



**Ecosystem Accounting in Armenia:  
Setting the Scene**



Leibniz Institute of  
Ecological Urban and  
Regional Development

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# Prototype Ecosystem Accounting of Armenia

(Terrestrial Ecosystems)

Version 1, March 2026

## Technical Report

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## Ecosystem Accounting in Armenia: Setting the Scene



Leibniz Institute of  
Ecological Urban and  
Regional Development

The project is being implemented by the Biodiversity Conservation Center (BCC Armenia), in collaboration with the Leibniz Institute of Ecological Urban and Regional Development (IOER, Germany), with the participation of experts from leading scientific organizations in Armenia.



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## 1. Introduction: the aim and general methodology of the project

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### 1.1. Aim of the project

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The aim of the project is to create a Prototype of national ecosystem accounting (EA) for natural terrestrial ecosystems of Armenia in physical terms, in accordance with the System of Environmental-Economic Accounting framework (SEEA EA) [United Nations, 2021], and to provide technical recommendations for initiating physical EA in Armenia.

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### 1.2. System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA)

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Sustainable development is impossible without an understanding of ecosystems, the services that they provide to humans, and the changes they undergo. This challenge is addressed by EA, which has been rapidly evolving in recent years. In 2024, 94 countries conducted accounting—to varying extents—under SEEA Central Framework (SEEA CF) and 53 countries also compile the SEEA Ecosystem Accounting (SEEA EA) and/or thematic accounts. [SEEA Global assessment, 2024]<sup>1</sup>. In particular, the INCA project has launched a pilot EA for EU countries [European Commission, 2021].

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The EA constitutes a statistical framework for organizing data about ecosystems and ecosystem services, tracking changes in them. EA data are needed for the following tasks: to make visible and understandable to people the material and non-material contribution of living nature to their well-being; to assess and track the state of ecosystems and their services; to identify and track the impact of human activities on the state of ecosystems and their services; to provide an information basis for decision-making in order to maintain and sustainably use ecosystems and ecosystem services.

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The SEEA EA is built on a few core accounts (Figure 1-1):

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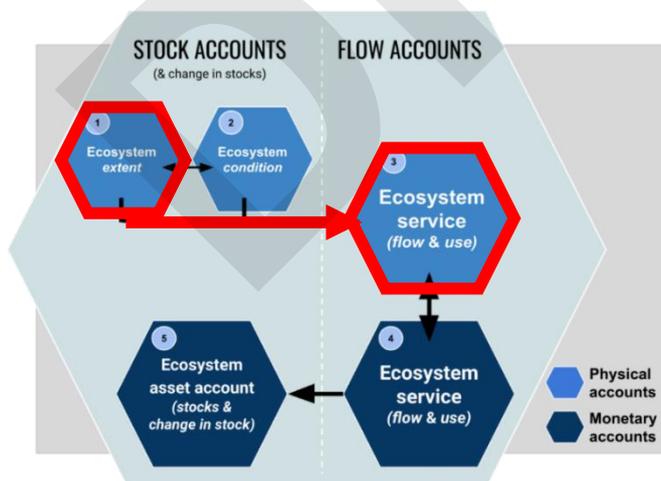
1. Ecosystem extent (EE) accounts record the size of ecosystems of different types and changes in it. Ecosystem extent is usually measured in terms of spatial area but may also be measured in terms of length or volume. Ecosystem extent is accounted for within ecosystem accounting areas (EAAs)—e.g., a nation, province, river basin, or protected area—by ecosystem type.

2. Ecosystem condition accounts record the condition of ecosystems and the changes in it providing valuable information on the health of ecosystems.

3. & 4. Ecosystem services (ES) accounts (physical and monetary) record the supply of ES by ecosystems and the use of those ES by economic units, including households.

5. Monetary ecosystem asset accounts record on stocks and changes in stocks of ecosystem assets.

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Figure 1-1. Figure 1: Ecosystem accounts and how they relate to each other (<https://seea.un.org/ecosystem-accounting>). Accounts included in the project are highlighted in red.

