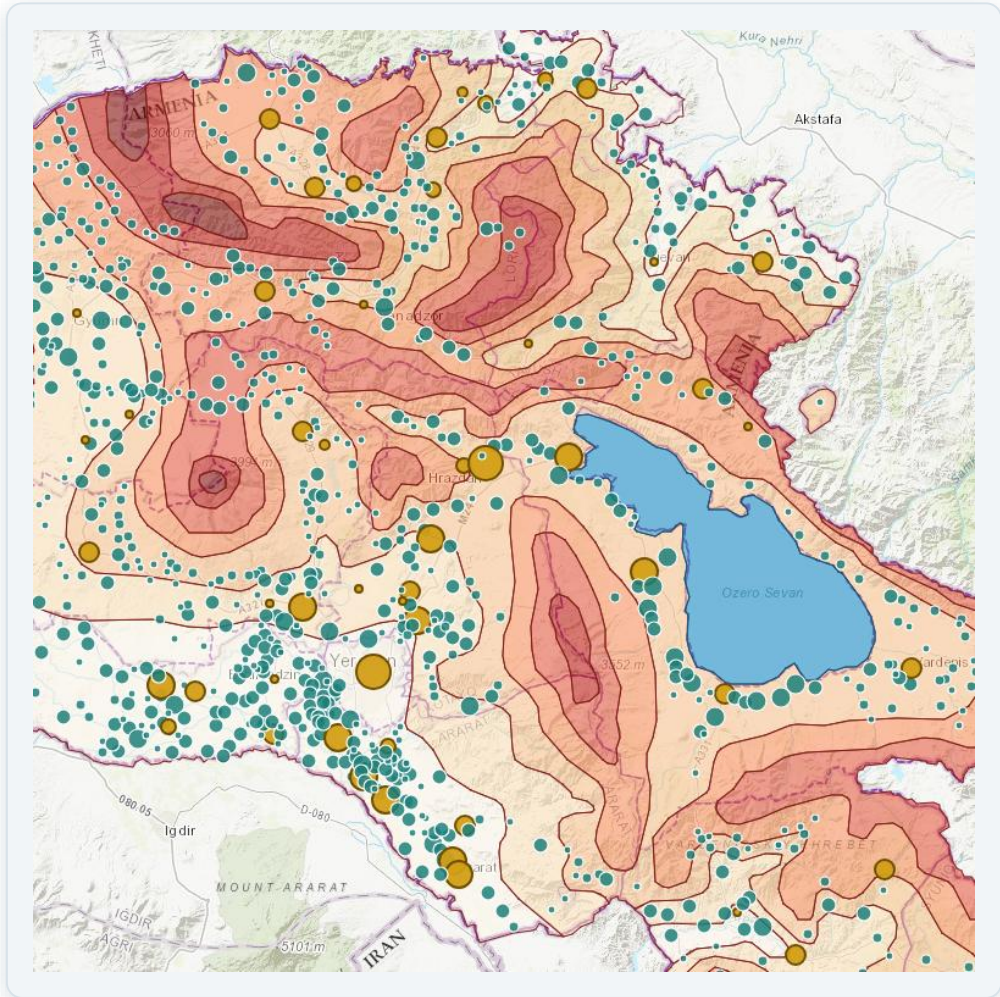
components

0–100

scoring scale

896

scored settlements



Example hazard layer: hail frequency, with settlement points sized by population

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How users can work with the map



Banks and financial institutions

Portfolio review, collateral location and client screening



Supervisors

Sectoral and geographical risk monitoring



Policy makers

Planning, community discussion and prioritisation



Analysts

Switch layers on and off and read the drivers behind each score

Practical reading sequence

1 Select the settlement



2 Review the final class



3 Inspect the main drivers



4 Return to source layers

The water accessibility index

A single settlement-level score for comparing water accessibility across Armenia, built from five subindices standardised to a common 0–100 scale.

