

## ФИЗИЧЕСКАЯ ГЕОГРАФИЯ И ГЕОЭКОЛОГИЯ

## PHYSICAL GEOGRAPHY AND GEOECOLOGY

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LANDSCAPE-ECOLOGICAL ZONING OF HILLS OF THE FERGANA VALLEY  
AND DESCRIPTION OF REGIONS

**Abstract.** *The article substantiates the demand for landscape-ecological zoning of hills in the Fergana Valley based on an analysis of the results of many years of research conducted in the region. The degree of anthropogenic alteration of hills landscapes was revealed and the following gradations were identified: slightly altered, altered, moderately altered, strongly altered, very strongly altered. Based on a comparison of the degree of change in hills landscapes, their landscape-ecological zoning has been carried out, and scientific foundations for rational nature management have been developed. It is shown that in order to rationally use the hills landscapes of the valley, it is advisable to pay attention to the following factors: the geological and geomorphological structure, the degree of anthropogenic change in the landscape, the potential for erosion, the level of groundwater, the degree of soil salinity, and the specialization of agricultural production.*

**Key words:** *hill landscapes, anthropogenic factor, natural conditions, zoning, region, anthropogenic landscapes, landscape change, geographical assessment.*

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ЛАНДШАФТНО-ЭКОЛОГИЧЕСКОЕ РАЙОНИРОВАНИЕ АДЫРОВ  
ФЕРГАНСКОЙ ДОЛИНЫ И ОПИСАНИЕ РАЙОНОВ

**Аннотация.** *В статье обоснована востребованность ландшафтно-экологического районирования адыров Ферганской долины на основе анализа результатов проведенных в регионе многолетних исследований. Выявлена степень антропогенного изменения адырных ландшафтов и выделены следующие её градации: слабо изменённые, изменённые, средне изменённые, сильно изменённые, очень сильно изменённые. На основе сравнения степени изменения адырных ландшафтов произведено их ландшафтно-экологическое районирование, разработаны научные основы рационального природопользования. Показано, что в целях рационального использования адырных ландшафтов долины целесообразно обращать внимание на следующие факторы: геологическая и геоморфологическая структура, степень антропогенного изменения ландшафта, потенциал развития эрозии, уровень грунтовых вод, степень засоления почв, специализация сельскохозяйственного производства.*

**Ключевые слова:** *адырные ландшафты, антропогенный фактор, природные условия, районирование, район, антропогенные ландшафты, изменение ландшафтов, географическая оценка.*

**Introduction and problem statement.** The Fergana Valley differs from other regions of Uzbekistan due to the variety of landscape complexes as a result of changes in its natural conditions and geosystems in accordance with the latitudinal and altitudinal zoning. At the same time, the valley area is characterized by well-developed agriculture and its nature has been strongly transformed due to human economic activity [7,8].

Classification of various anthropogenic landscapes created as a result of human

economic activity in terms of effective use is one of the urgent problems in modern landscape science. Solving the problem of classifying anthropogenic landscapes opens the way to finding a solution for their research in field conditions and mapping works at different scales.

**Study of the problem.** Fergana Valley has been the subject of several researches on effective use by many different scientists. Including; More detailed regionalization of Central Asia, such as the Fergana Valley, was done by V.M. Chetyrkin. In his monograph entitled "Experience of Complex Geographical Description and Zoning of Central Asia" (1960), he considers most of Central Asia as the Turanian geofacies and separates the Fergana Valley as a separate province. Fergana province, in turn, is divided into the following 3 subprovinces and 8 regional complexes [18].

I. North-western composite subprovince: 1. Eastern Chust regional complex; 2. West Karamazar regional complex;

II. North-eastern Chatkal-Fergana subprovince: 3. Fergana regional complex; 4. Chatkal regional complex;

III. Southern Turkestan-Alay subprovince: 5. Akbura-Shakhimardan regional complex; 6. Karadaria regional complex; 7. Sokh regional complex; 8. Khojabakirgan regional complex.

It should be noted that V.M. Chetyrkin gave a detailed description of the Turanian geofacies and the provinces separated in it, and indicated only the names of the separated regional complexes and their natural boundaries.

