2.4. Extent of natural landscapes

2.4.A. Extent of natural landscapes in Armenia

To estimate extent of natural landscapes, the map of landscape zones published in the Fifth National Report of Armenia to the CBD (2014) was used (available in digital form in Forest Atlas of Armenia FAA), along with ESRI land cover data for 2017 and 2023 as well as ESA 2021 data for comparison (Fig. 24A-1).

The area of natural landscapes was calculated as the area of a given landscape zone minus waterbodies and anthropogenically transformed territories, that is, built-up areas and croplands.

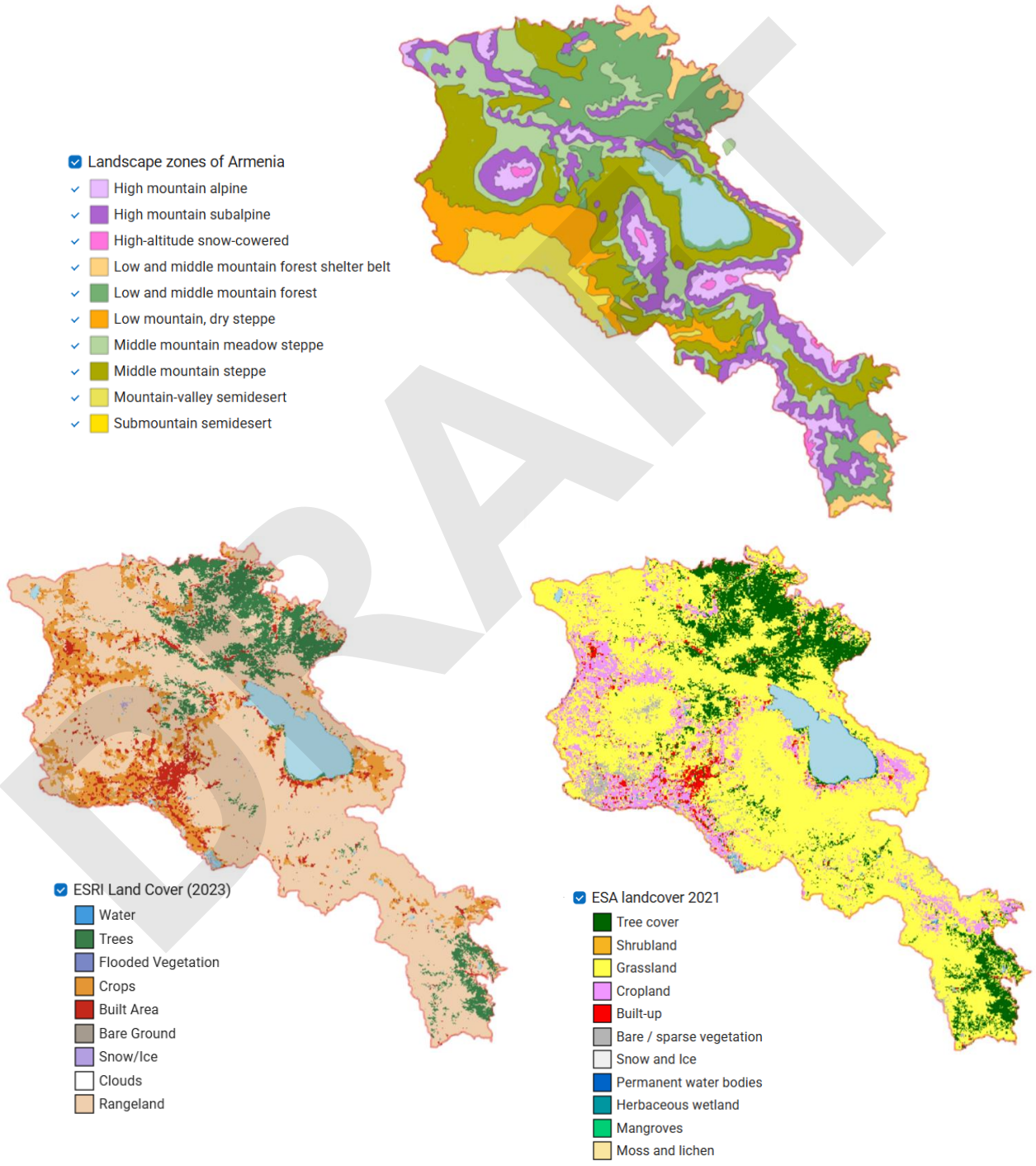

Figure 24A-1. The maps used for estimation of the extent of natural landscapes. For detailed maps see project Web-GIS, section "Ecosystem extent"

According to ESRI data, the most human-transformed zone is mountain-valley semi-desert, where only 27% of natural landscapes remain. It is followed by low mountain dry steppe and the middle mountain steppe zones, with 65% and 71% of natural landscapes remaining, respectively. High-mountain snow-covered, alpine, and subalpine zones have been almost unaffected by human activity. Forests are most widespread in zones of low-middle mountain forest (38%) and low-middle mountain forest shelter belt (17%). There is almost no forests in the half of landscape zones - high-altitude snow-cowered, alpine, dry steppe, and semi-deserts (Figures 24A-2 and 24A-3; Table 24A-1).

ESA data show a generally similar picture, but with smaller built-up area and larger area of tree cover and bare ground, which is particularly noticeable in the semi-deserts, dry steppe, and forest shelter belt (Figure 24A-2 and 24A-3; Table 24A-2). One of the reasons for this is that, as mentioned above, ESA identifies trees within settlements. The presence of trees in submountain semidesert zone in the ESA data is entirely due to this factor – all trees there are located inside settlements (see Section 2.1.A). In the semi-desert zone, some areas classified by ESRI as croplands were identified by ESA as bare ground and grasslands. As a result, the degree of transformation of this zone is considerably lower in ESA data than in ESRI data.

