



INVEST MODEL INPUT DATA COLLECTION REPORT

**TA-6884 REG: “Mainstreaming Natural Capital
Approaches into the Ararat River Basin
Management Plan - Armenia” project**



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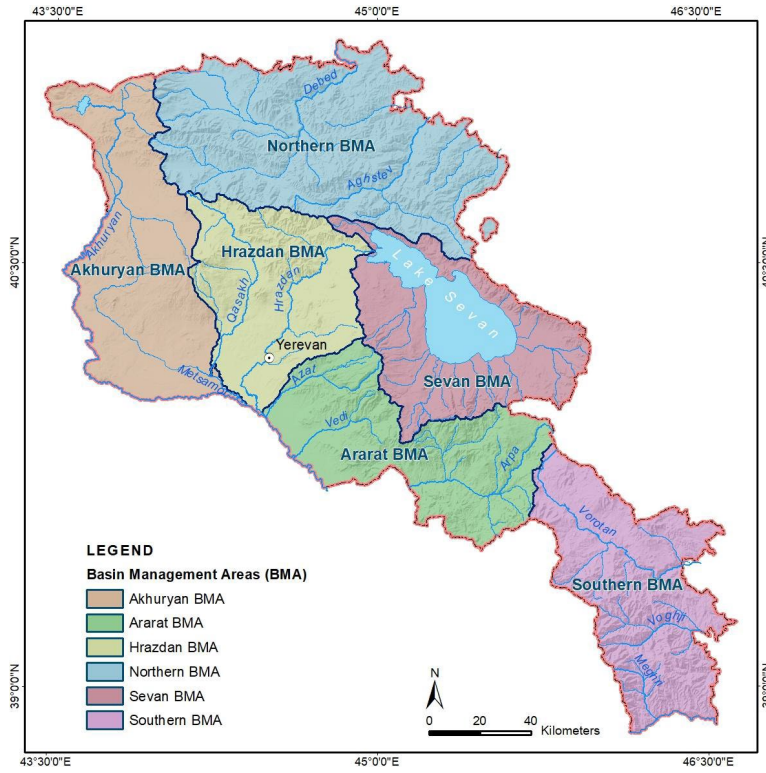
The project is funded by the Asian Development Bank and is being implemented in a partnership with Stanford University's Natural Capital Project

Report on Data Collection Methodology

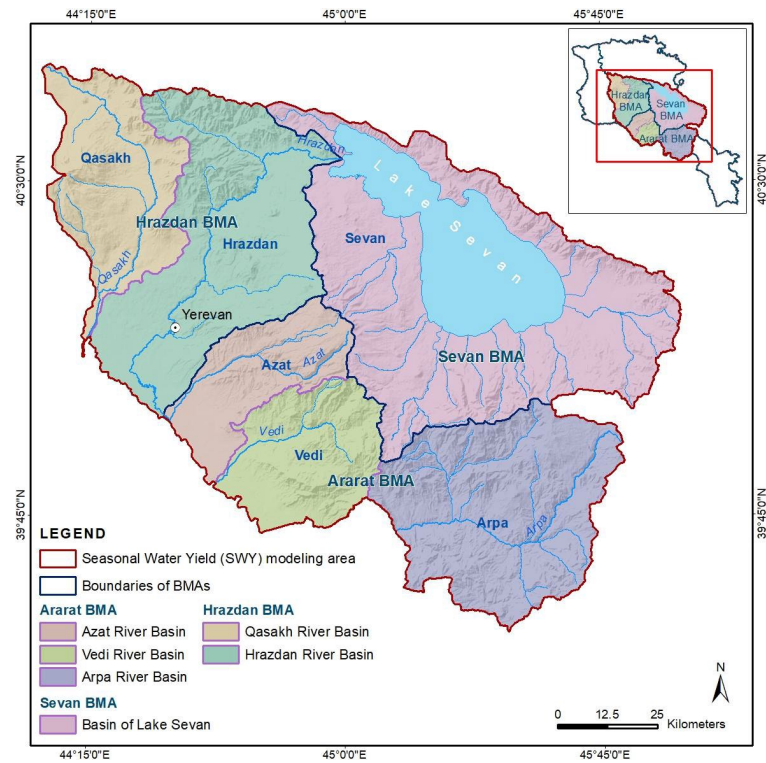
The integration of Natural Capital approaches into the Ararat River Basin Management Plan represents a critical step towards sustainable water resource management in Armenia. This report outlines the methodology employed by the project team to collect and generate essential datasets necessary for running Stanford University's InVEST Seasonal Water Yield Model on a national scale.

Alongside this report, we've included Database (available as SI Database 2.1) and Metadata Documentation. A comprehensive set of files, encapsulating the collected datasets, has been compiled into a folder for ease of access and reference, and also to facilitate a deeper understanding of each dataset's characteristics and parameters, we have prepared a metadata document in Excel format. This document provides detailed information about the attributes, sources, spatial extent, resolution, and any relevant notes or caveats associated with each layer.

