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THE ANTROPOGENIC ALTERATIONS OF TAVUSH MARZ NATURAL LANDSCAPES DUE TO MODERN LAND-USE

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The article presents anthropogenic alterations of the natural landscapes of the Tavush Marz of the RA under the current social and economic situation and analysis of modern land use. The altered natural landscapes of the Marz are characterized by various functions: residential, industrial, transportation, agricultural, recreational, forest, etc. Although there are no large industrial enterprises in the Marz, there are still socio-ecological problems that have significant impact on the alterations of natural landscapes and inefficient nature management.

Tavush Marz – natural landscapes – agro-landscape – resettlement – environmental problems

Հոդվածում ներկայացվում է ՀՀ Տավուշի մարզի բնական լանդշաֆտների մարդածին փոփոխվածությունը սոցիալ-տնտեսական արդի վիճակի և ժամանակակից հողօգտագործմա վերլուծության հիման վրա: Մարզի փոփոխված բնական լանդշաֆտներին բնորոշ են տարբեր գործառնություններ՝ բնակավայրային, արտադրական, տրանսպորտային, գյուղատնտեսական, ռեկրեացիոն, անտառտնտեսական և այլն: Չնայած մարզում չկան խոշոր արտադրական ձեռնարկություններ, այնտեղ այնուամենայնիվ առկա են սոցիալ-բնապահպանական հիմնախնդիրներ, որոնք էական ազդեցություն ունեն բնական լանդշաֆտների փոփոխման և ոչ արդյունավետ օգտագործման վրա:

Տավուշի մարզ – բնական լանդշաֆտներ – ագրոլանդշաֆտ – տարաբնակեցում – բնապահպանական հիմնախնդիրներ

В статье представлены антропогенные изменения в природных ландшафтах Тавушской области РА в свете нынешней социально-экономической ситуации и современного анализа землепользования. Измененные природные ландшафты области характеризуются различными функциями: жилыми, промышленными, транспортными, сельскохозяйственными, рекреационными, лесоводствами и т.д. Хотя в области нет крупных промышленных предприятий, по-прежнему существуют социально-экологические проблемы, которые оказывают значительное влияние на изменение природных ландшафтов и неэффективное природопользование.

Тавушская область – естественные ландшафты – агроландшафт – расселение населения – экологические проблемы

Tavush marz is located in the north-eastern part of Armenia, covering 2704 km². In 2016, the share of the main sectors of the Marz's economy in the total volume of the corresponding sectors was: industry – 0.9%, agriculture – 4.5%, construction – 3.1%, retail trade – 2%, services – 0.8%.

Materials and methods. For the survey, statistical data on distribution and socio-economic development of the Tavush Marz of the RA were used, reports and studies of various programs in the Marz, fund and cartographic materials. Historical, statistical, field observations, modern cartography, geographical information, comparative-geographical methods have been used in the work.

Results and Discussion.

Resettlement as a factor for transforming natural landscapes. According to January 1, 2017 data, the population of Tavush Marz is 124.5 thousand people, from which 52.5 thousand people (42.2%) live in urban areas, and 72 thousand (57.8%) in rural communities. The population density is 46 people / km² (average density of RA is 100.6 people / km²). Almost half (48.6%) of the population of the Marz live up to 800m above sea level, then the population density decreases to a height of up to 1800m, with no permanent dwellings [7]. The Marz has 5 urban (Ijevan, Dilijan, Noyemberyan, Berd, Ayrum) and 61 rural settlements united in 40 communities [3, 6]. Settlements landscape is one of the main varieties of anthropogenic landscape, the origin of which is related to the existing natural landscapes radical transformations such as natural vegetation transformation, changes in soils, animal life, water, topography and microclimate. As of 2016, the total area of settlements in Tavush Marz is 9970.9 ha [5], which makes 3.68% of the total area of the Marz (fig.1).