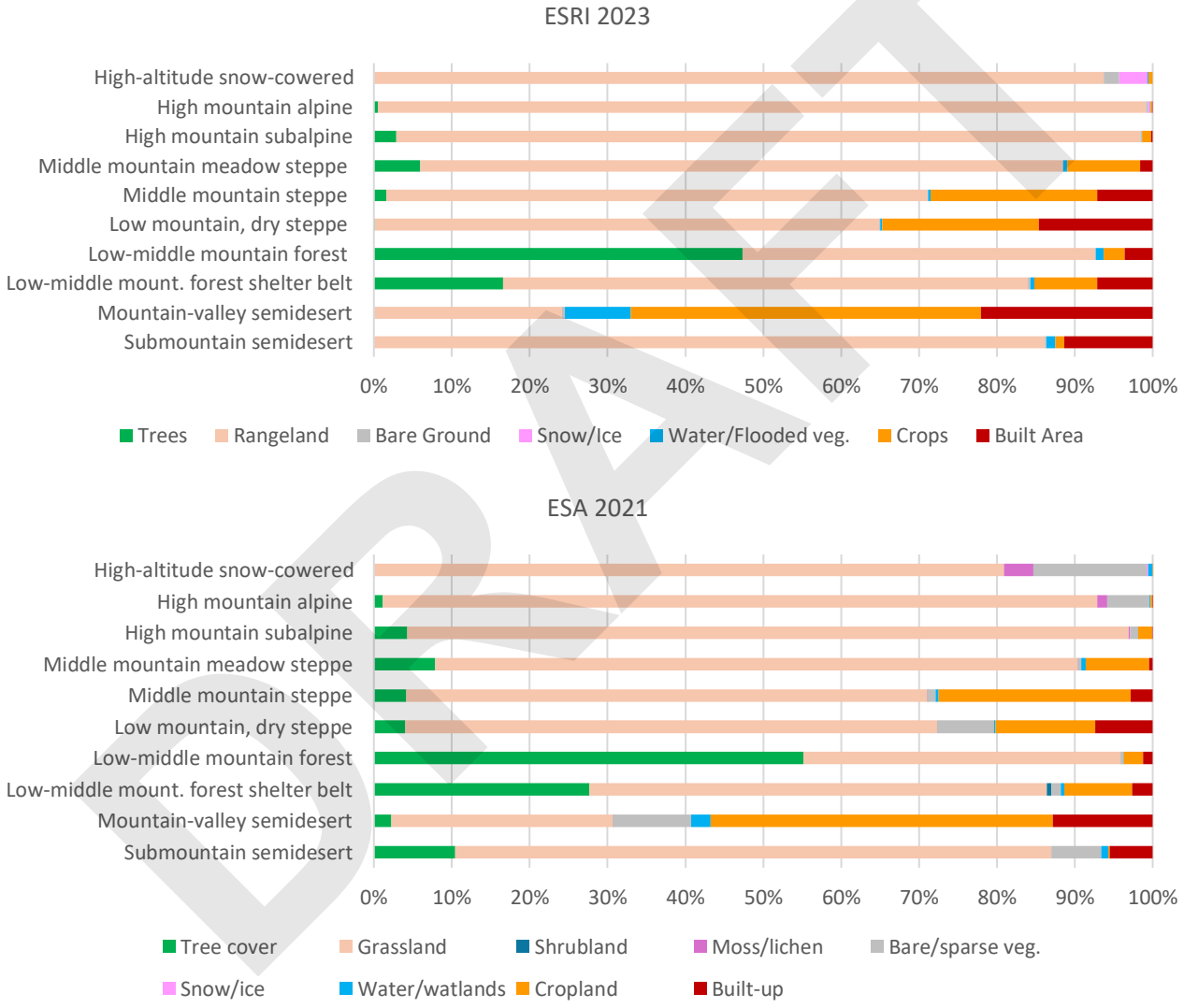

Figure 24A-2. Share of land cover classes within landscape zones according ESRI 2023 and ESA 2021 data

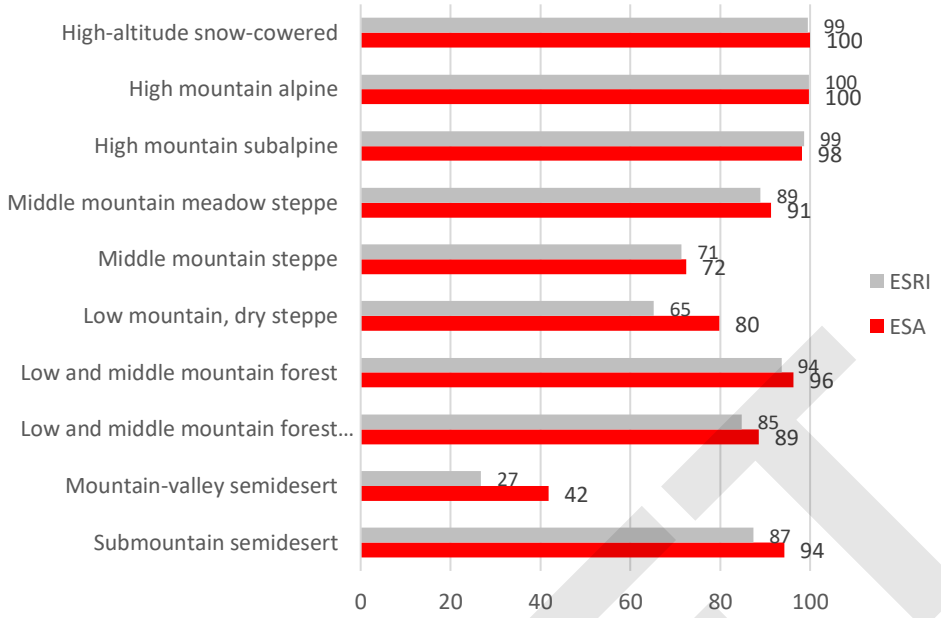

Figure 24A-3. Share of area of natural land cover classes within landscape zones (%) according ESRI and ESA data