As of the submission of this deliverable, the team has successfully conducted two runs of the Seasonal Water Yield model: the first utilizing a comprehensive global dataset encompassing the entirety of Armenia (Map 1), and the second incorporating climate change projections, which focused on the Ararat BMA (basins of Azat, Vedi, and Arpa rivers), Hrazdan BMA (basins of Hrazdan and Qasakh rivers), and Sevan BMA (Basin of Lake Sevan) (Map 2).



Map 1 - Basin Management Areas of the RA

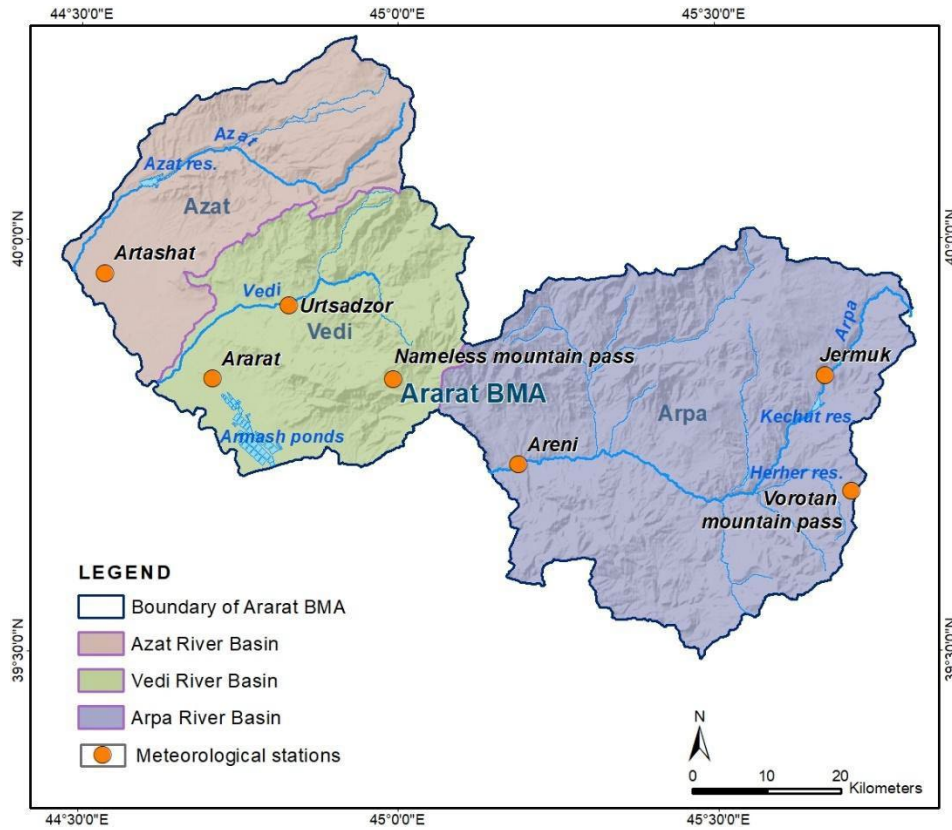


Map 2 - Seasonal Water Yield modeling area

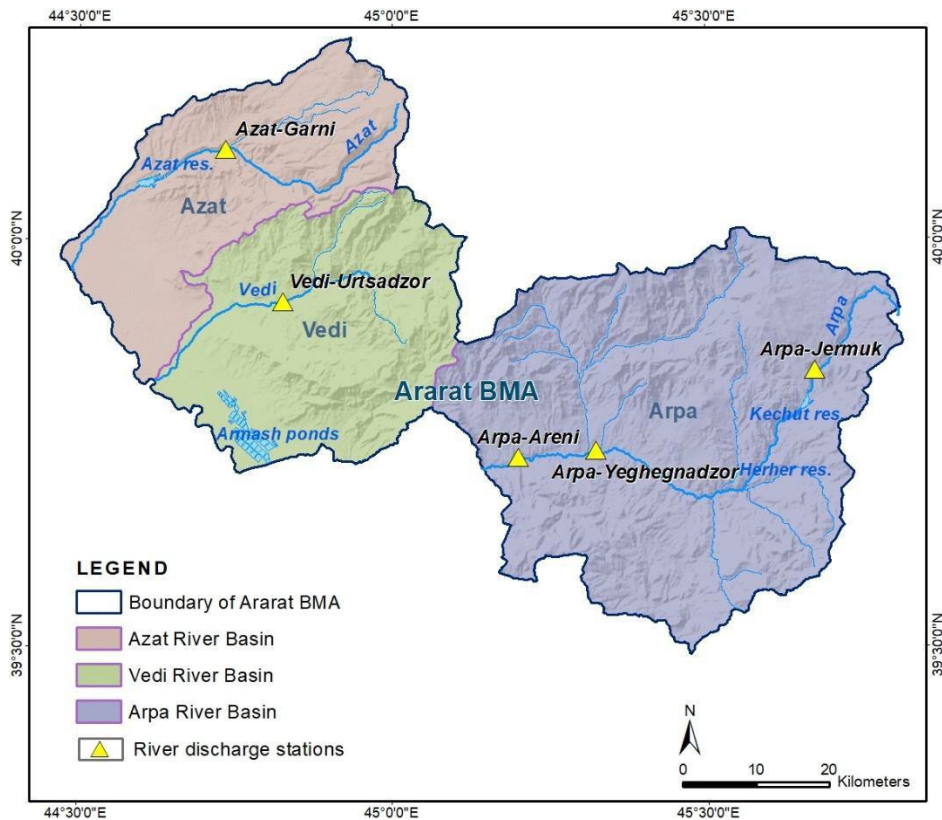
Data Collection:

