THE EFFECTS OF EROSION ON THE SOILS IN THE OGUZ REGION

L.S. Zeynalova, T.A. Hajiyev, S.A. Huseynova
ANAS, Institute of Ecology

Abstract: In modern times, many natural ecosystems have suffered significant degradation due to global climate change, particularly soils formed in vertical belts, which are of special interest. This article offers detailed information about the soils in the Oguz region and discusses how their typical diagnostic indicators have changed due to the erosion process.

Keywords: ridge, climate, air temperature, soil erosion, genetic section, soil type

***Corresponding Author:** seadet_huseynova@mail.ru

Received: 15 December 2024; Accepted: 28 February 2025; Published: 30 March 2025

DOI:10,54414/TBBD1881

Introduction:

The Main Caucasian Range is a system of mountain folds that are not crossed by rivers. It is characterised by high-mountain relief, with a watershed that generally takes the form of a narrow ridge where the highest peaks, Tufan and Bazarduzi, are located. The main features of the relief in this geomorphological region indicate that local mountain ranges and elevations are classified as anticlines while the depressions are classified as synclines (Budagov, 1969).

In the Oguz region, both at depth and at the surface where parent rocks are exposed, the sedimentary materials are composed of clays, limestones, loams, and conglomerates. These materials are susceptible to the destructive effects of water, significantly contributing to gully erosion in the area. Climate is an active natural factor that plays a crucial role in soil formation. The climatic characteristics largely determine the occurrence and development of erosion processes and the intensity of these processes (Museyibov, 1998).

To understand the impact of climate on erosion, we must first describe the climatic conditions of the region. Azerbaijan has a diverse range of physical and geographical conditions across its various natural zones, leading to the formation of different climatic types. There are eight climate types in Azerbaijan, ranging from humid subtropical to mountain tundra. Three of these types are typical of the Oguz region:

1. Moderately warm steppe climate with dry summers.
2. Moderately warm steppe climate with dry winters.
3. Moderately warm climate with dry winters.

The first two climates cover the southern part of the region, while the third type is found in the central and northern areas. The air temperature is affected by the area's altitude above sea level. Between the lowest point and the watershed, the temperature difference can reach -20°C in winter and +30°C in summer.

The significant changes in temperature, both throughout the day and by season, contribute to the degradation of the soil surface, which in turn hinders vegetation growth and increases soil erosion during heavy rainfall. In winter, when temperatures drop below 0°C (especially in the elevated parts of the region), the soil surface can freeze quickly. However, it is important to note that the average monthly soil temperature during the coldest months of winter remains positive.

Research methods:

The study utilized both ground-based measurement data and digital maps created through the interpretation of satellite images. This approach ensures high accuracy in geographical analysis and modelling. Ground-based measurements reflect data obtained in field conditions and are integrated with information derived from satellite imagery to enhance the precision and scalability of the research findings. The interpretation of satellite images enables the study of terrain structure, landscape changes, and other critical geographical elements. This method serves as an effective tool for analyzing and modelling the environment according to the objectives of the research.

Results and discussions:

In the Oguz district, the annual precipitation totals 500 mm, with the majority occurring during the spring and autumn months. The highest levels of soil erosion are typically recorded in the spring, coinciding with the peak precipitation. This rapid onset of erosion in spring is largely due to the intense rainfall, which overwhelms the soil's capacity to absorb water, resulting in surface runoff and accelerated erosion (Fig. 1).

During the winter months, although little snow falls, some soil erosion still occurs. The winter is relatively mild, preventing the formation of a permanent snow cover. Snow is only present when temperatures drop, with coverage ranging from 8 to 14 cm thick. This snow typically lasts from 15 to 60 days, appearing in late November or early December and melting by March.

Figure 1. Space image of the Oguz district

The peripheral zone that borders the mountain ranges is characterized by steppe soil formation. This area features both dark grey-brown and light grey-brown (chestnut) soils, as shown in Table 1 and illustrated in Picture 2 (Aliyev, 1978).

Table 1. Water-physical properties of steppe mountain-brown soils of the Oguz district.