Table 24A-1. Area of land cover classes within landscape zones according to ESRI 2023 data, km²

	Trees	Rangeland	Bare Ground	Snow/ Ice	Water/ Flooded veg.	Crops	Built Area	Total
High-altitude snow-cowered	0.06	183.27	3.83	7.09	0.32	1.01	0.00	195.58
High mountain alpine	9.90	1948.68	5.67	4.45	1.83	3.72	1.38	1975.62
High mountain subalpine	125.93	4222.75	3.73	0.00	2.73	49.13	10.25	4414.52
Middle mountain meadow steppe	294.31	4057.45	4.27	0.00	27.14	460.92	78.35	4922.44
Middle mountain steppe	108.88	4723.60	2.97	0.00	20.69	1454.46	484.65	6795.24
Low mountain, dry steppe	3.21	1461.86	3.35	0.00	5.61	454.76	329.90	2258.69
Low-middle mountain forest	2361.03	2261.51	2.81	0.00	50.26	133.77	180.49	4989.87
Low-middle mount. forest shelter belt	195.79	796.09	3.87	0.00	6.34	95.20	84.08	1181.37
Mountain-valley semidesert	0.52	411.32	5.75	0.00	144.50	766.06	376.07	1704.21
Submountain semidesert	0.00	14.93	0.03	0.00	0.20	0.19	1.97	17.33
Sevan	0	0	0	0	1227	0	0	1227.00

Table 24A-2. Area of land cover classes within landscape zones according to ESA 2021 data, km²

	Tree cover	Grass-land	Shrub-land	Moss/ lichen	Bare/ sparse veg.	Snow/ ice	Water/ Wet-lands	Crop-land	Built-up	Total
High-altitude snow-cowered	0.01	189.85	0.00	8.91	34.14	0.44	1.37	0.00	0.00	234.72
High mountain alpine	22.95	1814.63	0.00	25.59	106.82	0.11	2.24	5.78	0.11	1978.24
High mountain subalpine	189.42	4066.87	0.00	6.11	45.19	0.01	1.87	78.13	3.13	4390.74
Middle mountain meadow steppe	391.79	4088.71	0.00	0.92	21.20	0.00	28.58	404.81	22.02	4958.03
Middle mountain steppe	283.17	4578.27	0.18	0.00	69.91	0.00	23.36	1688.78	191.46	6835.12
Low mountain, dry steppe	90.96	1549.08	0.00	0.00	165.79	0.00	5.12	289.93	167.83	2268.72
Low-middle mountain forest	2751.63	2034.38	2.97	0.00	10.54	0.00	3.74	122.38	62.19	4987.84
Low-middle mount. forest shelter belt	327.59	695.87	6.82	0.00	14.03	0.00	5.26	103.17	31.54	1184.29
Mountain-valley semidesert	36.26	458.47	0.00	0.00	160.83	0.00	39.78	706.90	206.75	1608.98
Submountain semidesert	1.78	13.08	0.00	0.00	1.09	0.00	0.16	0.03	0.94	17.08
Sevan	0.00	0.00	0.00	0.00	0.00	0.00	1279.24	0.00	0.00	1279.24

The extent of natural areas within landscape zones differs significantly from the total extent of those zones (Figure 24A-4). When comparing the total area of the landscape zones, middle mountain steppes far exceed all other landscape zones. However, if anthropogenic areas are excluded, four types of natural landscapes have similar extents, each covering 15–16% of Armenia's territory – middle mountain steppe and meadow steppe, subalpine and forest zones. Mountain-valley semi-desert zone is shrinking the most – from 5.4% to 1.4-2.3% – as it has been transformed by human activity to the greatest extent. Differences in the estimated extent of natural landscapes between ESRI and ESA are greatest for the zones most heavily transformed by human activity, as ESA identifies smaller areas of croplands and built-up land (see above).

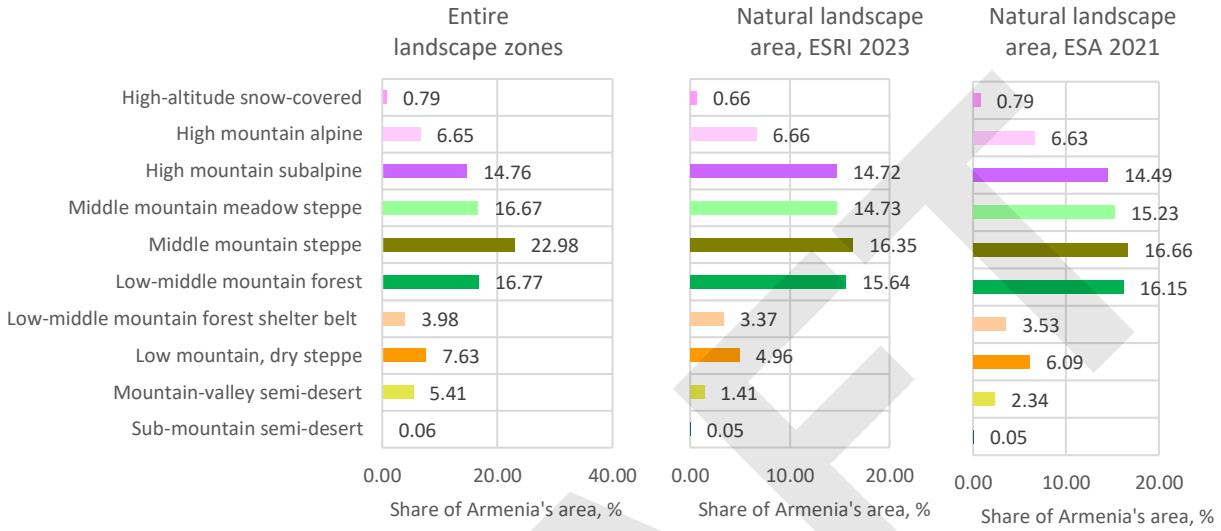

Figure 24A-4. The share of landscape zones and natural landscapes in Armenia's total area, %