1. Hydrometeorological in situ Data:

- The project team officially requested hydrometeorological and hydrogeological multi-year observation data from the "Hydrometeorology and Monitoring Service" SNCO of the Ministry of Environment of Armenia.
- The following data was requested for the years 2000-2023:
 - Average monthly air temperatures for meteorological stations Armavir, Artashat, Ararat, Zvartnots, and Urtsadzor (Map 3).
 - Monthly precipitation for meteorological stations Artashat, Urtsadzor, Ararat, Anonymous mountain pass, Areni, Jermuk, and Vorotan mountain passes.
 - Average monthly river flows for various observation points including Hrazdan, Sevjur, Akhuryan, Araks, Vedi, Azat, Arpa, among others (Map 4).
 - Average monthly groundwater flow and levels for observation points within the Ararat River Basin Management area.
- Upon receiving the data, it was converted into spatial layers for further analysis.



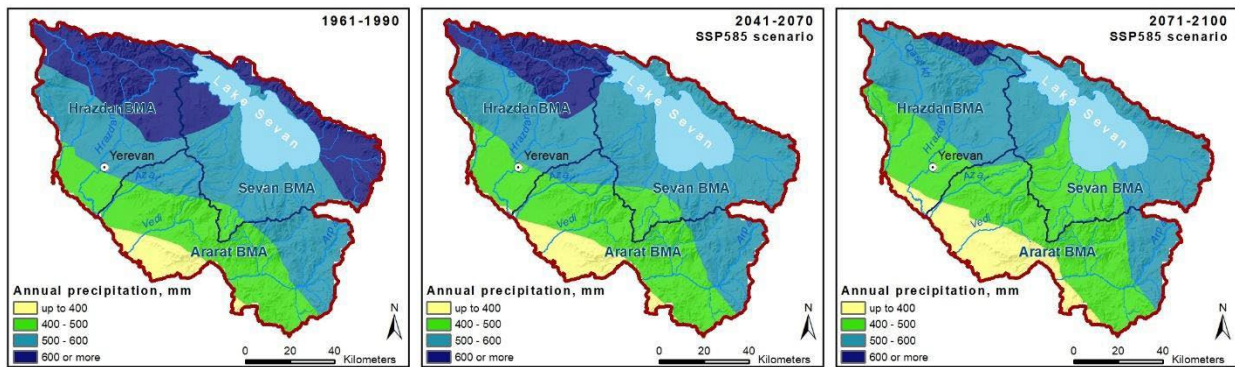
Map 3 - Project Area, Meteorological Stations Distribution



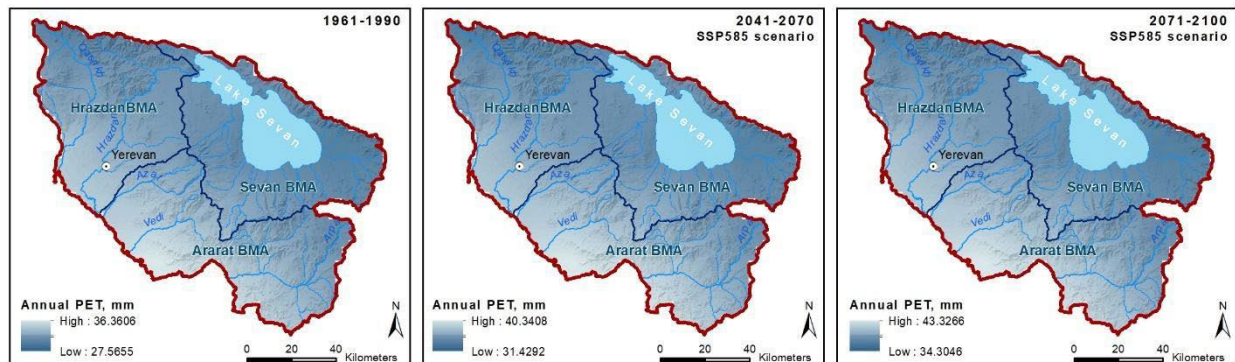
Map 4 - Project Area, River Discharge Stations Distribution

2. Climate Projections:

- Climate change projections were obtained from the EU4Sevan Project, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, including data for temperature, precipitation, and potential evapotranspiration for the years 1961-1990, 2041-2070, and 2071-2100. The projections were based on CMIP6 models derived within the framework of the "Monitoring, Modelling, and Managing of Water Resources in the Lake Sevan basin" activity conducted by Helmholtz Centre for Environmental Research.