Section	Genetic horizon.	Depth in sm.	Field moisture %	Bulk density g/sm^3	Specific gravity g/sm^3	Total porosity %
1 Unwashed	A	0-36	19,85	1,06	2,45	55,61
	B	36-59	18,49	1,12	2,49	57,3
	C	59-88	16,19	1,14	2,52	57,9
2 medium washed out	A	0-27	18,94	1,04	2,54	58,2
	B	27-44	18,35	1,09	2,54	58,7
	C	44-67	16,79	1,11	2,51	58,9

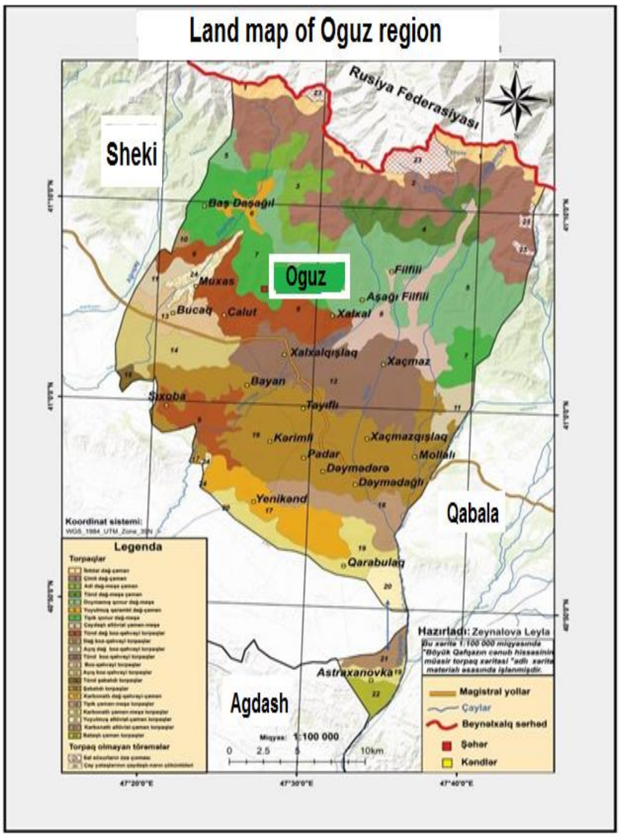

Figure 2. Soil map of Oguz district

The research was conducted in the foothills of the Oguz district, where soil sections were examined in both unwashed and moderately washed areas.

Section No. 1: Unwashed Soil

- A (0-36 cm): Dark brown with a granular-nutty structure, containing live roots; the soil is heavily loamy, and wet, and shows a clear transition.

- B (36-59 cm): Dark brown with roots; this layer is also heavily loamy, wet, and has a clear makeup.

- C (59-88 cm): Light brown, with an indistinct structure; fragments of slightly weathered rocks are present, and it effervesces when treated with HCl.

Section No. 2: Moderately Washed Soil

- A (0-27 cm): Brown with a lumpy-granular structure; this soil is heavy loamy and wet with a clear transition.

- B (27-44 cm): Light brown with a lumpy structure; heavy loamy and moderately wet, with a clear transition.

- C (44-67 cm): Light clayey with no expressed structure; contains fragments of parent rock, is dense, and boils when treated with HCl.

Table 2 presents the water-physical properties of mountain-brown steppe soils in the Oguz region. The total porosity, specific weight, and volumetric weight of unwashed soils in the upper horizon are 55.6%, 2.45 g/cm³, and 1.06 g/cm³, respectively. In moderately washed samples, these indicators increased, suggesting an ongoing erosion process.

Table 2. Particle size distribution of mountain brown soils of Oguz district

Section	Genetic horizon.	Depth in sm.	Factions %						
			1-0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	<0,01
3 Unwashed	A	0-25	6,95	0,92	20,56	9,84	18,00	42,00	69,84
	B	25-57	4,15	1,70	19,42	7,85	16,12	36,22	61,82
	C	57-86	5,35	11,20	21,42	7,33	19,10	33,45	64,52
4 medium washed out	A	0-11	5,74	2,45	24,85	11,15	19,34	34,65	51,75
	B	11-39	2,35	10,55	13,14	8,09	17,55	29,15	47,65
	C	39-67	0,75	6,74	11,35	7,91	15,64	22,41	44,99

Regarding the mechanical composition, the soils are classified as heavy loamy with a physical clay content of 69.84%. However, in moderately washed samples, the physical clay content is noticeably lighter (refer to Table 3). According to Table 4, the structural-aggregate composition shows that the content of aggregates larger than 1 mm during dry sifting was 60.85% in unwashed samples and 33.80% in moderately washed samples. In the upper 0-27 cm horizon of moderately washed samples, these values were recorded at 52.68% and 21.20%, respectively.