2.4.B. Changes in extent of natural landscapes from 2017 to 2023 based on ESRI data

The extent of most natural landscapes decreased from 2017 to 2023 due to the expansion of human-occupied areas (croplands and built-up zones), as described in the Section 2.2.B. A noticeable increase in natural area was observed only in mountain-valley semi-desert in marzes Armavir and Ararat (see Section 2.4.C below)

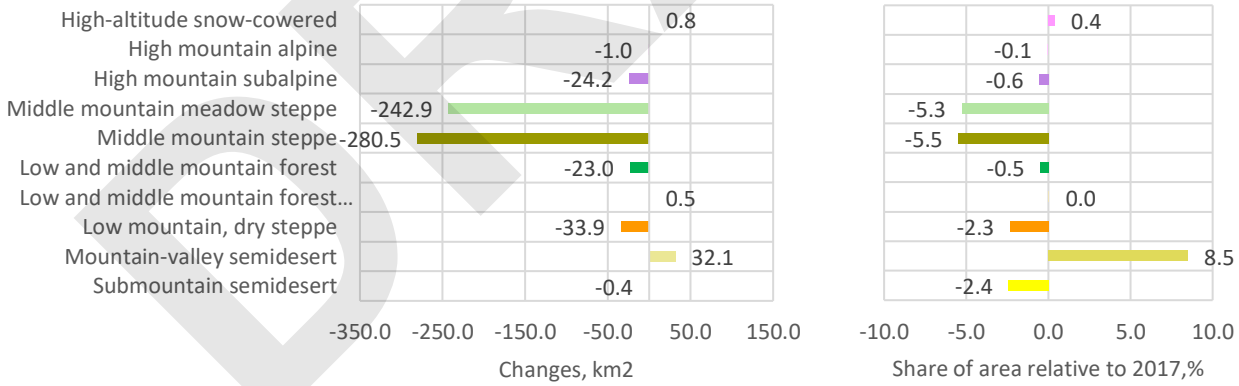

Figure 24B-1. Absolute and relative changes in natural landscape extent

2.4.C. Natural landscape extent at marz level

In terms of the extent of natural landscapes in marzes, ESRI and ESA provide a very similar picture. The main part of the forest landscape zone is located in three marzes — Lori, Tavush, and Syunik. The largest areas of alpine and subalpine landscapes are found in Syunik and Gegharkunik, although these landscapes are also notably present in all other marzes except Armavir and Tavush. Steppe landscapes are present in all marzes, but in Tavush and Armavir marzes, their area is small. The remaining natural areas of mountain-valley semi-desert are mainly located in the marzes of Ararat and Armavir. Submountain semi-desert is represented by small patches only in the south of Syunik marz (Figure 24C-1; Tables 24C-1, 24C-2).