Impact of industry on the landscapes. The leading branch of Tavush Marz is the processing industry. Food industry and wood processing are prevailing. Food industry is represented by wine, canned food, cheese, bakery, mineral water production. Large wood processing enterprises of the province are in Ijevan, Dilijan, Noyemberyan. The following branches of industry has a certain degree of development: precision machinery, construction materials industry, particularly the production of felsite tuff (Noyemberyan Marz) marble, bentonite clay and lime (Ijevan Marz). The carpet industry in the Marz has a leading place in the volume of output.

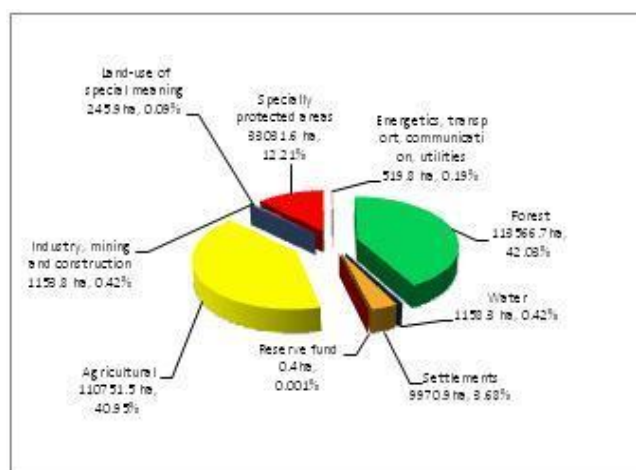


Fig. 1. Tavush Marz land fund according to land-use goal

In exploring production landscapes of the Marz, it is necessary to first of all examine the peculiarities of the branches of economy based on the exploitation of local natural resources and their development perspectives in order to reveal environmental issues.

In this regard, the study of the impacts of extracting and processing of benutonite clay, lime, lithographic stone, dolomite, and felsite is of practical significance for changing biological and abiotic components of landscapes. Particularly agricultural lands which are convenient for horticulture are alienated. It is emitted huge quantities of dust and chemicals in the atmosphere that weaken the atmosphere's transparency. Accumulated mineral wastes increase the strength of the mud flows and the extent of possible damage. As a result, large amounts of amelioration measures are required to restore and maintain the balance of natural processes. In 2016 the amount of waste generated in the territory of the Marz was 353 tons. The largest amount of harmful substances were emitted from the stationary sources. In 2016, it was 20110.3 tons, per capita - 160.9 kg (RA average value is 44.1 kg) and for 1 sq. km 7437.2 kg (RA average value is 4630.5 kg)[8]. Figure 2 shows the amount of emissions into atmosphere from the stationary sources for the period 2012-2016. Currently, the area of disturbed lands caused by mining in Tavush Marz is 335 hectares or 0.13% of the Marz's territory.

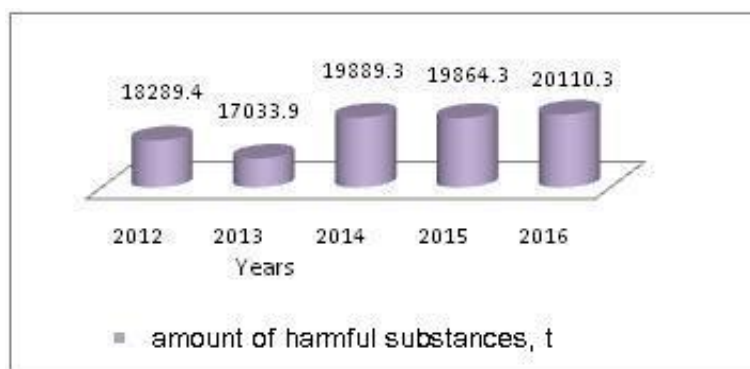


Fig.2. Emissions from Tavush Marz stationary sources during 2012-2016 [8]

The impact of transport on natural landscapes. The leading branch of transport in Tavush Marz is a motor vehicle. There are 152.6 km interstate, 336.8 km republican and 300.1 km Marzal roads. The 70-year-old Ijevan-Hrazdan railway passes through the Aghstev gorge that does not work at the moment. The 7km long section of the Yerevan-Tbilisi railway passes along the northern border of Debed.