-  **Surface water** — rivers, lakes, Lake Sevan, reservoirs, canals, springs
-  **Groundwater** — deposits, aquifers and recharge zones
-  **Infrastructure** — roads, treatment plants, irrigation, drainage
-  **Terrain** — elevation, slope and aspect
-  **Pressure and context** — sewage canals, tailings and river basins

950

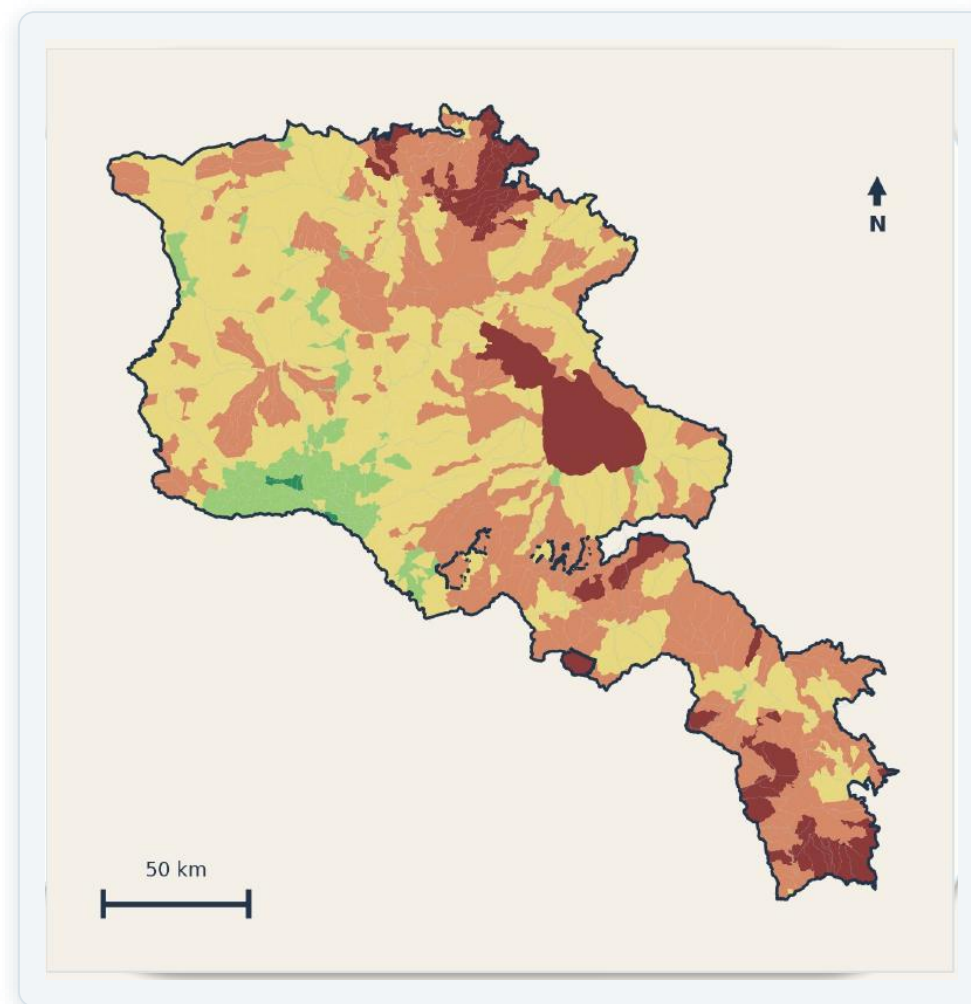
settlements

5

subindices

0–100

score scale



Water accessibility index by settlement, low to high

PART TWO

How to use the map

A walkthrough of the interactive platform — from the layer menu to the exported report.



Layer menu



Map view



Settlement report



Tools and exports

Layer groups and what sits inside them

Main layer menu

Settlements table

Administrative boundaries

Physical hazards

Meteorological hazards

Water Accessibility Index



Physical hazards

Settlements table

Administrative boundaries

Physical hazards

Physical hazards

☐ Landslides

☐ Mudflows

☐ Flood event points

☐ Flood hazard zones

☐ Flood embankments

☐ Burned areas (2018–2025)

Meteorological hazards

Settlements table

Administrative boundaries

Physical hazards

Meteorological hazards

☐ Hail

☐ Duration layer (days)

☐ Climate zones

☐ Freezing

☐ Precipitation

☐ Maximum air temperature

☐ Minimum air temperature

☐ Avalanches

☐ Historic Drought Frequency

Water accessibility index

Settlements table

Administrative boundaries

Physical hazards

Water Accessibility Index

☐ Water Accessibility Index (WAI)

☐ Irrigated areas

☐ Surface waters + reservoirs + canals + drainage

Legend

In this same panel, surface waters, reservoirs, canals, and drainage are switched on/off together.