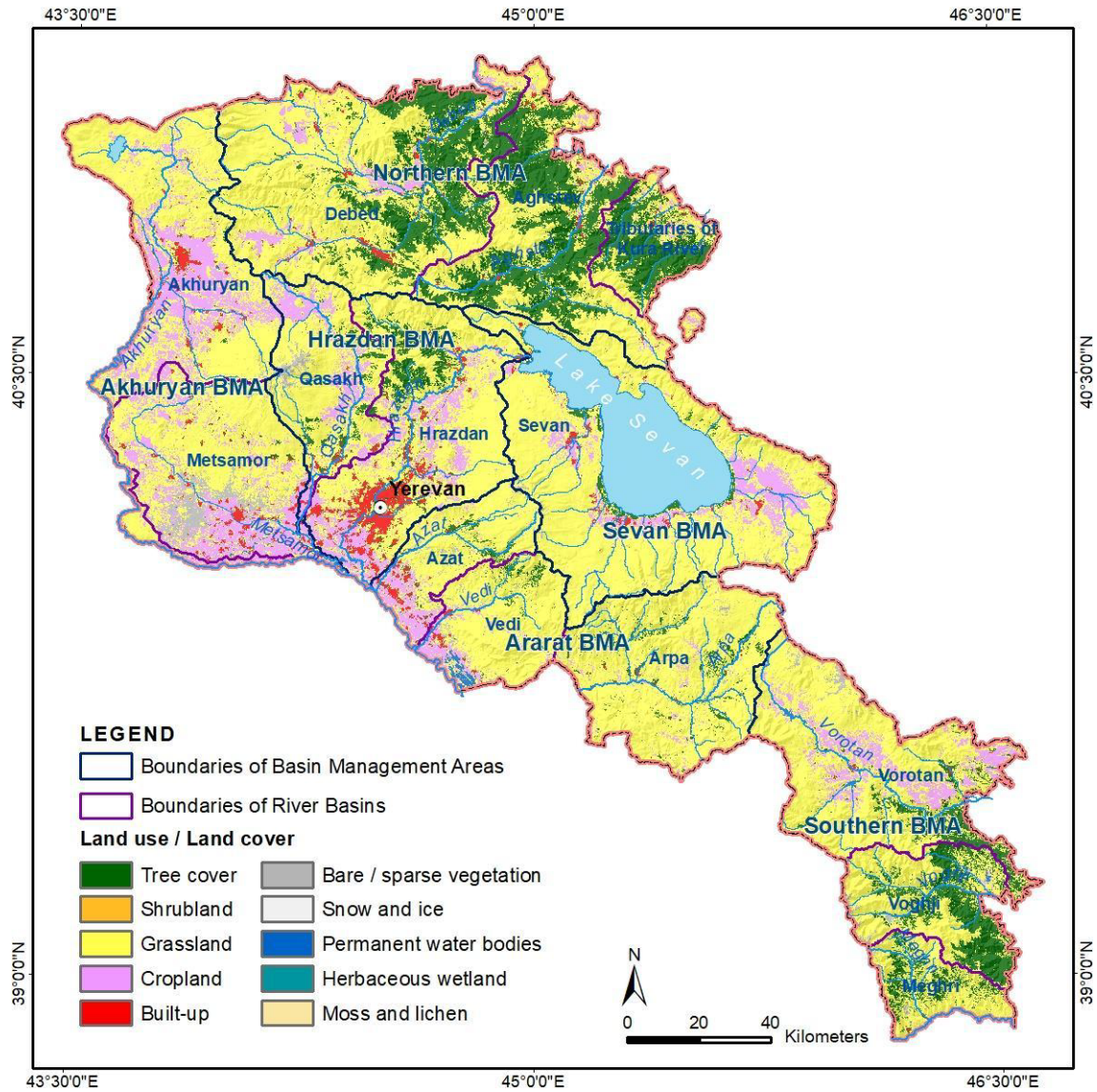
Map 5 - Climate projections, Annual Precipitation