<sup>1</sup> SEEA Global assessment, 2024. <https://seea.un.org/content/global-assessment-environmental-economic-accounting>

### 1.3. Ecosystem accounting in Armenia

Currently, Armenia is among the 94 countries that apply the SEEA Central Framework and among the 67 countries that publish at least one account on a regular basis (Stage III)<sup>2</sup>. As indicated by the 2024 SEEA Global Assessment<sup>3</sup> Armenia compiles water accounts—specifically, physical and monetary supply-and-use tables for water<sup>4</sup>—which are published on the website of Statistical Committee of the Republic of Armenia (ArmStat)<sup>5</sup>

As stated on the SEEA website, as of 2024 Armenia has not yet begun compiling ecosystem accounts. Nevertheless, important steps toward ecosystem accounting have already been taken, both at the government level and by Armenian scientific community.

The Decision of the Government of the Republic of Armenia in April 11, 2019 n 431-n<sup>6</sup> “On approval of the procedure for classification of the land cover of the Republic of Armenia” set out the framework for the annual accounting of the areas of the main land-cover classes in Armenia, based on the results of current land accounting in communities, marzes (provinces), and nationwide. Accounts should be compiled for the following land-cover classes: Cultivated lands; Grasslands; Tree-covered areas; Shrub-covered areas; Water covered areas; Vegetation-free areas. Since then, statistical data on the areas of these land-cover classes have been publicly available at the marz level and for Armenia as a whole (see Section 2.2). Annual accounting of land-cover class areas is a fundamentally important step toward ecosystem accounting. However, for a modern, comprehensive accounting of ecosystems—as carriers of biodiversity and providers of ecosystem services—it is necessary to have not only statistical tables but also digital maps, which are not yet available for the entire territory of Armenia.

In recent years, attention to Armenia’s ES has been increasing [Shahnazaryan, Harutyunyan, 2017], including water-regulating ES [Introduction..., 2011], soil erosion prevention [GIZ EcoServe Project, 2014; 2016; Pietsch et al., 2019] and cultural ES [Asatryan et al., 2024; Pietsch et al., 2019]. However, quantitative assessment and mapping of ES at the national level in Armenia have not yet been carried out.

### 1.4. EA Prototype Version 1

The EA Prototype Version 1 (V1) follows the recommendations of SEEA-EA [United Nations, 2021] and the European INCA project on ecosystem accounting [Eurostat, 2024 a,b; Vallecillo et al., 2019] and covers physical EE and ES account (highlighted in red in Figure 1-1). Monetary accounts are not included in the project. EA Prototype V1 includes statistical tables and maps presenting EE and ES indicators, as well as a short description of the main results, data sources used, the assessment methodology.

EA Prototype V1 was created based on currently available data - published open statistical, cartographic and scientific data for Armenia, as well as global databases. The project did not include the collection of primary data or specialized scientific research. In cases where national data are not available, the assessment was made based on global databases or expert estimates. Therefore, EA Prototype V1 presents a simplified version of EA, including only those components that could be assessed within the project framework using available open global and national data. Nevertheless, EA Prototype V1 demonstrates the main approaches to EE and ES accounting, including examples of accounting tables in the UN-recommended format.

Natural terrestrial ecosystems are understood as all areas excluding anthropogenic areas that are created and managed by humans—namely, built-up areas and cropland. Water bodies and aquatic ecosystems were excluded from the analysis because the factors determining their condition and dynamics differ significantly from those affecting terrestrial ecosystems. Agroecosystems on cultivated lands and ecosystems within settlements were excluded from the accounts. Thus, the city of Yerevan was excluded from the accounts at the marz level.

EE and ES accounts were compiled for the following ecosystem accounting areas (EAA):

- At the national and marz levels, using Armenia’s national and marz boundaries from the Interactive Forest Atlas of Armenia<sup>7</sup> website;
- Main watersheds [HydroSHEDS],
- Landscape zones [Forest Atlas of Armenia];
- Vegetation zones based on the map produced under the project (Section 2.3)
- For methodological purposes, we also developed sample EE and ES accounts for Armenia’s protected areas (PAs) (Sections 2.6 and 3.1.D).