Rivers / streams

Natural lakes

Reservoirs

Lake Sevan

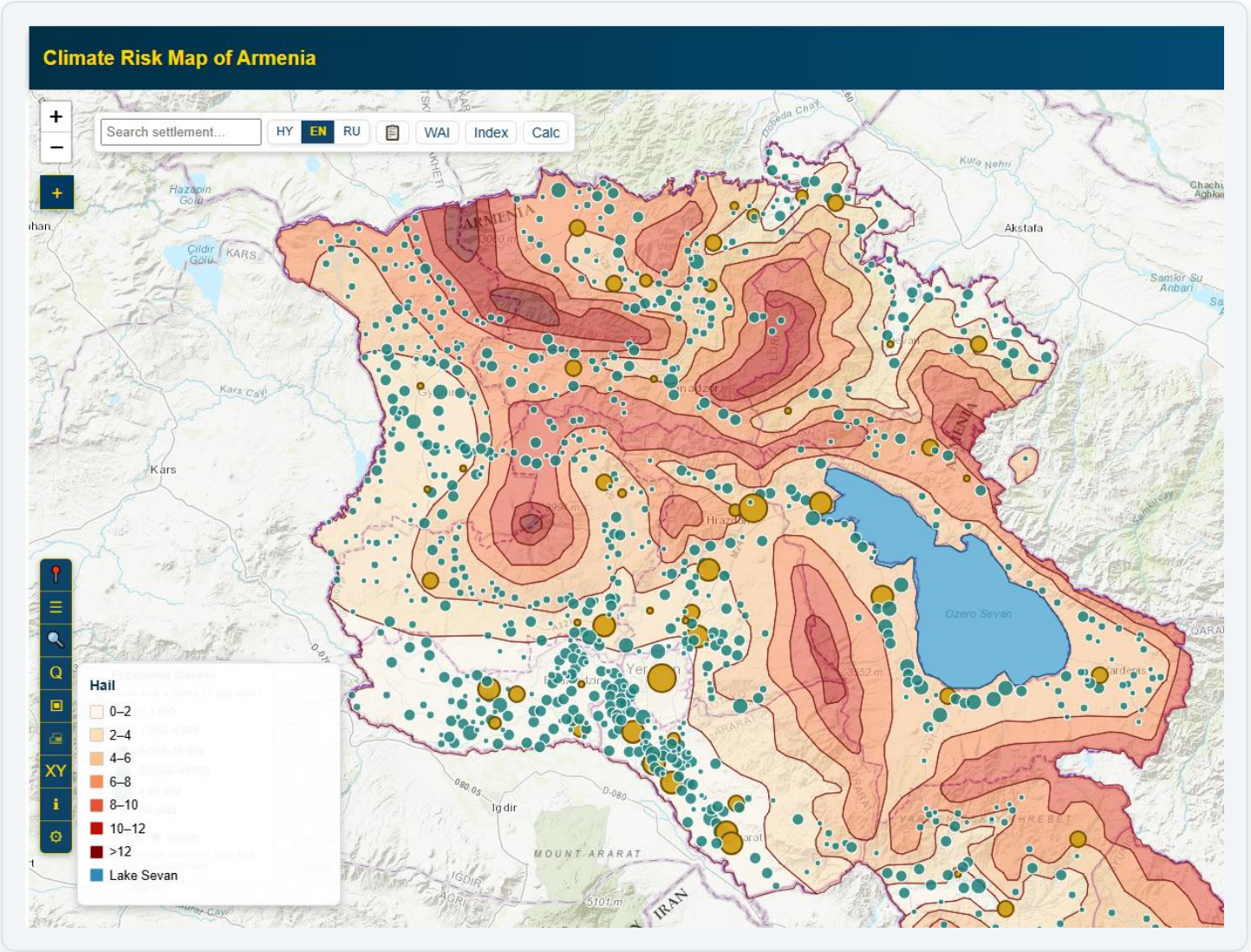
Canals

Drainage

Five groups, each opening its own panel

Layers switch on and off independently, information buttons explain each one, and the legend always follows the layer that is currently active.

Reading the map



Hazard surface

Shaded bands and contours show the intensity of the selected hazard layer.



Settlement points

Each point is a settlement; size reflects its population class.



Top toolbar

Settlement search, language switch, report, water index, index and calculator.



Legend

The legend panel updates automatically with the layer currently switched on.