Map 6- Annual PET

3. Land Use / Land Cover Data:

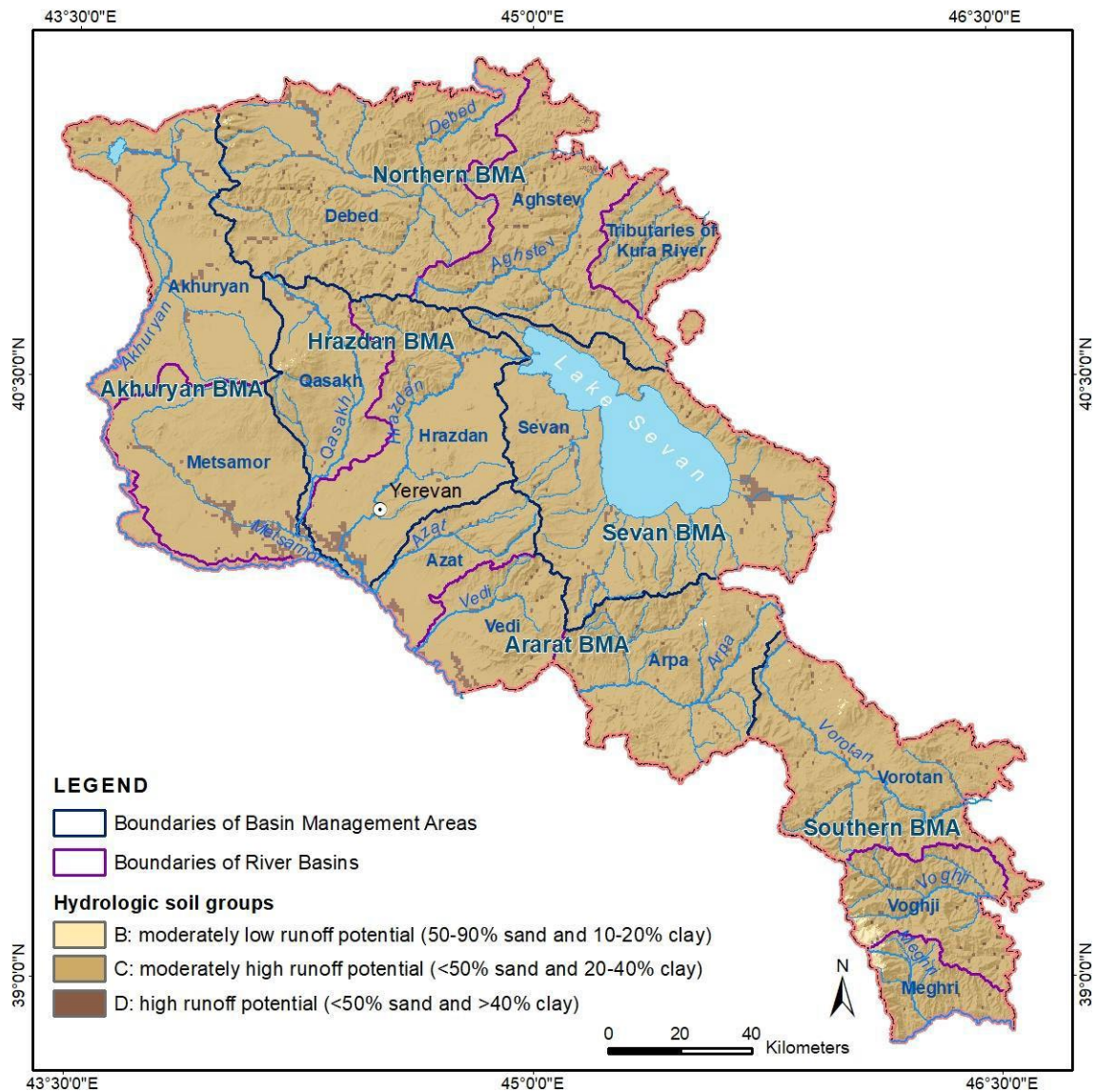
- Land use data for the years 2020 and 2021 was acquired from Worldwide Land Cover Mapping. The dataset provides global land cover products at a 10 m resolution, developed and validated in near-real time based on Sentinel-1 and Sentinel-2 data (Map 7).



Map 7 – Land Use / Land Cover

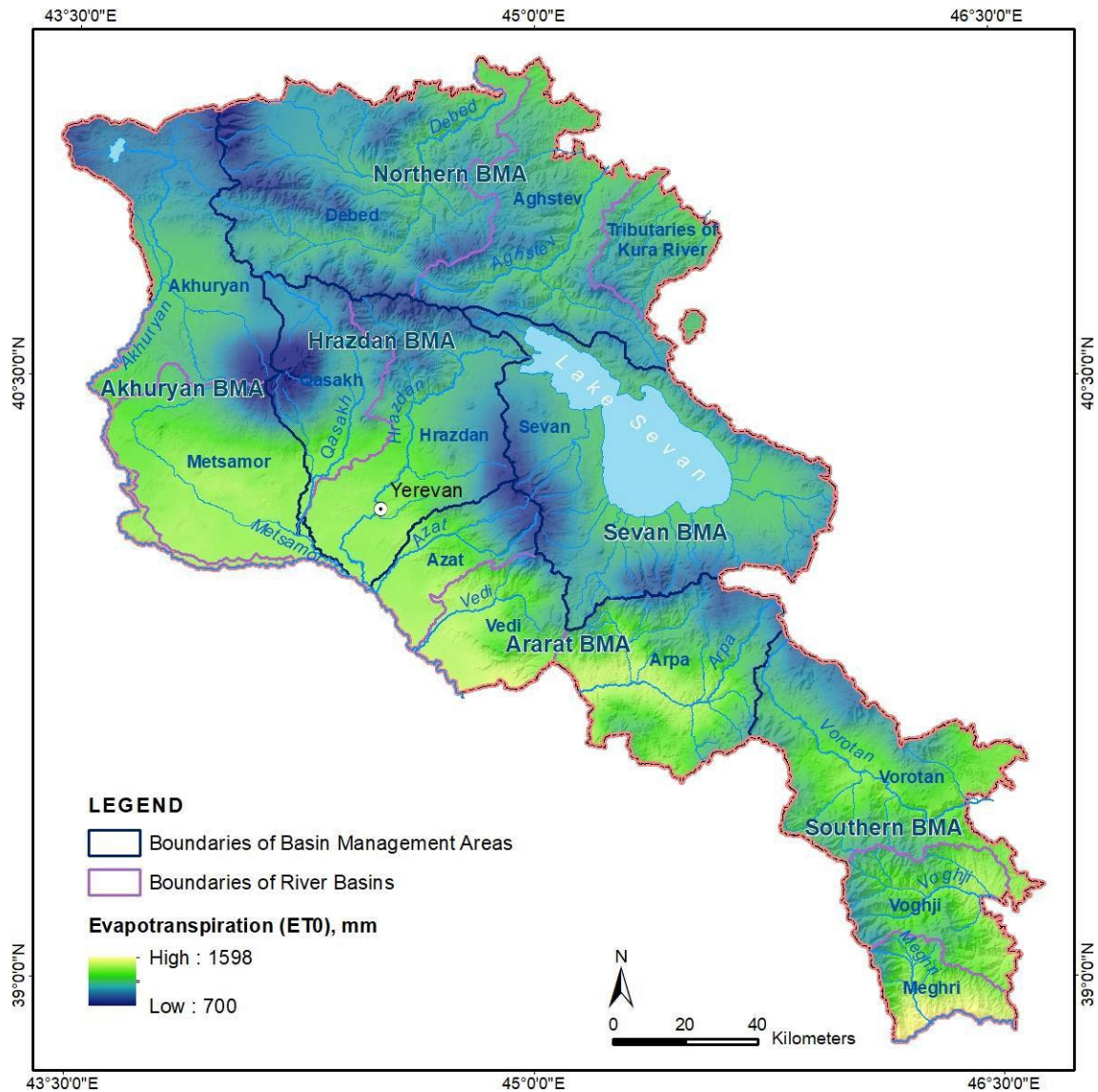
4. Soil Groups:

- Global Hydrologic Soil Groups (HYSOGs250m) for Curve Number-Based Runoff Modeling were downloaded from the ORNL DAAC for Biogeochemical Dynamics's official website (Map 8).



5. Evapotranspiration (ET0):

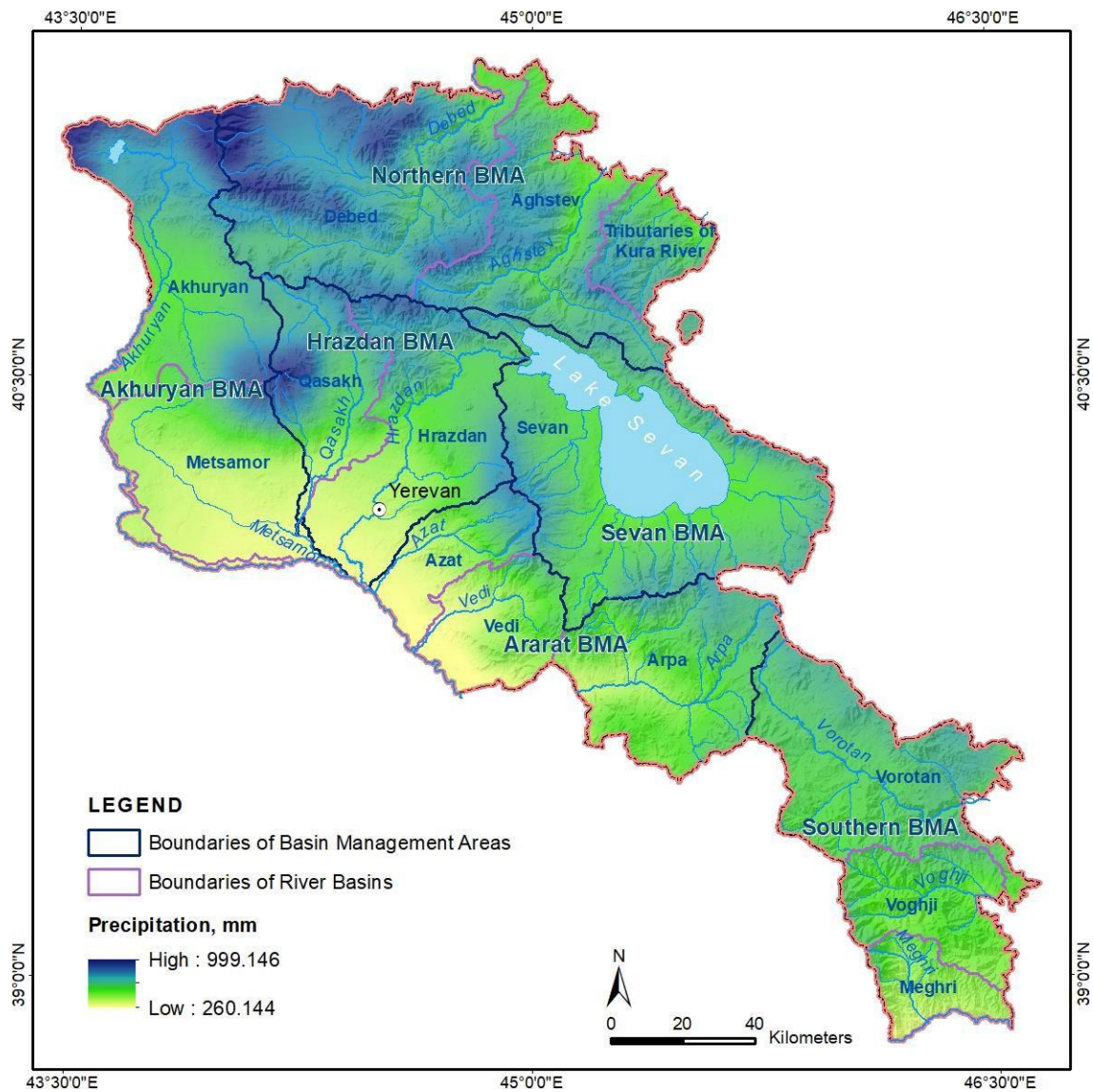
- Monthly data on Evapotranspiration for the years 2000-2023 was obtained from the official website of CGIAR CSI's Global Aridity and PET Database (Map 9).