<sup>2</sup> <https://seea.un.org/content/global-assessment-environmental-economic-accounting>

<sup>3</sup> <https://seea.un.org/content/2024-global-assessment>

<sup>4</sup> [https://seea.un.org/sites/seea.un.org/files/files/Global\\_assessment/2024\\_GA/global\\_assessment\\_for\\_website\\_2024\\_final.xlsx](https://seea.un.org/sites/seea.un.org/files/files/Global_assessment/2024_GA/global_assessment_for_website_2024_final.xlsx)

<sup>5</sup> [PxWeb - Select table](#)

<sup>6</sup> <https://www.arlis.am/hy/acts/135631>

<sup>7</sup> <https://forestatlas.am/>

253 To map and assess EE and ES we used the 10 m-resolution [ESRI land cover dataset](#)<sup>8</sup> to exclude built-up areas and  
254 cropland from the accounts, as well to delineate forest and non-forest areas. The ESRI land-cover dataset was selected  
255 as an EA component following tests of several land-cover datasets, which indicated that ESRI data closely align with state  
256 statistics on agricultural areas in Armenia and enable us to demonstrate the dynamics of ecosystem extent and ES (Section  
257 2.1). To demonstrate the ability of the EA Prototype to track changes in ecosystem extent and ES, we selected two  
258 reference years—2017 and 2023—based on the ESRI land cover dataset.

259 For data preprocessing, EE and ES mapping, and GIS analysis we used the open source QGIS application [QGIS] and  
260 custom Python scripts. For assessing and mapping water-related regulating services, we used models from the InVEST  
261 GIS tool (Section 3.1.A).

#### 262 **1.4.A. Methodology for mapping and assessing ecosystem extent**

263 At present, Armenia lacks a detailed, regularly updated digital ecosystem map. Therefore, to support an informed  
264 choice of the most suitable EE accounting methodology, we tested the feasibility of compiling EE accounts using different  
265 approaches to ecosystem classification:

- 266 - The most generalized division of ecosystems by land-cover classes, that is, accounting for the extent of natural land-  
267 cover classes (Section 2.2);
- 268 - Types of natural vegetation as a proxy of terrestrial ecosystems (Section 2.3)
- 269 - Types of natural landscapes as a proxy of terrestrial ecosystems (Section 2.4);
- 270 - Intersections of landscape zones land cover classes (LLCC) as a proxy of terrestrial ecosystems (Section 2.5).

271 SEEA EA recommends compiling national ecosystem accounts in accordance with the national ecosystem  
272 classification. Accordingly, we used the classification of landscape and vegetation zones adopted by the academic  
273 community of Armenia. Subsequently, all results can be reclassified into the SEEA-approved IUCN GET system level 3 for  
274 the purpose of international comparison.

275 The source land cover maps were provided as raster data in GeoTIFF format, while the layers of climatic, landscape,  
276 and vegetation zones were delivered as vector data in GeoPackage format. To combine these data, first, the vector maps  
277 were rasterized in QGIS to match the coordinate reference system, spatial extent, and resolution of the land cover rasters,  
278 ensuring all maps shared the same pixel-wise structure. Next, the resulting raster maps with zonal boundaries were  
279 combined with the land cover raster maps through two steps: (i) the pixel values of the land cover map were multiplied  
280 by 100, and (ii) these adjusted values were added to the corresponding pixel values of a zonal map, resulting in a unified  
281 raster. For example, a final pixel value of 204 indicates that the pixel has a land cover value of two (e.g., trees) and a  
282 landscape value of four (e.g., low and middle mountain forest). This combined raster was then analyzed using a vector  
283 layer containing marz of watershed borders. The Zonal Histogram tool in QGIS was employed to count the occurrences  
284 of each unique raster value within the polygonal zones of the marzes or watersheds. The output layer, which contained  
285 statistics on the number of pixels with unique raster value within each marz or watershed, was exported in tabular format  
286 for further statistical analysis.