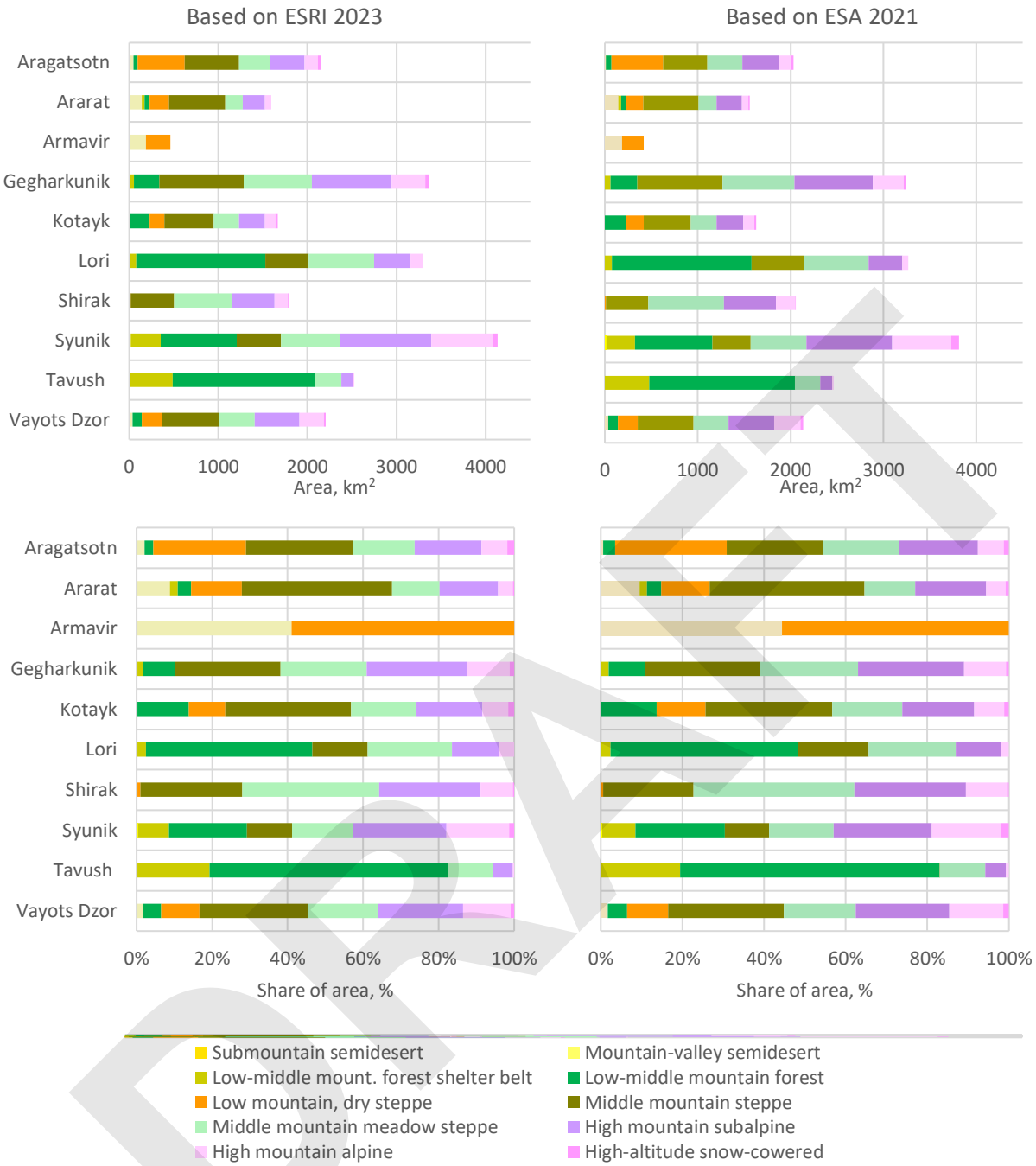

Figure 24C-1. Area and share of natural landscapes in marzes

Table 24C-1. Area of natural landscapes, based on ESRI 2023 land cover data, km²

Landscape zone	Aragat sotn	Ararat	Arma-vir	Geghar kunik	Kotayk	Lori	Shirak	Syunik	Tavush	Vayots Dzor
High-altitude snow-cowered	39.1	5.9	0.0	40.2	26.2	0.0	7.5	54.5	0.0	20.9
High mountain alpine	146.4	62.6	0.0	380.5	114.8	134.5	152.9	688.8	10.2	278.0
High mountain subalpine	383.5	245.1	0.0	892.1	290.0	407.7	479.4	1021.6	134.1	499.5
Middle mount. meadow steppe	351.3	199.8	0.0	768.9	288.0	735.7	648.7	664.7	294.6	404.3
Middle mountain steppe	611.2	631.7	0.0	943.5	553.7	481.4	482.9	494.4	0.0	636.7
Low mountain, dry steppe	527.8	214.3	272.5	0.0	160.4	0.0	19.0	0.0	0.0	224.1
Low-middle mountain forest	50.1	55.7	0.0	284.5	231.3	1448.1	0.0	854.0	1595.4	106.3
Low-mid. mount. forest shelter belt	0.0	33.7	0.0	53.3	0.0	81.3	0.0	338.2	489.3	0.0
Mountain-valley semidesert	45.1	139.6	189.3	0.0	0.0	0.0	0.0	0.0	0.0	37.0
Submountain semidesert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	0.0

Table 24C-2. Area of natural landscapes, based on ESA 2021 land cover data, km^2

Landscape zone	Aragats otn	Ararat	Arma-vir	Geghar kunik	Kotayk	Lori	Shirak	Syunik	Tavush	Vayots Dzor
High-altitude snow-cowered	25.6	13.7	0.0	24.8	19.2	0.0	5.1	81.2	0.0	29.6
High mountain alpine	128.2	72.6	0.0	331.2	119.1	63.1	212.4	639.3	16.7	282.8
High mountain subalpine	393.5	271.4	0.0	842.9	287.5	361.7	561.3	919.2	127.2	489.4
Middle mount. meadow steppe	378.0	195.1	0.0	778.4	279.1	699.1	811.6	601.3	274.1	376.5
Middle mountain steppe	478.6	591.4	0.0	915.3	506.6	562.9	457.4	411.9	0.2	604.4
Low mountain, dry steppe	555.8	184.8	232.9	0.0	195.7	0.0	11.2	0.0	0.0	213.2
Low-middle mountain forest	59.0	54.8	0.0	286.9	222.7	1502.0	0.0	836.1	1567.9	102.7
Low-mid. mount. forest shelter belt	0.0	28.6	0.0	63.3	0.0	77.6	0.0	309.6	479.1	0.0
Mountain-valley semidesert	11.6	147.5	186.3	0.0	0.0	0.0	0.0	0.0	0.0	36.1
Sub-mountain semidesert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.0	0.0

According to the ESRI land-cover data, the natural area of steppe and meadow-steppe landscapes decreased in all marzes except Vayots Dzor, Tavush, and Ararat (these landscape zones are absent in Armavir); subalpine landscape decreased in Shirak mars; low-mountain dry steppe – in Aragatsotn and Armavir marzes (Figure 24C-2; Table 24C-3). The only noticeable increases in the natural (non-cropland, non-built-up) area of landscape zones are the increase in mountain-valley semidesert area in the Ararat and Armavir marzes and in area of low mountain, dry steppe in Ararat, driven by a reduction in cropland in these marzes (see Section 2.2.B).

Table 24C-3. Changes in the area of natural landscapes from 2017 to 2023, % relative to 2017