Map 9 – Reference Evapotranspiration

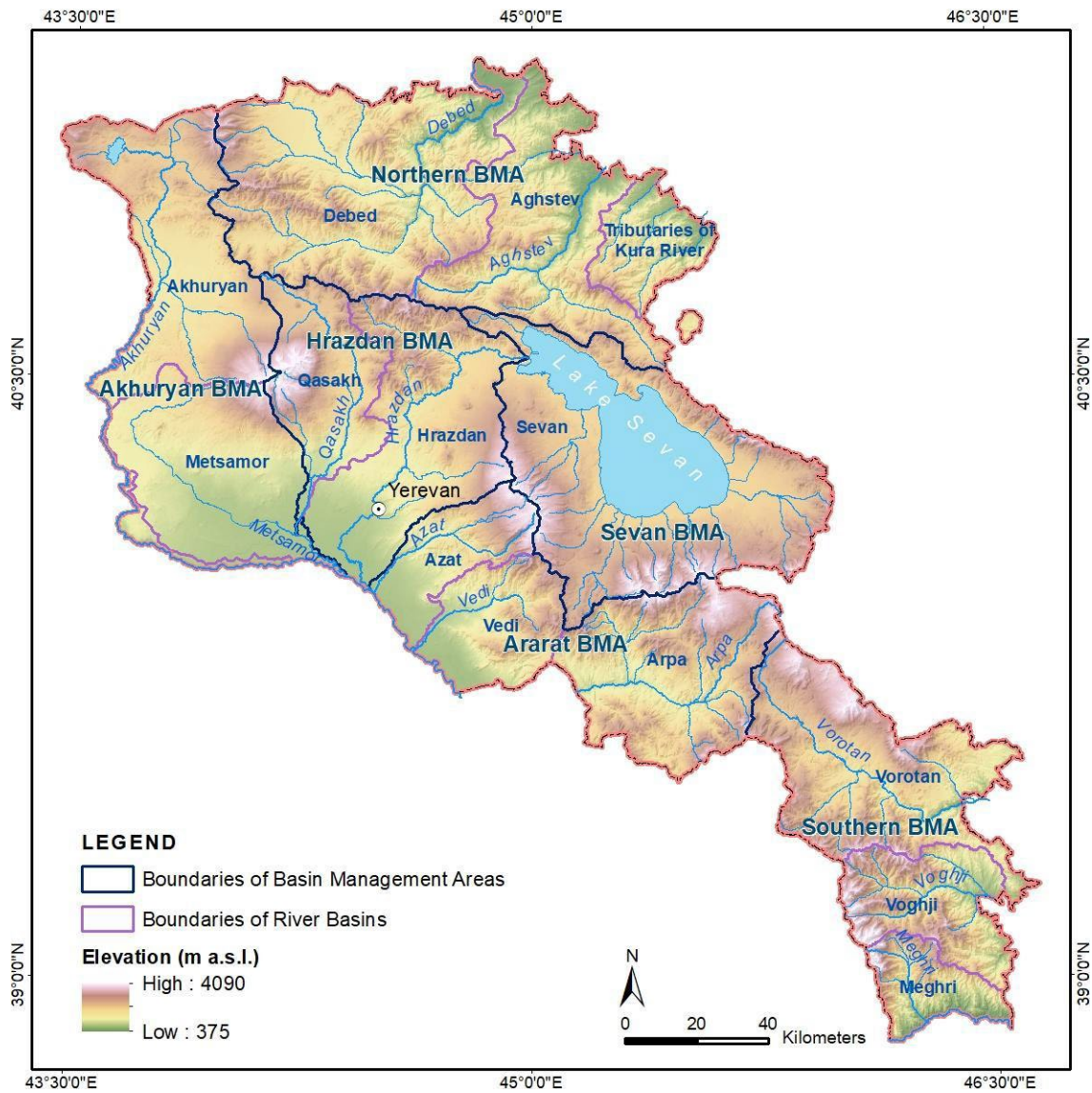
6. Precipitation:

- Annual precipitation data for the years 2000-2020 was downloaded from the WorldClim platform's Historical Monthly Weather Data database (Map 10).