287 The area was calculated based on an average pixel size of 100 m<sup>2</sup>. The mismatch between the total area of the country  
288 and marzes derived from land cover data and the official figures is due to discrepancies in the boundaries of the digital  
289 maps used, as well as unaccounted variation in pixel area caused by terrain across Armenia. These discrepancies should  
290 be addressed in the development of a national ecosystem extent accounting in Armenia.

291 SEEA EA recommends annual accounting of ecosystem extent. However, in Armenia, according to the [Decision of the  
292 Government of the Republic of Armenia in April 11, 2019 n 431-n](#), annual data collection is currently established only for  
293 statistics on the areas of land-cover classes, without publicly accessible digital maps (see Section 2.2.A). Therefore, for  
294 methodological purposes—and to demonstrate ability of EA to track ecosystem dynamics—we used ESRI Land Cover data  
295 for 2017 and 2023.

296 Also, we could not fully comply with the SEEA-EA recommendations to distinguish changes in ecosystem extent  
297 between managed and unmanaged changes because of the lack of data. However, for a substantial share of the land-  
298 cover changes detected by the ESRI land cover data—specifically the expansion of cropland and built area—it is evident  
299 that these are managed changes. Therefore, in the final accounting tables, this driver is indicated for these cases; for the  
300 other cases, the driver is recorded as “not determined.”

301 EE account by economic units was made for marzes.

302 Transition matrices (change matrices) were produced on the base of GIS-analysis for both land-cover classes and  
303 vegetation types. The land-cover class matrix directly captures class-to-class transitions between the ESRI 2017 and 2023  
304 datasets. The vegetation-type transition matrix also shows how areas of vegetation zones transitioned into land-cover  
305 classes (e.g., steppe vegetation converting to croplands, built-up, bare ground, or tree cover, and vice versa). Zone-to-  
306 zone vegetation transitions are not recorded in PV1, because the zone boundaries did not change.

<sup>8</sup> <https://livingatlas.arcgis.com/en/home/>

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#### 1.4.B. Methodology for mapping and assessing ecosystem services

308 In the SEEA-EA [United Nations, 2024], ES are understood as the contributions of ecosystems to benefits used in  
 309 economic and other human activities. Final ES are those in which the user of the service is an economic unit; thus, every  
 310 final ES represents a flow between an ecosystem asset and an economic unit. Intermediate ES are those in which the user  
 311 is an ecosystem asset and there is a connection to the supply of final ES. Benefits are the goods and services that are  
 312 ultimately used and enjoyed by people and society. As applied in ecosystem accounting, a benefit will reflect a gain or  
 313 positive contribution to well-being arising from the use of ecosystem services.

314 PV1 accounts for 13 final ES across all three SEEA-EA categories: provisioning, regulating, and cultural (Table 1-1). We  
 315 did not consider intermediate ES. Benefits derived from assessed ES are described in Table 1-2.

316 PV1 focuses on the natural conditions and processes underpinning ES provision, while excluding societal factors of ES  
 317 supply and use, ecosystem management and other labor and resource inputs associated with ES supply and use, ES  
 318 import-export, as well as ES contributions to the System of National Accounts.

319

#### Potential ES and supplied-used ES

320 The SEEA EA terminology concerning ES volume provided by ecosystems differs slightly from that commonly used in  
 321 the literature. In much of the ES literature, the term supply is used to refer to an ecosystem's potential or capacity to  
 322 supply ES irrespective of use. In the SEEA-EA framework, ES physical accounts record the supply of ES by ecosystems and  
 323 the use of ES by economic units (businesses, governments and households). ES are recorded as flows between ecosystem  
 324 assets and economic units. The measures of supply and use are equivalent and will be equal to the actual flow between  
 325 the ecosystem asset and people. In other words, the total volume of ES supplied by different ecosystems equals the total  
 326 volume of ES used by different users. These indicators show how ES produced by different ecosystems are redistributed  
 327 among different users. However, they do not reveal management-relevant aspects — such as the degree of ES use  
 328 (including overuse and the potential to scale up use), or the extent to which the existing ES flow meets demand. These  
 329 aspects can be assessed on the base of ecosystem potential to provide ES (capacity) which is understood as the ability of  
 330 an ecosystem to generate an ES at the highest yield or use level that does not negatively affect the future supply of the  
 331 same or other ES from that ecosystem. SEEA EA proposes keeping separate accounts for ecosystem capacity. INCA project  
 332 proposes to include in accounting tables indicators of ES potential (capacity), ES demand, actual ES flow which is equal to  
 333 ES supply-use, and unmet demand [Vallecillo et al., 2019].