The landscapes of the Tavush Marz have a negative impact on the ecosystems and emissions from the transport. The negative impact of road transport on the ecological state of the Marz's landscapes is also expressed during road construction. Engineering works during the construction result in increased slopes processes, breakage of soil cover, wastes accumulation, change of water supply, etc. The area occupied by autorouts and railways is 435 hectares or 0.16% of the total area of the Marz [5].

The agriculture development impact on the transformation of natural landscapes. Agriculture is a form of land use that results in an obvious man-nature interaction and relationship with its negative and positive sides [2]: In the Tavush Marz, the agrarian landscapes are dominant. The geographical location and climatic conditions of the Marz are favorable for development of crop and livestock breeding. The leading branches in the crop cultivation are cereal crops and viticulture. In 2016, the agricultural

lands were 110751.5 hectares [5]. The natural-climatic conditions of the Marz are favorable for gardening, especially for stone fruits, leguminous, subtropical fruits, berries and grapes. Prospects for development include tobacco production and fodder production. 2016 According to the data, the sown area was 16522 hectares [1]. That is to say 65% of the arable land of the Marz (25577.7 hectare) is used, and around 9055.7 hectares have been turned into hayfields or pastures. Cereals and leguminous crops (61%), followed by fodder crops (14%) and potatoes (12%) have a high share in the overall crop production [10]. The area of perennial plantations is 1901.9 hectares. The Marz has a considerable share in the republic, including subtropical species (269 hectares) and walnut (182 hectares) constituting correspondingly 36% and 9% share in the country [1, 5]. The one of leading branches of husbandry are cattle breeding and pigs. In recent years bee keeping is developing rather fast.

The reforms implemented in the agricultural sector in the Soviet era still had a negative impact on the ecological state of the Marz's landscapes. Later, the problems that emerged during the years of independence have aggravated the ecological situation: the transport blockade, the energy crisis, the negative effects of unfair rapid privatization of land, the break-up of former economic relations as a result of the current political situation and the extremely grave social condition of the rural population (especially borderline and highland communities) resulted in mass exodus and desertification of privatized lands, lack of irrigation water and high fees, grapes and fruit mass and cutting gardens, etc [2]. Thus, there are serious problems in the area of agricultural development of the Marz, the steps to overcome them do not yet provide efficiency of agricultural production, rational use of agricultural land [2]. The area occupied by agricultural land is 40.95% (fig.1).

Forest estate distribution features. The total area of forests in Tavush Marz is 118087 hectares, of which 103957.6 hectares or 88% are covered with forests. The forest management is implemented through "Hayantar" SNCO "Ijevan"- 25512 ha, "Sevqar"- 20484 ha, "Noyemberyan"- 29254 ha and "Artsvaberd", 42837 ha forestry enterprises [10]. The hard political, socioeconomic situation created in the 1990s caused huge pressure on the forest resources. It is estimated that 50% of the thermal energy consumed by forest adjacent communities has been utilized for firewood [9;11]. Irregular logging continues today. These are particularly dangerous when carried on the slopes of more than 30 degree slopes, in the water-protective buffer zones of the rivers, as well as on the south-facing positions where the vegetation is most vulnerable and high in the grazing load. Currently, the degradation of the forest landscapes in the Marz is conditioned by irregular logging and poor forest management practices.

Conservation of natural landscapes through the system of specially protected natural areas. Specially protected natural areas, "Dilijan" national park, "Zikatar", "Hazel nut", "Ijevan" and "Gandzakar" state sanctuaries, 12 geological and biological natural monument, as well as Ijevan and Berd "Soranner" dendroparks have been created for the preservation and sustainable use of unique wildlife and non-destructive components of the wildlife, including forest ecosystems. [4] (fig.3): To analyze the contemporary land use in Tavush Marz by using the ArcGIS software, we have calculated the distribution of land plots and land utilization in each of the landscape zones in the Marz by targeted purpose. The results obtained were analyzed and mapped (fig. 4), and data on the availability and distribution of land fund and land use for each landscape zone (as per destination) are presented in tab. 1.