The natural geographical zoning of oasis landscapes of the Fergana Valley was carried out by L.N. Babushkin and N.A. Kogay [4-6], A.A. Abdulkasimov [1-3]. L.N. Babushkin and N.A. Kogay are engaged in the natural geographical zoning of the territory of Uzbekistan and research the landscapes in detail on the basis of the landscape-typological mapping of the Fergana Valley. These two scientists separated the Turanian natural geographical province of the Fergana valley as a mountainous district. The authors, understanding the essence of the geopair theory, come to the conclusion that the plains together with the mountains surrounding them form a single geographical unity, and the mountains and plains in the valley parts combine functional unity and dynamic development. The natural geographical conditions in the territory of the district vary from place to place, which is the basis for the separation of 6 natural geographical regions in the Fergana natural geographical district. There are Western Alay, Central Plain, Gavasay, Chatkal, Fergana and Eastern Alay. It consists of a group of landscapes separated on a typological basis from the point of view of the structure of natural geographical regions. The total number of them reaches 40 in the Fergana Valley. L.N. Babushkin and N.A. Kogay in their research study all the landscapes of the district in a perfect complex and taking into account the agricultural issues, show their occupied areas in the district in percentages. They use the following system of taxonomic units in the complex natural geographic zoning system of the country: mainland - country - province - sub-province - district - area - landscape. In this system: mainland - Eurasia, country - Middle Asia, province - Turanian, sub-province - plain and highland-mountain parts, district - for example, Fergana valley, area - Central Fergana, landscape types - meadow - landscape of tall meadows on saline soils fits. Thus, the complex natural geographical zoning system of the Fergana Valley, developed by L.N. Babushkin and N.A. Kogay, can be considered as the logical end of the problems of territorial stratification of the country's natural resources and conditions. Because the unique regional landscape-typological system of these authors is recognized by scholars [5].

A. Abdulkasimov developed a system of landscape-typological units of the valley area based on the materials of the Fergana Valley. Based on these units, in the Fergana Valley 1. Landscape: class - mountain, subclass - intermountain - sedimentary, type - mountainous - barren, 2. Location: type – hill-semi-desert, small type-strong fragmented gravelly hill, 3. Urochishcha: group-grass meadow, type-meadow-sorchock type separates the landscapes in the form of tall meadows with arid growing on salt-rich soils. A. Abdulkasimov's system of

landscape-typological units for clarifying the internal differences of the nature of the Fergana Valley is based on: region-class-subclass-landscape type-place type-small place type-group of plots-type of plot. At the same time, according to A.A. Abdulkasimov, 5 natural geographical regions are distinguished in the Fergana Valley: the rocky desert region consisting of Western Leninabad-Akbel hills; Southern Sokh-Fergana hilly and semi-desert region; The Central Karakalpak-Namangan plain is a semi-desert region; Northern Chust-Maylisu is a semi-desert region consisting of broken hills; Eastern Osh-Kugart steppe region [1,2].

Also by M.M. Mamatkulov the Fergana Valley was zoned for hydrogeological purposes according to its geomorphological features [12].

**The aim and objectives of the work.** The hills of the Fergana Valley are landscape-ecologically zoned and characterized by the effective use of the nature of the regions. The hills of the Fergana Valley were taken as the object of the research work.

**Materials and research methods.** One of the most important tasks in the Fergana Valley hill landscapes and their effective use is the evaluation of the ecological conditions of the environment. It takes into account the degree of human exploitation of the natural and resource potentials of landscapes that create ecological conditions. The man-made processes in the areas where human economic activity is strongly developed have changed the landscape-geochemical state and become the basis for assessing the ecological conditions of the landscapes. The natural potential of the hilly landscapes of the Fergana Valley is used in agriculture, and the resource potential is used in industrial production and other purposes [15].

It is desirable to pay attention to the hilly landscapes of the Fergana Valley and their effective use: the degree of change in the state of the landscape, erosion, the level of groundwater, the level of salinity, the share of anthropogenic landscapes in the total area, types of agricultural production, geological, geomorphological structure [14].

**Results and its discussion.** Based on the analysis of the obtained materials, the hilly landscapes of the Fergana Valley were evaluated according to human-induced changes as follows: weakly changed, changed, moderately changed, strongly changed, extremely strongly changed, and the territory was zoned based on them [9-11,14] (Figure 1).