334 Given the pivotal importance of the ecosystem potential (capacity) indicator for ecosystem management, we adopted  
 335 it in PV 1 as the primary basis for ES assessment. Ecosystem potential can be evaluated from natural factors and the  
 336 biological characteristics of ecosystems. Such data were available for all 12 ES assessed quantitatively or by scoring (the  
 337 exception is the ES “biodiversity value for Armenia’s culture,” which we only described with examples). The ecosystem  
 338 potential (capacity) is relevant both for ES that can be overused (provisioning and recreational services) and for regulating  
 339 ES, which cannot be directly overused but may be insufficient to meet human demand. The capacity was assessed for 12  
 340 ES (Table 1-1).

341 The assessment of ES use requires socio-economic data, which were available for only six ES. In four cases the ES users  
 342 (economic units) were the marzes for the grazed biomass production ES (ES 1 in Table 1-1), two water-regulating ES (ES  
 343 8 and 9), and pollination (ES 11); in one case—settlements for the ecosystems’ cooling effect (ES 6); and in one case—  
 344 Protected Areas for the ES of natural conditions for hiking in Pas (ES 12).

345

#### Changes in ES

346 Changes in ES were assessed only in terms of their potential (capacity), based on land-cover changes between 2017  
 347 and 2023. The effects of climate change were not taken into account. An assessment of changes in ES use and supply was  
 348 not conducted because data on ES use for 2017 are unavailable.

349 Changes in water-related regulating ES that were assessed and mapped using InVEST models were evaluated using  
 350 two approaches: 1) as difference between modelled ES values at maps in 2017 and in 2023; 2) on the base of the changes  
 351 in the extent of ecosystem types which provide ES. Changes in all other ES were assessed using only the second approach.

352 The first approach is more accurate, as it takes into account environmental factors (relief, soils, climate) in the  
 353 locations where land cover changes occurred. However, for the ES of baseflow provision, this approach estimates only  
 354 changes in relative indicators of baseflow and quickflow, expressed in mm. In addition, this approach does not fully meet  
 355 the requirements of the SEEA-EA methodology, which links changes in ES to changes in the extent of different ecosystem  
 356 types, whereas InVEST models account only for changes in the main land cover classes.

357 The second approach is consistent with the SEEA-EA framework, but in essence represents an averaging of the actual  
 358 changes in ES within different ecosystem types. Changes in ES provided by ecosystems can be assessed using the indicator  
 359 of mean ES value per 1 km<sup>2</sup> or per 1 ha of each ecosystem type, together with changes in ecosystem extent between  
 360 2017 and 2023. This approach makes it possible to calculate the data for accounting tables for the ES capacity in 2017  
 361 and in 2023.

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Table 1-1. List of ES from SEEA EA, with those included in PV1 highlighted in **bold italics**.