	Aragats-otn	Ararat	Arma-vir	Geghar-kunik	Kotayk	Lori	Shirak	Syunik	Ta-vush	Vayots Dzor	Total
	Changes, km2										
High-altitude snow-cowered	0.01	0.02	0.00	0.00	0.73	0.00	0.00	-0.02	0.00	0.00	0.75
High mountain alpine	-1.34	-0.06	0.00	0.12	-0.03	0.00	-0.01	0.39	0.00	-0.10	-1.03
High mountain subalpine	-1.25	-0.27	0.00	4.27	-0.88	-0.61	-20.75	-4.58	-0.01	-0.13	-24.20
Middle mountain meadow steppe	-50.33	0.25	0.00	-14.64	0.38	-21.47	-131.42	-25.29	-0.10	-0.24	-242.86
Middle mountain steppe	3.15	0.60	0.00	-79.17	-24.57	-85.90	-61.12	-33.06	0.00	-0.45	-280.52
Low and middle mountain forest	-2.17	0.01	0.00	-7.23	5.60	-10.54	0.00	-7.54	-0.74	-0.41	-23.03
Low-mid. mount. forest shelter belt	0.00	-0.09	0.00	-3.13	0.00	-2.25	0.00	1.33	4.63	0.00	0.48
Low mountain, dry steppe	-18.98	9.98	-19.59	0.00	-3.44	0.00	-0.66	0.00	0.00	-1.19	-33.88
Mountain-valley semidesert	-0.36	13.03	20.23	0.00	0.00	0.00	0.00	0.00	0.00	-0.76	32.14
Submountain semidesert	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.37	0.00	0.00	-0.37
	Share of changed area, relative to 2017, %										
	Aragats-otn	Ararat	Arma-vir	Geghar-kunik	Kotayk	Lori	Shirak	Syunik	Ta-vush	Vayots Dzor	
High-altitude snow-cowered	0.03	0.39	0.00	0.00	2.88	0.00	0.00	-0.03	0.00	0.00	
High mountain alpine	-0.91	-0.09	0.00	0.03	-0.02	0.00	0.00	0.06	0.00	-0.04	
High mountain subalpine	-0.32	-0.11	0.00	0.48	-0.30	-0.15	-4.15	-0.45	-0.01	-0.03	
Middle mountain meadow steppe	-12.53	0.12	0.00	-1.87	0.13	-2.84	-16.85	-3.67	-0.04	-0.06	
Middle mountain steppe	0.52	0.10	0.00	-7.74	-4.25	-15.14	-11.24	-6.27	0.00	-0.07	
Low and middle mountain forest	-4.16	0.01	0.00	-2.48	2.48	-0.72	0.00	-0.88	-0.05	-0.38	
Low-mid. mount. forest shelter belt	0.00	-0.28	0.00	-5.55	0.00	-2.70	0.00	0.39	0.95	0.00	
Low mountain, dry steppe	-3.47	4.89	-6.71	0.00	-2.10	0.00	-3.36	0.00	0.00	-0.53	
Mountain-valley semidesert	-0.80	10.29	11.97	0.00	0.00	0.00	0.00	0.00	0.00	-2.01	
Submountain semidesert	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2.43	0.00	0.00	

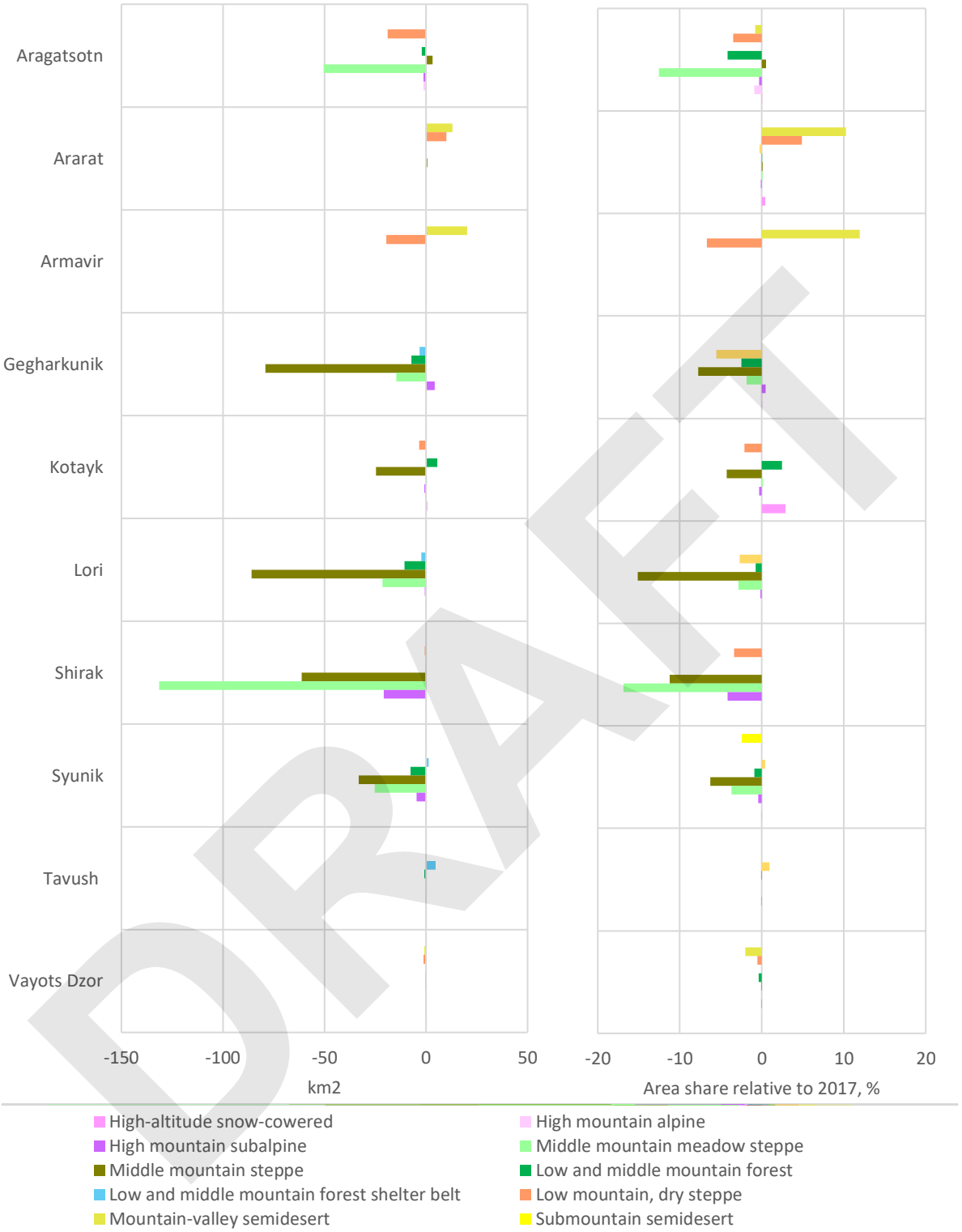

Figure 24C-2. Changes in natural landscape extent from 2017 to 2023, based on ESRI data: a) absolute changes, km2; b) share of changed area relative to 2017, %

2.4.D. Assessment of marz importance for conservation of natural landscape diversity in Armenia

To assess the importance of provinces for conserving natural landscapes in Armenia, we used the indicator of the total share of landscape areas located within each province relative to the total area of that landscape in Armenia. This approach was applied to ensure that the value of rare landscapes is not diminished.