In order to use them effectively, it is desirable to know a number of the above features.

**1. Weakly modified (Chust-Pap and Chonara-Shorsu) region** occupies the territories located in the north-western and southern parts of the valley, in the direction of the Kokand-Bekabad wind. This area covers 31% of the total hills and stretches from south-west to north-east.

The area of anthropogenic landscapes is 10-20%, consists of sandstone, gravel and sandy deposits. In this area, geotectonic movements are felt more strongly than in other flat parts of the valley. The rocks forming the territory consist of Quaternary deposits.

The valleys of Adir landscapes are composed of Meso-Cenozoic rocks. According to the lithological composition, the hills of this region are sedimentary rocks and they are the product of running water.

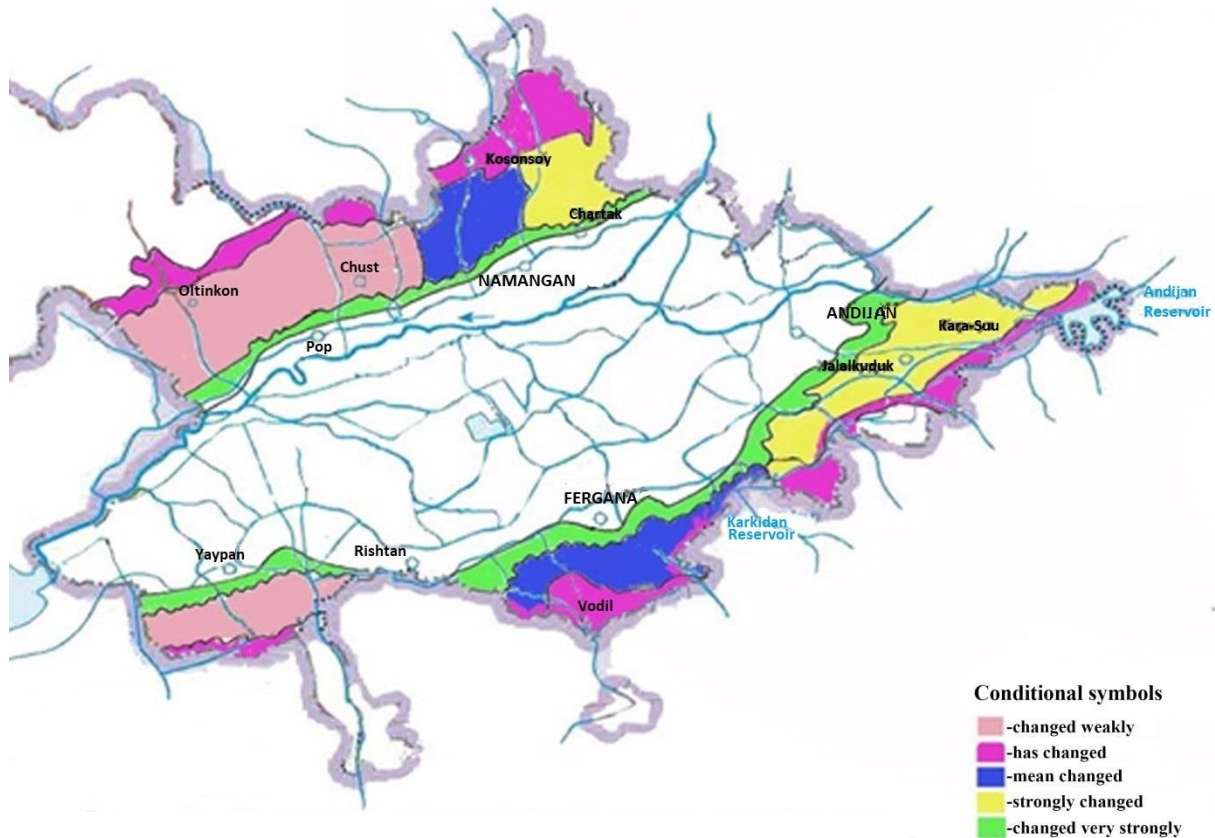
In terms of relief structure, the Chust-Pap and Chonara-Shorsu hilly landscapes are the lowest regions among the hilly landscapes of the Fergana Valley.