Ecosystem service		Indicators of potential ES (capacity)	Indicators of ES supply and use	Assessing method	Section of PV1
Provisioning ES					
<b>Biomass provisioning</b>	Crop provisioning ES	NA (ES provided by non-natural agroecosystems)			
	<b>1) Grazed biomass provisioning ES: production of fodder for cultivated livestock by natural grasslands</b>	Maximum allowable stocking rate (LU/ha)	Current number of cattle, sheep and goats (LU/ha)	Mapping, GIS- and descriptive data analysis	3.2.A
	Livestock provisioning ES	NA (ES provided by non-natural agroecosystems)			
	Aquaculture provisioning ES	NA (ES provided by non-natural aqua-systems)			
	Wood provisioning services	NA (lack of open statistical data)			
	Wild fish and other natural aquatic biomass provisioning ES	NA (lack of open statistical data)			
	<b>Wild plants biomass provisioning ES: 2) Culinary plants 3) Medicinal plants</b>	Score-based assessment	NA	Mapping, GIS- and descriptive data analysis	3.2.B
Wild animals and other biomass provisioning ES	NA (lack of open statistical data)				
Genetic material	NA (limited project resources and time)				
Water supply	Water supply is accounted for ES of baseflow provisioning				
<b>Other provisioning ES</b>	<b>4) Nectar production by wild melliferous plants for honey bees to produce honey</b>	Score-based assessment	NA	Mapping, GIS- and descriptive data analysis	3.2.B
Regulating and maintenance ES					
<b>Global climate regulation</b>	<b>5) Storage of carbon in ecosystems in soil and tree biomass</b>	Carbon content, tC/ha Carbon stock, Mtc	NA	Mapping, GIS- and descriptive data analysis	3.1.G
	Other global climate regulation ES	NA (limited project resources and time)			
Rainfall pattern regulation	NA (limited project resources and time)				
<b>Local (micro and meso) climate regulation</b>	<b>6) Effect of natural ecosystems on surface temperature as the balance between evaporative cooling and albedo</b>	Cooling capacity of natural ecosystems	NA	GIS-modeling with the InVEST Urban Cooling model	3.1.E
Air filtration	NA (ES is most important for urban ecosystems)				
Soil quality regulation	NA (limited project resources and time)				
<b>Soil and sediment retention</b>	<b>7) Prevention of soil erosion; 8) Prevention of sediment export to streams</b>	Avoided erosion and avoided sediment export, t/ha/year; Mt/year	Amount of sediment avoided in the volume of water consumed, t/year	GIS-modeling with the InVEST Sediment Delivery Ratio model	3.1.C
	Landslide mitigation ES	NA (limited project resources and time)			
Solid waste remediation	NA (limited project resources and time)				

Water purification	Retention and breakdown of nutrients and other pollutants	NA (lack of open statistical data)			
<b>Water flow regulation</b>	<b>9) Regulation of seasonal river flow and baseflow maintenance</b>	Ecosystem effect on total river flow, baseflow and quick flow, mm; m <sup>3</sup>	Water consumption, m <sup>3</sup>	GIS-modeling with the InVEST Seasonal Water Yield model	3.1.B
	<b>10) Runoff retention by ecosystems under average and extreme rainfall</b>	Ecosystem runoff retention, m <sup>3</sup>	NA	GIS-modeling with the InVEST Urban Flood Risk Mitigation model	3.1.D
Flood control	Coastal protection ES	NA (limited project resources and time)			
	River flood mitigation ES	Flood mitigation ES assessed as Peak flow mitigation ES			
Storm mitigation		NA (limited project resources and time)			
Noise attenuation		NA (ES is most important for urban ecosystems)			
<b>Pollination</b>	<b>11) Crop pollination by wild insects</b>	Score-based assessment	Score-based assessment	Mapping, GIS- and descriptive data analysis	3.1.H
Biological control ES	Pest control services	NA (limited project resources and time)			
	Disease control services	NA (limited project resources and time)			
Nursery population and habitat maintenance ES		Not assessed (Intermediate ES)			
Cultural services					
<b>Recreation-related ES</b>	<b>12) Natural conditions for recreation: hiking in PAs</b>	Maximum allowable number of tourists on hiking routes (persons/year)	Current number of tourists on hiking routes (persons/year)	Mapping, GIS- and descriptive data analysis	3.3
Visual amenity ES		NA (limited project resources and time)			
Education, scientific and research ES		NA (limited project resources and time)			
<b>Spiritual, artistic and symbolic ES</b>	<b>13) Importance of biodiversity for Armenian culture</b>	Collection and description of visual examples			