In terms of agrochemical indicators, the mountain-brown steppe soils of the Oguz district contain a total nitrogen content of 0.344% and a humus of 5.2% in unwashed samples. The sum of exchangeable cations was 38.23 m.eq. per 100 g of soil. In moderately washed samples from the upper 0-27 cm horizon, total nitrogen is 0.279%, while humus content is 3.1%, indicating a downward trend as the depth increases.

Table 3. Structural and aggregate composition of mountain-brown steppe soils of the Oguz district.

Section	Genetic horizon.	Depth in sm.	Factions мм							
			>7	7-5	5-3	3-1	1-0,5	0,5-0,25	<0,25	>1
1 Unwashed	A	0-36	<u>35,42</u> 8,80	<u>6,31</u> 7,00	<u>9,42</u> 11,60	<u>9,70</u> 16,40	<u>1,01</u> 14,60	<u>0,94</u> 6,40	<u>2,14</u> 27,00	<u>60,85</u> 33,80
	B	36-59	<u>31,11</u> 3,40	<u>9,04</u> 8,60	<u>7,25</u> 9,50	<u>8,38</u> 14,60	<u>0,73</u> 15,00	<u>0,63</u> 6,20	<u>1,96</u> 32,40	<u>45,88</u> 36,10
	C	59-88	<u>20,44</u> -	<u>3,40</u> 5,60	<u>6,79</u> 11,80	<u>12,34</u> 9,60	<u>22,10</u> 14,70	<u>82,40</u> 10,10	<u>32,15</u> 39,80	<u>42,97</u> 27,11
2 medium washed out	A	0-27	<u>25,67</u> -	<u>9,91</u> 1,00	<u>9,76</u> 7,00	<u>7,17</u> 13,60	<u>0,74</u> 15,30	<u>0,58</u> 12,70	<u>1,59</u> 42,90	<u>52,68</u> 21,20
	B	27-44	<u>15,65</u> -	<u>1,58</u> 1,40	<u>10,75</u> 3,20	<u>8,17</u> 10,05	<u>0,98</u> 14,60	<u>0,46</u> 9,10	<u>13,41</u> 49,70	<u>44,32</u> 14,65
	C	44-67	<u>11,31</u> 0,91	<u>7,32</u> 2,51	<u>5,68</u> 5,49	<u>4,14</u> 3,75	<u>15,77</u> 24,75	<u>28,95</u> 32,84	<u>26,83</u> 29,75	<u>28,45</u> 12,66

Table 4. Some agrochemical indicators of mountain-brown steppe soils of the Oguz district.

Section	Genetic horizon	Depth in sm.	Ca+Mg/eq. 100g. soil			Total Nitrogen%	humus, %	C:N
			Ca	Mg	Ca+Mg			
1 Unwashed	A	0-36	32,11	6,12	38,23	0,344	5,2	8.77
	B	36-59	30,52	5,8	36,32	0,336	4,8	8.28
	C	59-88	27,41	4,7	32,11	0,265	3,4	7.44
2 medium washed out	A	0-27	23,15	4,31	27,46	0,279	3,1	6.44
	B	27-44	19,49	3,09	22,58	0,235	2,6	6.41
	C	44-67	14,19	2,8	16,99	0,174	1,9	6.30

Conclusıon:

In both samples provided, we observe differences in the shapes and sizes of morphological and diagnostic indicators throughout the soil profile. The gradation of transitions along the profile is illustrated in the soil profile example. Additionally, erosion and degradation have resulted in the reduction of the soil profile, leading to a decrease in absorbed cations and humus in the productive sowing layer.

References:

Budagov, B. A. (1969). Geomorphology of the southern slope of the Greater Caucasus. Baku: Elm (in Russian).

Museyibov, M.A. (1998) Azərbaycanın fiziki coğrafiyası, Maarif nəşriyyatı. Bakı: 201.

Aliyev, GA (1978) Soil the Greater Caucasus (within the Azerbaijan SSR). Part 1. IZD-vo Elm.