The degree of slope is a slope (1-2 °C). Their height is from 450-650 m to 800 m above sea level. The sum of positive temperatures is 4000-4300 °C, annual rainfall is 200 mm. As a result of the flowing waters crossing the hills, they were separated from each other and suffered moderate disintegration. Chust-Pap and Chonara-Shorsu hilly landscapes are irrigated by rivers such as Chadaksay, Gavasay, Rezaksay, Chustsay-Sokh, and also receive water from artificial irrigation facilities. Groundwater is located at a depth of 2-3 m. However, in most of Chust's hilly landscapes, the presence of groundwater near the surface and the rising level of it are expanding the scope of salt marshes and marshes. The soil layers are plastered sandstone, large and small gravel rocks and sandy deposits, and their surface is occupied by loess rocks and loess-like deposits. In the cultivated lands, light gray soils are

scattered. Salt marshes, soups and brown soils also occupied a large area. The proximity of the soil layer to the surface of the earth has a significant negative effect on soil fertility. Anthropogenic landscapes are moderately and weakly cultivated, weakly washed and salted [13,16,17].

The factors that create geographical conditions are mainly climate, inland waters, terrain, and pasture livestock. All these factors cause water and wind erosion, pasture degradation and salinization processes in Chust-Pap and Chonara-Shorsu hilly landscapes.

To prevent such negative situations and ensure that the number of livestock is moderate in the use of pasture landscapes for efficient use; organization of surrounding forests to prevent wind erosion; irrigated agricultural crops should be organized on the basis of scientifically based hydromelioration plans.



**Fig. 1. Landscape ecological zoning of the hills of the Fergana Valley**

**2. The changed (back-hill plains) region** includes the northern and southern foothills of the Fergana valley hill landscapes, the areas extending from west to east. The area of anthropogenic landscapes is 40-50%.

This region accounts for 12% of the total territory, which is spread over the back plains of the hilly landscapes of the Fergana Valley. Geotectonic movements are felt more strongly in comparison to other flat parts of the valley. The rocks forming the back plains of hill landscapes consist of Quaternary deposits. According to the lithological composition of the hills of this region, they are considered sedimentary rocks and they are the product of running water. In terms of relief structure, the back plains of the hilly landscapes are areas of medium height within the pre-mountainous landscapes of the Fergana Valley. Their height is 800-1200 m above sea level. The degree of slope is a slope (1-2 °C). The sum of positive temperatures is 4100-4300°C, the amount of annual precipitation is 300-450 mm. As a result of the flow of water, they were separated from each other. The hilly landscape is divided by the back plains of streams. Groundwater is located at a depth of 0,5-2 m, but in some parts, seepage water is located close to the surface of the earth, which leads to the expansion of

swampy areas, and at the same time, it expands the scale of salt marshes and marshes. Soil layers consist of plastered sandstone, large and small gravel rocks and sandy rocks. In the cultivated lands, light colored, typical gray and dark gray soils are distributed. Saline and swampy soils occupy large areas. The proximity of the soil layer to the surface of the earth has a negative effect on soil fertility. Anthropogenic landscapes are moderately and weakly cultivated, strongly fragmented and weakly salinized.

The factors that create geographical conditions are mainly internal waters, relief and human economic activity. All these factors cause salinization, salinization, swamping processes and all types of erosion in the back-hill plains. For their prevention and effective use, it is necessary to pay attention to the following: in irrigated agriculture, taking into account the slope levels and ground layer and reducing the water flow rate; digging trenches and drains for swamping and establishing long-rooted shrubs and perennial trees; to ensure a moderate number of livestock in the use of pasture landscapes.