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Table 1-2. Initial logic chains for assessed ES

ES	Ecosystem types	Factors determining supply		Factors determining use	Metrics for the ES	Benefits (description)	Main users and beneficiaries
		Ecological	Societal				
Grazed biomass provisioning	Different types of grasslands (alpine, subalpine, steppe, semidesert)	Vegetation zone	NA	Number of cattle, sheep and goats in marzes	Stocking rate (LU/ha)	Livestock and livestock products (e.g., meat, milk, eggs, wool) (SNA benefits)	Agriculture in marzes
Wild edible and culinary plants biomass provisioning	Forests and different types of grasslands (alpine, subalpine, steppe, semidesert)	Vegetation zone	NA	NA	Score-based assessment	Harvested edible and culinary plants (non-SNA benefit)	NA
Wild medicinal plants biomass provisioning						Harvested medicinal plants (non-SNA benefit)	
Wild-plant nectar						Honey from domestic bees (non-	

provisioning					SNA benefit)	
Global climate regulation – C storage in ecosystems	All natural terrestrial ecosystems	The global map of C content in soil Average C content in tree biomass in Armenia		Tonnes of carbon	Reduced concentrations CO2 in the atmosphere leading to less climate change	NA
Ecosystem effect on surface temperature	Forests and grasslands	Climate zone	The size and shape of settlements	Cooling capacity	Improved living conditions and economic production (non-SNA benefit)	Population in settlements
Preventing soil erosion	Forests and different types of grasslands (alpine, subalpine, steppe, semidesert)	Topology; soil type; climate conditions, land cover class (grassland or trees)	NA	Tonnes of avoided erosion	Soil stability (non-SNA benefit)	NA
Preventing of sediment transport to streams			Water use in marzes	Tonnes of avoided sediment transport	Water quality improving	Economy of marzes
Baseflow provisioning			Water use in marzes	Total flow and baseflow, m3	Water supply	Economy of marzes
Flood risk mitigation (runoff retention)	Forests and grasslands	Soil type; climate conditions, land cover class (grassland or trees)	NA	Runoff retention, mm	Mitigation of flood damage	NA
Pollination	Forests and different types of grasslands (alpine, subalpine, steppe, semidesert)	Abundance and activity of wild pollinators in different vegetation zones	The share of entomophilous crops; the distance from natural ecosystems	Score-based assessment	High yield of insect-pollinated crops and cost savings on alternative pollination (SNA benefit)	Economy of marzes
Recreation-related services	Forests and different types of grasslands (alpine, subalpine, steppe, semidesert)	Vegetation zone	The route length; the number of hikers	Number of hikers	Physical and mental health; enjoyment (non-SNA benefit)	Tourism service in PAs
Cultural importance of biodiversity	Iconic animal and plant species, natural landscapes	-	NA	The collection of images with descriptions	Understanding of national culture	NA

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To determine ES volume provided by ecosystems, we proceeded from the following understanding of baseline conditions — situations in which ecosystems are absent and ES is not performed (Table 1-3). For most ES, it was assumed that in the absence of ecosystems ES would be entirely absent (no/zero ES). For water-related regulating ES, which are partly performed by the bare land surface without living cover, the baseline conditions were represented by a “bare ground” scenario, where all natural ecosystems were replaced with bare ground (see Section 3.1.A).

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Table 3-1: Baselines for assessed ES

ES	Baseline
Grazed biomass provisioning	No/zero biomass provisioning
Wild edible and culinary plants biomass provisioning	
Wild medicinal plants biomass provisioning	
Wild-plant nectar provisioning	
Global climate regulation – C storage in ecosystems	
Local climate regulation -ecosystem effect on surface temperature	Bare ground scenario
Preventing soil erosion	
Preventing of sediment transport to streams	
Seasonal flow regulating and baseflow maintenance	
Flood risk mitigation (runoff retention)	
Pollination	No/zero pollination
Recreation-related services	No/zero ES

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