The rankings based on ESRI and ESA data are very similar, differing only in the positions of some provinces with similar indicators in the middle of the list. According to the criterion we used, Syunik marz has the greatest value for conserving Armenia's landscape diversity, because it contains the highest cumulative share of the national extent of all landscape zones. The high summed Syunik value is largely due to the fact that 100% of submountain semidesert zone occurs in Syunik. However, even without it, Syunik still ranks above the other marzes. The least valuable are Shirak, Kotayk, and Armavir marzes (Fig. 24D-1; Tables 24D-1 and 24D-2).

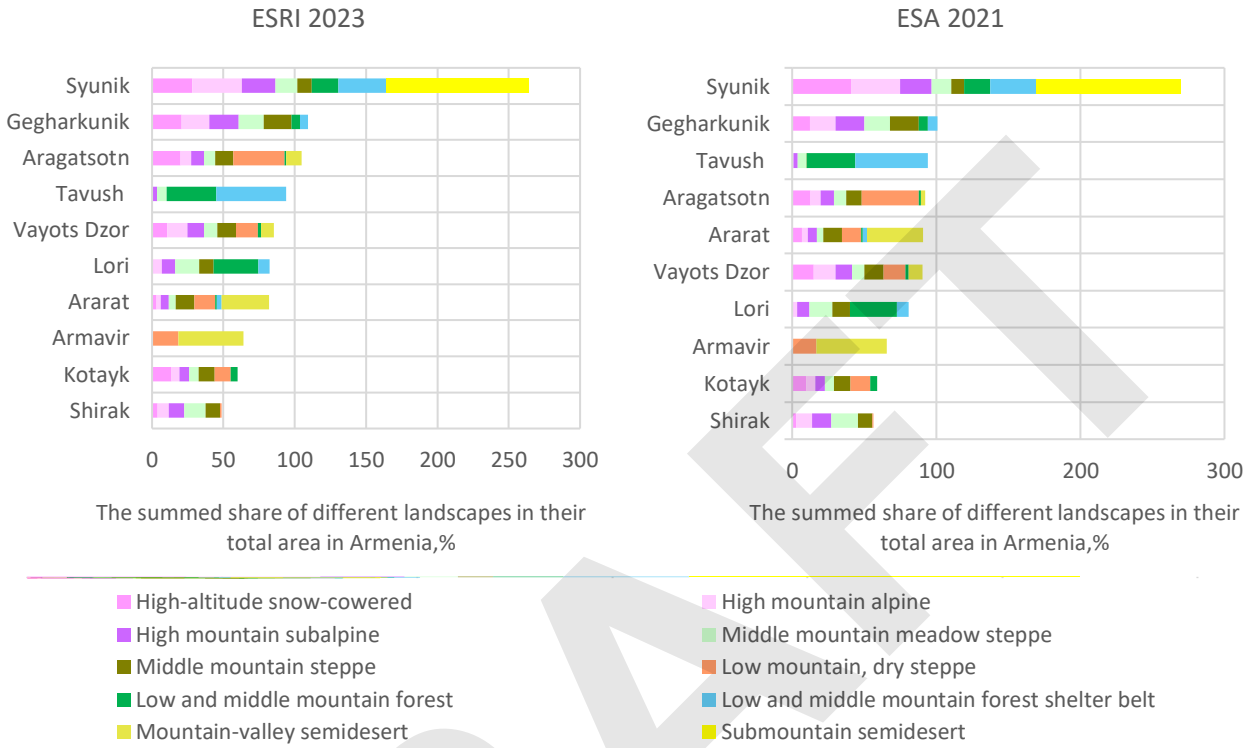

Figure 24D-1. The rankings of marz importance for conservation of natural landscape diversity in Armenia. The total percentage for provinces can exceed 100%.

Table 24D-1. The share of different landscapes in their total area in Armenia according to ESRI data, %. The total percentage for provinces can exceed 100%.

	Syunik	Geghar-kunik	Aragats-otn	Tavush	Vayots Dzor	Lori	Ararat	Arma-vir	Kotayk	Shirak
	2023									
High-altitude snow-cowered	28.05	20.71	20.11	0	10.74	0	3.03	0	13.5	3.85
High mountain alpine	34.99	19.33	7.44	0.52	14.12	6.83	3.18	0	5.83	7.77
High mountain subalpine	23.47	20.49	8.81	3.08	11.47	9.37	5.63	0	6.66	11.01
Middle mountain meadow steppe	15.26	17.65	8.07	6.76	9.28	16.89	4.59	0	6.61	14.89
Middle mountain steppe	10.22	19.51	12.64	0	13.17	9.96	13.06	0	11.45	9.99
Low mountain, dry steppe	0	0	35.94	0	15.26	0	14.59	18.56	10.93	1.3
Low and middle mountain forest	18.46	6.15	1.08	34.49	2.3	31.31	1.2	0	5	0
Low-mid. mountain forest shelter belt	33.97	5.35	0	49.13	0	8.16	3.39	0	0	0
Mountain-valley semidesert	0	0	10.81	0	8.87	0	33.44	45.33	0	0
Sub-mountain semidesert	100	0	0	0	0	0	0	0	0	0
Total share	264.42	109.2	104.9	93.99	85.21	82.51	82.11	63.89	59.98	48.8
	2017									
High-altitude snow-cowered	28.2	20.8	20.2	0.0	10.8	0.0	3.0	0.0	13.2	3.9
High mountain alpine	35.0	19.3	7.5	0.5	14.1	6.8	3.2	0.0	5.8	7.8
High mountain subalpine	23.4	20.3	8.8	3.1	11.4	9.3	5.6	0.0	6.6	11.4
Middle mountain meadow steppe	15.0	17.0	8.7	6.4	8.8	16.5	4.3	0.0	6.3	17.0
Middle mountain steppe	10.3	20.0	11.9	0.0	12.5	11.1	12.3	0.0	11.3	10.6
Low mountain, dry steppe	0.0	0.0	36.2	0.0	14.9	0.0	13.5	19.4	10.9	1.3
Low and middle mountain forest	18.5	6.3	1.1	34.3	2.3	31.4	1.2	0.0	4.9	0.0
Low-mid. mountain forest shelter belt	33.8	5.7	0.0	48.7	0.0	8.4	3.4	0.0	0.0	0.0
Mountain-valley semidesert	0.0	0.0	11.7	0.0	9.8	0.0	32.7	43.6	0.0	0.0
Sub-mountain semidesert	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total share	264.3	109.4	106.2	93.0	84.6	83.5	79.3	63.0	58.9	52.0

Table 24D-2. The share of different landscapes in their total area in Armenia according to ESA 2021 data, %. The total percentage for provinces can exceed 100%.