**3. Moderately changed (Kasansay-Turakurgan and Rishtan, Chimyon, Avval, Arsif) region** of hill landscapes of the Fergana Valley include the central areas of the northern and southern parts of the valley. The area of anthropogenic landscapes is 60-70%. This region includes 15% of the total territory and stretches from south to north; because its northern and southern parts are connected to Chatkal and Alay mountains, tectonic movements are stronger. The rocks forming the area are made of Quaternary deposits, and the depressions of the hill range are made of Meso-Cenozoic rocks. Sedimentary rocks make up the lithological composition. They are the product of running water. In terms of relief structure, Kasansay-Turakurgan and Rishtan, Chimyon, Avval, Arsif hilly landscapes are areas of average height within the region, with an average slope (3-7°). This accelerates the process of erosion in irrigated agricultural fields in the region. Their height is from 500-600 m to 1100 m above sea level. The sum of positive temperatures is 4200-4300 °C, the amount of annual precipitation is 200-250 mm. Rivers and streams have dissected the hilly landscapes, and they have undergone severe fragmentation. Kasansay-Turakurgan hill landscapes are irrigated by Kasansay stream and Kukumbay, Rishtan, Chimyon, Avval, Arsif hill landscapes with water from Shakhimardansay, Altariksay and artificial irrigation facilities. Groundwater is located at a depth of 2-5 m. The soil layers are composed of loess rocks mixed with sand and stone. In the cultivated lands, pale and typical gray soils are scattered. The proximity of the soil layer to the surface of the earth has a significant negative effect on soil fertility. Anthropogenic landscapes are moderately and weakly cultivated, weakly washed.

The factors that create geographical conditions are mainly inland waters, relief and anthropogenic influence. All these factors created cultural landscapes as well as degraded landscapes in the Kasansay-Turakurgan and Rishtan, Chimyon, Avval, Arsif mountain landscapes.

To prevent these problems and to use them effectively, to take into account the slope levels of the land and the soil layer when placing agricultural crops; instead of opening new lands, attention should be paid to activities such as efficient use of existing lands.

**4. Strongly changed (Asaka, Bulakbashi, Kurgantepa, Khodjaabad and Uychi-Chartak) region** occupied the eastern regions of the hilly landscapes of the Fergana Valley in the northeastern part of Namangan region and the southeastern part of Andijan region. The area of anthropogenic landscapes reaches 70-80%. This region includes 24% of the total hills and stretches from south to north and northeast. Tectonic movements are slow, but often repeated.

According to the lithological composition of the hilly landscapes of the Fergana Valley, sedimentary rocks of the Quaternary period are widespread. The depressions located between hilly landscapes are composed of Meso-Cenozoic rocks. They are the product of running water. In terms of geomorphological structure, the hilly landscapes of Asaka, Bulakbashi, Kurgantepa, Khodjaabad and Uychi-Chartak are the highest regions among the hilly landscapes of the Fergana Valley. Their height from sea level is from 750 m to 1100 m.

The degree of slope is a large slope (more than  $7^\circ$ ). The sum of positive temperatures is 4200-4300 °C, the amount of annual precipitation is 200-300 mm. As a result of the activity of running water, they were separated from each other and were strongly disintegrated. Hilly landscapes of Asaka, Bulakbashi, Kurgantepa, Khodjaabad and Uychi-Chartak are irrigated with the waters of streams such as Shakhimardansay, Altariksay and Chartaksay, Padshaatasay, Chinach, Namangansay and channels and reservoirs are also important in the irrigation of agro-landscapes. The strong development of irrigated agriculture and the location of the impermeable layer on the surface created geological cracks, ravines, funnels, landslides, suffocation folds in the zone of hilly landscapes of Asaka, Bulakbashi, Kurgantepa, Khodjaabad and Uychi-Chartak. The soil layers are composed of loess-like rocks mixed with sandstone. In the cultivated lands, pale and typical gray soils are scattered. Saline and saline soils also occupy large areas. The proximity of the soil layer to the surface of the earth has a negative effect on soil fertility. Anthropogenic landscapes are moderately and weakly cultivated, weakly washed and salted. The territory is strongly changed.

The factors that create the geographical conditions are mainly internal waters, relief and anthropogenic influence. All of these factors caused eruptions, suffocation phenomena, cracks, erosion and salinization processes in the hill landscapes of Asaka, Bulakbashi, Kurgantepa, Khodjaabad and Uychi-Chartak. In order to prevent and effectively use these problems, it is necessary to pay attention to the following measures: selective placement of land and taking into account the soil layer in the organization of irrigated agricultural areas and crops that require a lot of water, organization of drip irrigation, control of the constant technical condition of irrigation sources.

**5. The extremely changed (hill slope plains) region** occupies the northern part of the Syr Darya and Big Namangan channels in the Namangan region, the south of the hilly landscapes of the region, the north of the hilly landscapes in Andijan and Fergana, and the hilly landscapes from the southwest to the northeast occupied the areas of the hilly front slope plains includes. The area of anthropogenic landscapes in them is 80-90%.