Settlement hazards and indices summary

Arzakan · 8/14/2026, 10:00:32 AM

HOW TO USE

Arzakan

Settlement summary panel

Exposure & Water Vulnerability Index

High · 66/100

Hazard score: 58/100 · WAI: 56.3 · Moderate

Exposure and Water Vulnerability Index calculation	
Exposure & Water Vulnerability Index	66/100
Class	High
Weighted hazard score	58/100
Water vulnerability	43.7%
Main factors	Landslides (5×1.20); Mudflow (5×1.20); Freezings (5×0.80); Maximum air temperature (4×0.80)

All hazards affecting the settlement

Landslides

High

Very High

w 1.20

Mudflow

High

Very High

w 1.20

Freezings

High

Very High

w 0.80

Maximum air temperature

34–38°C

High

w 0.80

Minimum air temperature

-34 – -38°C

Very High

w 0.60

Hail

4-6

Low

w 0.70

Low precipitation

700 mm

Very Low

w 0.90

Climate forecast

2011–2040

Mean annual temperature: 8.0 °C
Annual precipitation: 838.8 mm

2041–2070

Mean annual temperature: 9.2 °C
Annual precipitation: 812.1 mm

Change (2041–2070 compared with 2011–2040)

Temperature change: +1.2 °C
Precipitation change: -26.7 mm (-3.2%)

Climate data used: Source: settlement-level climate projection table. It summarizes mean annual temperature and annual precipitation projections for 2011–2040 and 2041–2070. cl_t11/cl_p11 refer to 2011–2040, cl_t41/cl_p41 to 2041–2070, cl_dt to temperature change, and cl_dpmm/cl_dpp to precipitation change in mm and %.

Settlement analytical report

Observed climate-related layers	
Maximum air temperature	34–38°C
Minimum air temperature	-34 – -38°C
Precipitation	700 mm/year
Climate zones	Moderate, relatively dry warm summers and cold winters