7. Digital Elevation Model:

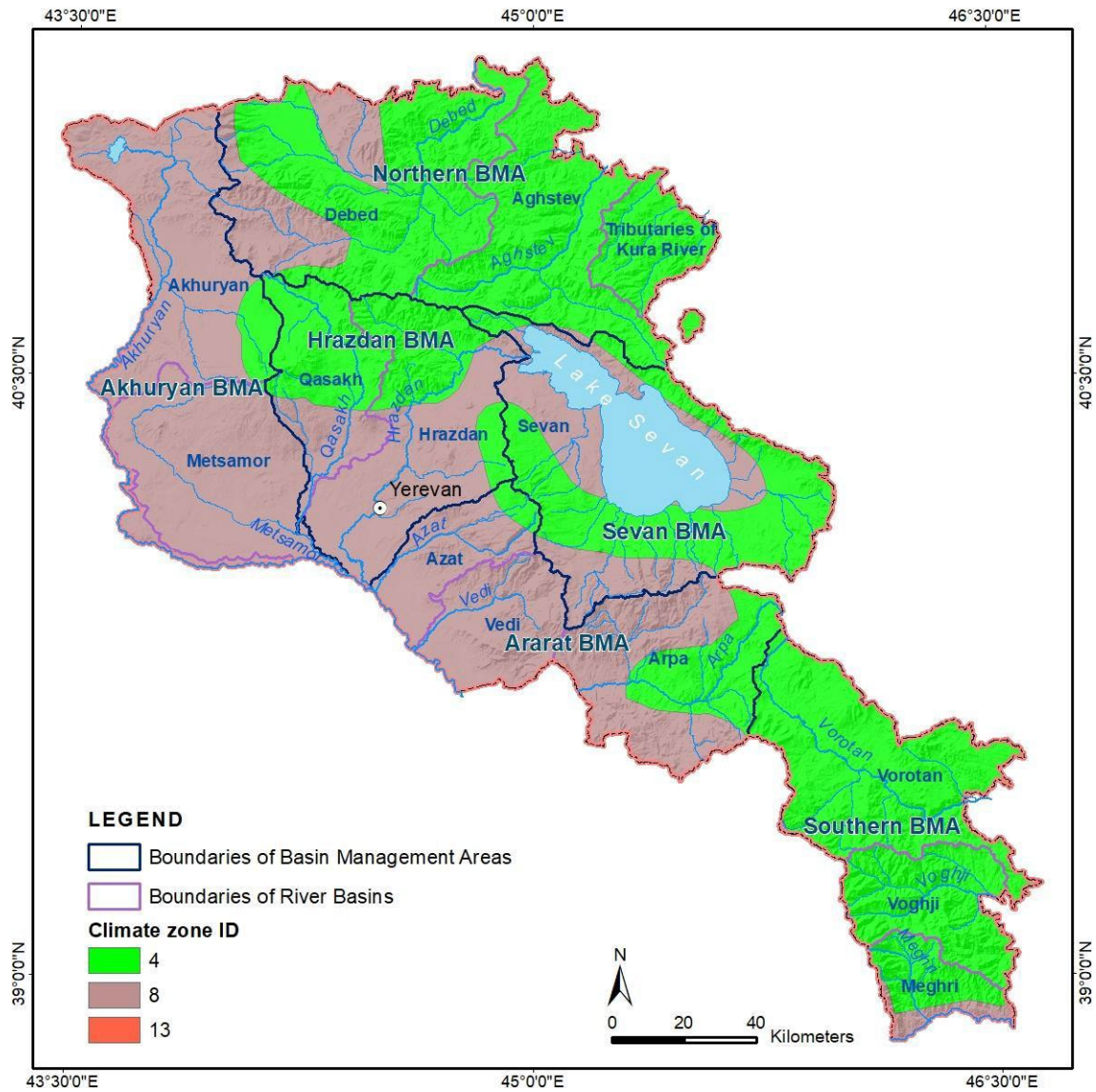
- DEM retrieved from USGS's SRTM 90m Digital Elevation Database (Map 11).



Map 11 – Digital Elevation Model

8. Climate Zones:

- Climate zone data was sourced from the WWF, Terrestrial Ecoregions of the World' GIS dataset (Map 12).



Map 12 – Climate Zones

9. Precipitation Events by Climate Zones:

- Precipitation event data categorized by climate zones was retrieved from the CHIRPS Rainfall data's database (Table 1). A table contains the number of rain events for each month.

Climate zone ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4	9	7	11	10	12	7	5	4	3	5	5	7
8	9	7	11	11	12	7	4	3	3	4	5	7
13	9	7	11	10	12	7	4	4	4	4	5	6

Table 1 - Precipitation Events by Climate Zones

As of the submission of this deliverable, the team has conducted two runs of the model. The initial run utilized a global dataset covering the entire Armenia. The second run was performed using the climate change projections for the project area and adjacent basins (Sevan BMA, Hrazdan BMA). The preliminary maps of retrieved results of the second run (SWY Quickflow, SWY Baseflow) are shown below (Map 13, Map 14).