This region includes 12% of the total hilly landscapes, and it is spread over all hilly land areas. Tectonic movements in these areas are very slow compared to other parts of the valley. The rocks forming the pre-slope plains of hilly landscapes consist of Quaternary deposits. According to the lithological composition of this region, sedimentary rocks are considered. In terms of relief structure, the front slope of the hill is the lowest part of the territory. It is 450-550 m above sea level. The degree of slope is a weak slope ( $0,3-1^\circ$ ). The sum of positive temperatures is 4700-4900 °C, the amount of annual precipitation is 100-200 mm. As a result of the action of running water, they were separated from each other and suffered weak decomposition. The front slope plains of hills are Andijansay in Andijan, Shakhrikhansay, Katartal channel, Big Fergana channel named after U.Yusupov, Sarijida channel, Isfayramsay in Fergana, Fayziabadsay, Altariksay, Dekhkanabad channel, Southern Fergana channel, Sokh, Kokandsay channel, Avganbag channel, Yanginayman channel, Tomosha channel, Chadaksay, Gavasay, Sumsarsay, Kasansay, Namangansay, Big Namangan channel, Northern Fergana channel are irrigated. Groundwater is located at a depth of 0.5-1 m, but in large areas of the front slopes of the hills, the level of groundwater is close to the surface and the rising level is expanding the scope of salt marshes and marshes. The soil layers are composed of loess rocks mixed with sand and stone. The region is fully developed and strongly attracted to human economic activities. Degraded terrain and landscape, saline soils occupied large areas along the settlement landscapes. The proximity of the soil layer to the surface of the earth also has a negative effect on soil fertility. This area has changed very strongly.

The factors that create geographical conditions are mainly climate, internal waters, relief and economic activities of people. All these factors have resulted in salinization processes, anthropogenic influence on the hill slopes and degraded landscape and reliefs. In their prevention and effective use, it is necessary to pay attention to the following: it is

necessary to pay attention to farming in compliance with agrotechnical rules and to the degrees of slope of the land, the laying of the ground layer; it is necessary to carry out reclamation and reclamation works in disturbed landscapes.

**Conclusion.** The hilly landscapes of the Fergana Valley were evaluated and divided according to the changes caused by human activity: weakly changed, changed, moderately changed, strongly changed, extremely strongly changed, and recommendations were developed on the effective use of the nature of the regions.

A number of natural geographical principles and methods have been developed for the assessment of landscape-ecological conditions. Based on them, when assessing the ecological conditions of landscapes, its components are studied separately, and the assessment of all its parts is considered.

The hills of the Fergana Valley are characterized by the following: the natural state of the landscape, specific features of the geological and geomorphological structure, hydrothermal conditions, the degree of change in the soil and vegetation cover, human economic activity, the share and type of anthropogenic landscapes, the current state of the landscape-ecological condition, the main factors of the change in the landscape-ecological condition based on such principles as weakly changed, changed, moderately changed, strongly changed, very strongly changed state was evaluated.

The hills of the Fergana Valley were landscape-ecologically zoned. Zoning was carried out according to the degree of change in landscape-ecological conditions of the area.

According to landscape-ecological conditions, the hills were divided into weakly changed, changed, moderately, strongly and extremely strongly changed regions.

Landscape-ecological conditions in the weakly changed landscape-ecological region are mainly created by pasture livestock, climate, inland waters, relief.

In the changed landscape-ecological region, the landscape-ecological conditions are created by the economic activities of people, internal waters, relief.

Landscape-ecological conditions in the moderately changed landscape-ecological region are created by relief, climate and economic activities of people.

Landscape-ecological conditions of strongly changed landscape-ecological region are caused by anthropogenic influence and inland waters, waters mainly pasture livestock and climate, inland waters, terrain.

Economic activities of people, climate, inland waters, and terrain play a major role in the formation of landscape-ecological conditions in a strongly changed landscape-ecological region.

Anthropogenic landscapes are important in the formation of landscape-ecological conditions in the hills of Fergana Valley, they are unevenly distributed on the area and caused various ecological problems in the area. It is considered appropriate to follow scientifically based measures to prevent them.

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