%	Syunik	Geghar-kunik	Tavush	Aragats-otn	Ararat	Vayots Dzor	Lori	Armavir	Kotayk	Shirak
High-altitude snow-cowered	40.78	12.45	0	12.85	6.88	14.86	0	0	9.63	2.57
High mountain alpine	34.27	17.76	0.9	6.87	3.89	15.16	3.38	0	6.38	11.39
High mountain subalpine	21.61	19.81	2.99	9.25	6.38	11.5	8.5	0	6.76	13.19
Middle mountain meadow steppe	13.69	17.72	6.24	8.61	4.44	8.57	15.91	0	6.35	18.47
Middle mountain steppe	9.1	20.21	0	10.57	13.06	13.35	12.43	0	11.19	10.1
Low mountain, dry steppe	0	0	0	39.88	13.26	15.3	0	16.71	14.04	0.81
Low and middle mountain forest	18.05	6.19	33.85	1.27	1.18	2.22	32.43	0	4.81	0
Low-middle mountain forest shelter belt	32.32	6.6	50	0	2.99	0	8.1	0	0	0
Mountain-valley semidesert	0	0	0	3.04	38.68	9.45	0	48.84	0	0
Submountain semidesert	100	0	0	0	0	0	0	0	0	0
Total share	269.81	100.74	93.97	92.33	90.76	90.4	80.75	65.55	59.16	56.53

From 2017 to 2023, summed value indicator changed by no more than 3% across marzes (Figure 24D-2). The value for Shirak marz declined from 52.0% to 48.8%, primarily due to a decrease in the share of the national meadow-steppe extent conserved there. For Ararat marz, this indicator rose from 79.3% to 82.1% owing to increases in the shares of the forest, steppe, and semidesert zones. For the other marzes, changes in the aggregate indicator were smaller.

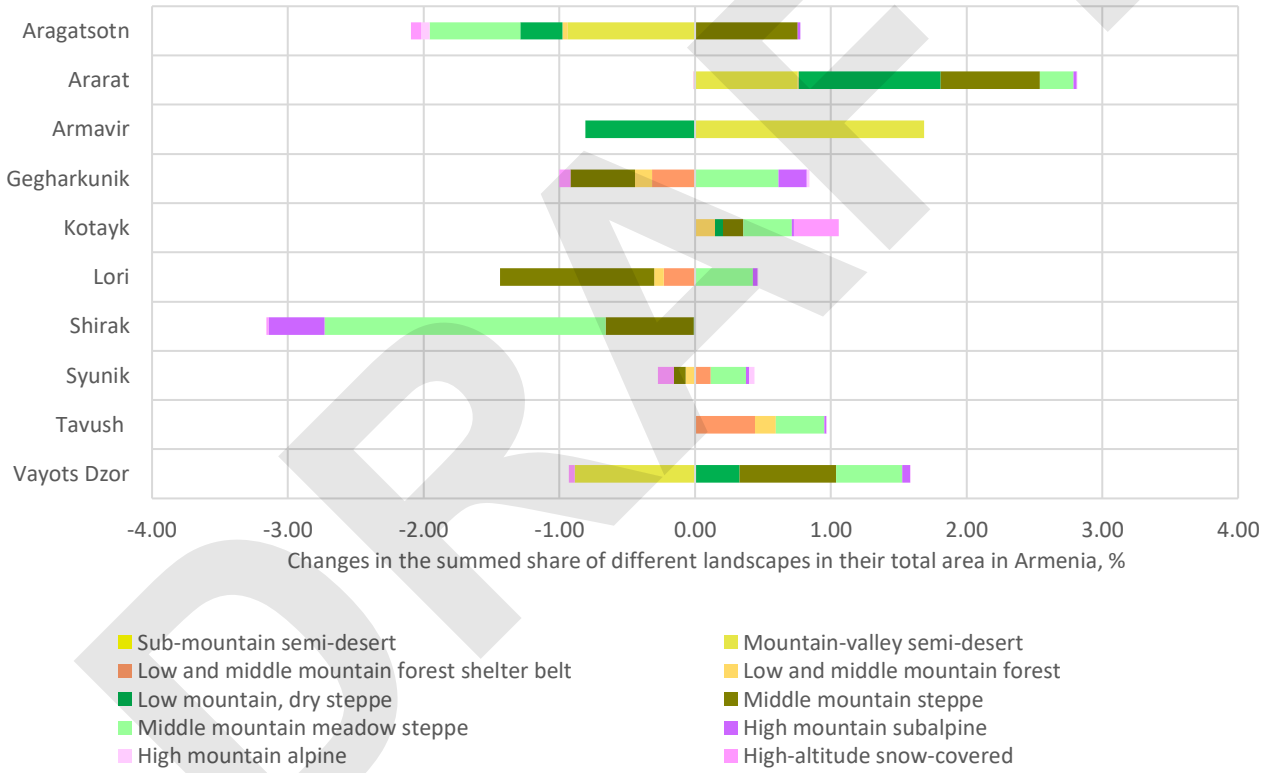

Figure 24D-2. Changes in marz importance for conservation of natural landscape diversity in Armenia from 2017 to 2023.