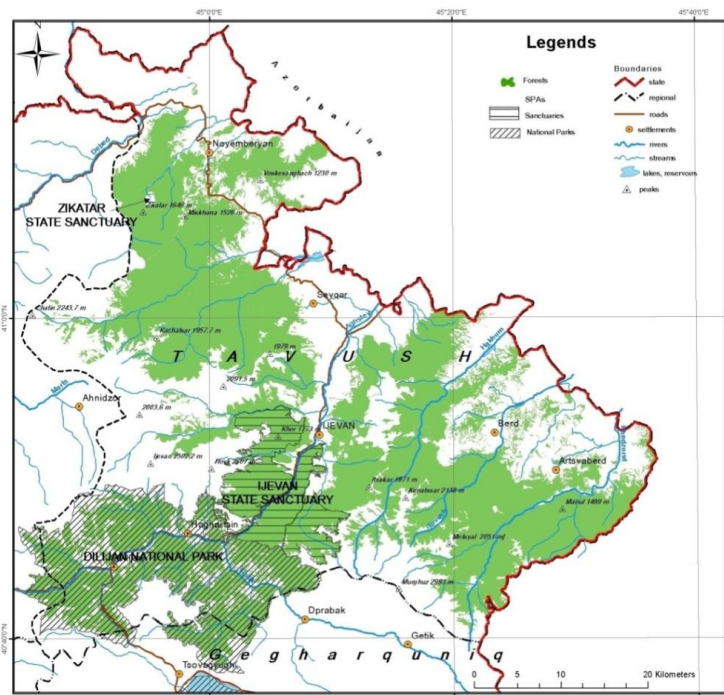


Fig. 3. The specially protected are systems of Tavush Marz

Table 1. Current land-use in Tavush Marz by landscape zones (ha)

Allocation of land fund according to the goal meaning	Landscape zones				Total
	Lowmountain, post-forest, warm, semi-dry steppe (374m-1000m)	Low and middle mountain, humid forest (1000m-2300m)	High mountain, humid meadow-steppe (2200m-2600m)	High mountain, cold, humid, pre-alpine and alpine (2400m-2993m)	
Forest	16795.2	93650.6	2990.4	130.5	113566.7
Water	806.4	286.3	65.3	0.3	1158.3
Settlements	6348.1	3257.7	365.1	-	9970.9
Reserve	0.1	0.2	0.1	-	0.4
Agriculture	42896.4	42938.2	23892.1	1024.8	110751.5
Industry, mining and other construction meaning	803.6	306.25	43.9	0.05	1153.8
Special meaning	191.4	51.4	3.1	-	245.9
Specially protected areas	928.45	27111.2	4991.9	0.05	33031.6
Energetics, transport, communication, household, etc.	303.5	185.72	30.4	0.18	519.8
Total(%)	69073.15(25.5)	167787.57(62)	32382.3(12)	1155.88(0.5)	270398.9