Water and other layers

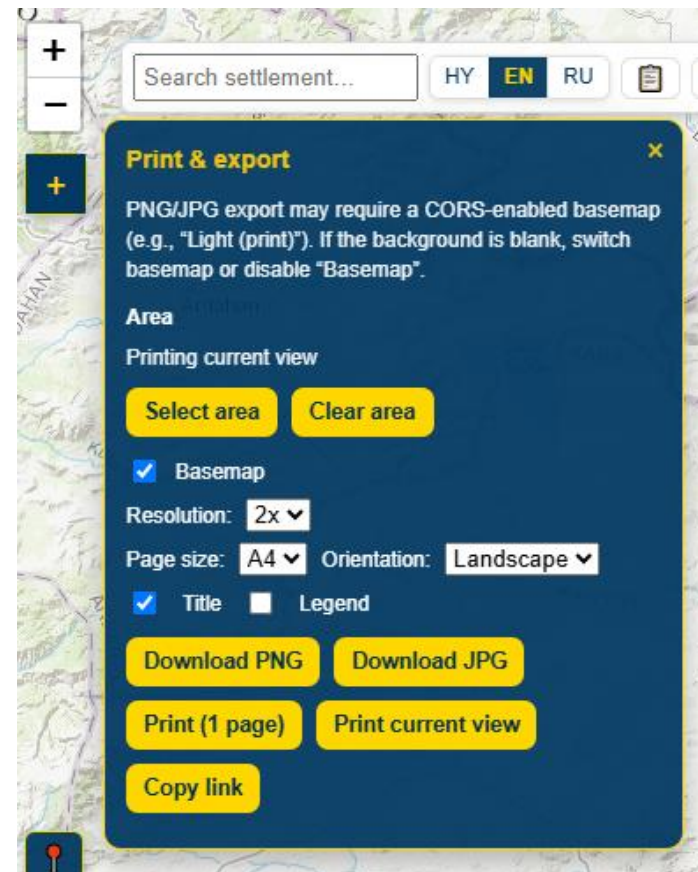
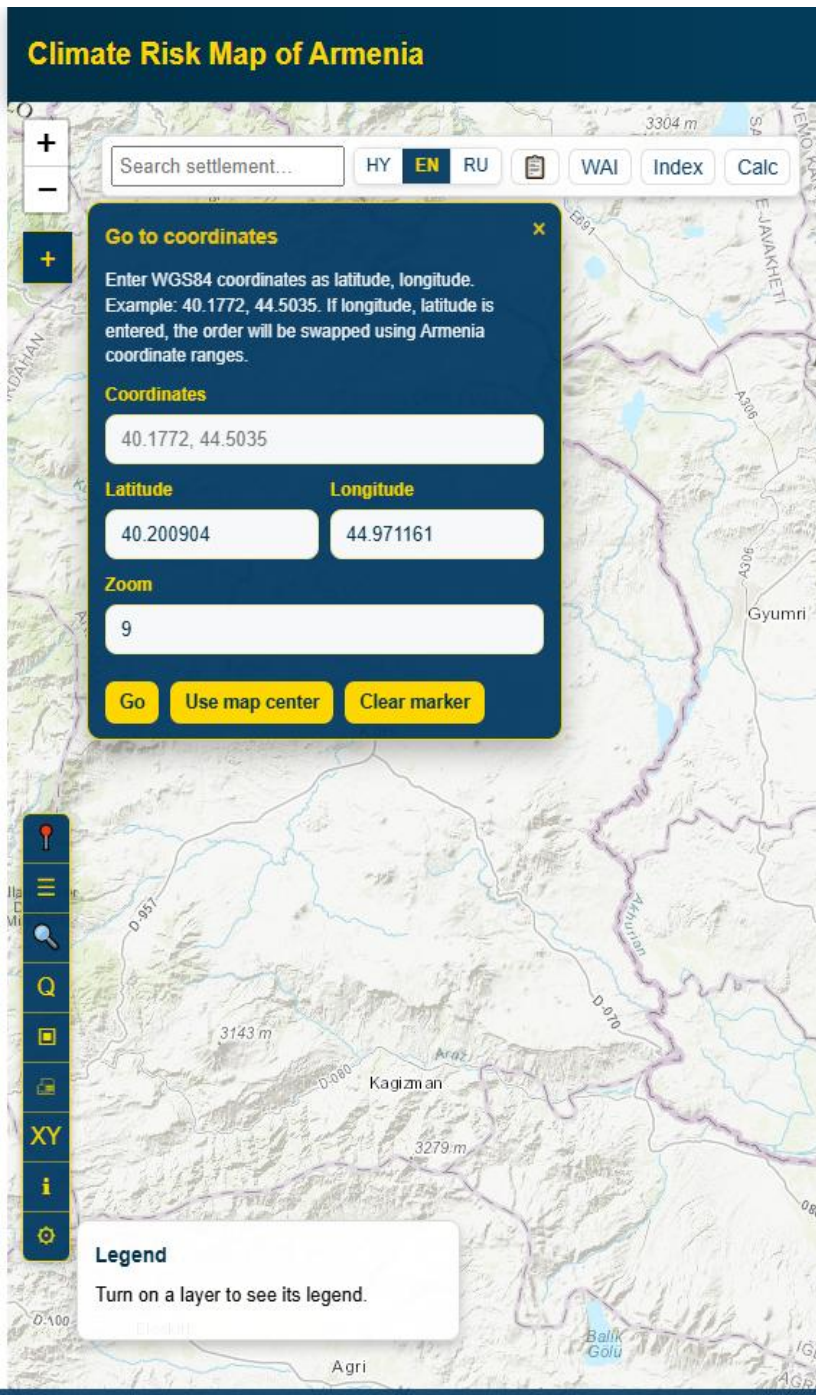
Settlement type	Village
WAI score	56.26
Class	Moderate
Irrigated areas	Sevan-Hrazdan — 21.7%
Population	2938
Population class	1,000–4,999

This report was generated from the settlement summary window of the interactive map.

The report carries the index score, its class, the weighted drivers and the underlying observed layers on a single page.

Other tools and exports

- XY search option
- Settlement search
- Print and export



3 languages

Open settlements
and hazard Excel

Water Accessibility Index
(Excel/CSV)

Settlement Exposure & Water
Vulnerability Screening Index

What the index contains, and how it is checked

Hazard

Nine weighted components across physical hazards, hydrometeorological hazards, temperature stress, and water and production pressure.

In the score

Exposure

The settlement itself: a representative point and a boundary polygon, with population class shown as the size of the symbol.

On the map, not in the score

Vulnerability

Building stock, dwelling characteristics and asset values do not appear in either the layer package or the index.

Not represented

How the layers are checked today

Geometries, names and classes are harmonised; satellite signals cross-check the spatial pattern of the national layers; high-risk cases go to sectoral or field verification. The scores are not yet compared against recorded losses.