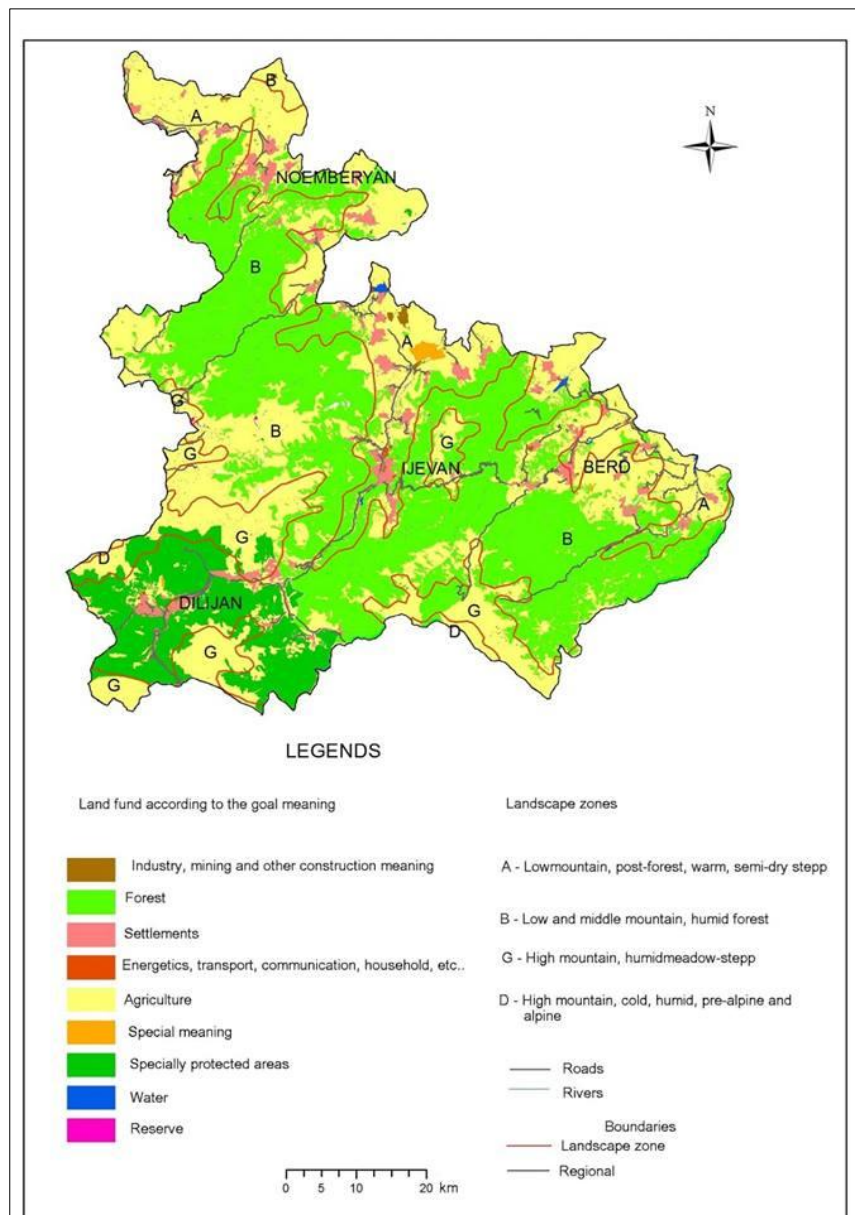


Fig. 4. Tavush Marz contemporary land-use by landscape vertical zones

The analysis of data shows that lowland, post-forest, warm, semi-arid steppes (374-1000m) occupy 69073.15 ha, or 25.5% of the Marz's territory. Human influence here is expressed with great intensity, and the landscape zone is completely transformed, thanks to intensive farming and livestock breeding. It is the main agricultural district of the Marz, about 62% of the area – 42896.4 ha, constitutes agricultural land. In this zone, the majority of the Marz's settlements are also allocated, which accounts for 9% of the area's territory. The majority of the Marz's territory – 62% or 167787.57 ha, forms a low mountainous and middle-altitude forest zone (1000-2300m).

Human impact on the transformation of the landscape zone is clearly expressed in agricultural activities. 16% of this zone forms agricultural land. Here, forest areas and specially protected natural areas correspondingly occupy an area of 93650.6 ha or 56% and 27111.2 ha, or 26% of the zone area. Forest landscapes, especially during the last two decades, have been subject to continuous irregular and illegal logging, resulting in poor quality and quantitative characteristics of forests. In these landscapes it has been continuing degradation processes. The highland, wet meadow-steppe zone (2200m-2600m) makes 332382.3 ha or 12% of the Marz's territory. The vast majority of the zone's area – 74% is of the agricultural significance, mostly used as grasslands and pastures. 16% of the zone's territory is occupied by specially protected natural areas, and 9% – forest landscapes. 0.5% of the territory of the Marz is a zone of high mountainous, wet steppes and alpine (2400 m-2993 m), which, despite the economic use of human beings, has almost not changed.

Thus, the analysis of anthropogenic changes in the natural landscapes of Tavush Marz shows that the population density and land-use utilization is not intensive, but there are serious environmental issues that are related to hazardous emissions from stationary industrial facilities, violations of agro-technique rules in agriculture, pasture overgrazing, non-designed development of settlements, emissions from road transport and road constructions, and especially unsustainable use of forest resources.

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