

**Emergence Of Landscape-Ecological Situations In The Watersheds Of Northern Fergana**Otamirzaeva Mohigul Hakimjon kizi<sup>1</sup>, Mirzahmedov Ismoiljon Karimjon ugli<sup>2</sup><sup>1</sup> Department of Geography, Namangan State University, Namangan, 160107, Uzbekistan  
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**Abstract:** The Northern Fergana river basins under study are located in the territory of the Republics of Uzbekistan and Kyrgyzstan, and are part of Fergana valley. The territory of the Northern Fergana is provided with many rivers comparing to other parts of Fergana valley. These rivers are so important for economic and agricultural activities. Because of land use/land cover change, there is an ever-increasing impact on the environment. The present paper analyzes the landscape-ecological situations of the largest river basins of the Northern Fergana (basins of Pochchaotasoy, Kasansay, Gavasay rivers). For this purpose, land use land cover changes of watersheds were calculated. The results show that anthropogenic activities play an important role in forming landscape-ecological situations of the watersheds.

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**Keywords:** land use/land cover change, watershed, Northern Fergana, impervious surface.

**1. Introduction**

River basins are a source of fresh water as a huge reservoir. The importance of landscapes for the watersheds consists of water retention, infiltration, filtering, collecting natural clean water and providing hydrological balance of watershed. It has an important role in keeping the river's water flowing downstream, where countless communities rely on it for aid, irrigation and sanitation. Healthy watersheds serve as natural sponges, capturing precipitation and slowly releasing it into streams, lakes and rivers.

They provide a home to diverse species and play a key role in filtering clean water (Boyle, 2024). However, land use/land cover change (the reduction of permanent snow, glaciers and forests, the increase of agro-landscapes and urban landscapes) reduce the ability of watersheds to perform the above-mentioned functions, and accelerates soil erosion, increases muddy discharges and decreases water quality. In particular, the natural water regulation function of watershed is disrupted with loss of natural landscapes. If we look at the landscape ecological situations that arise in the watersheds of Northern Fergana, it is possible to observe that these situations are taking place in a specific direction in each landscape unit.

**2. Literature review.**

In Uzbekistan, these issues are currently being investigated by U. Umrzakova, E. Soliyev, K.Boymirzayev, O.Mirzamahmudov and others. A large number of theoretical papers propose various approaches to assessing landscape-ecological situations in the watersheds of Northern Fergana. Thus, at the regional level, for example, the works include issues of use and protection of water resources (Umrzakova, 2022); changes in the annual distribution of the hydrological regime of the rivers (Soliev, 2014); anthropogenic transformation of hilly landscapes (O.Mirzamahmudov, 2023).

**3. Materials and Methods.**

Remote sensing images (SRTM) and Arc GIS software were used watershed delineation of Northern Fergana. Analysis of land use/land cover change of the Northern Fergana watersheds between 2017-2023 were based on Sentinel-2 images (Figure 3). Also, the method of literature analysis was used for evaluating landscape-ecological situations based on the results of several research studies on Northern Fergana.

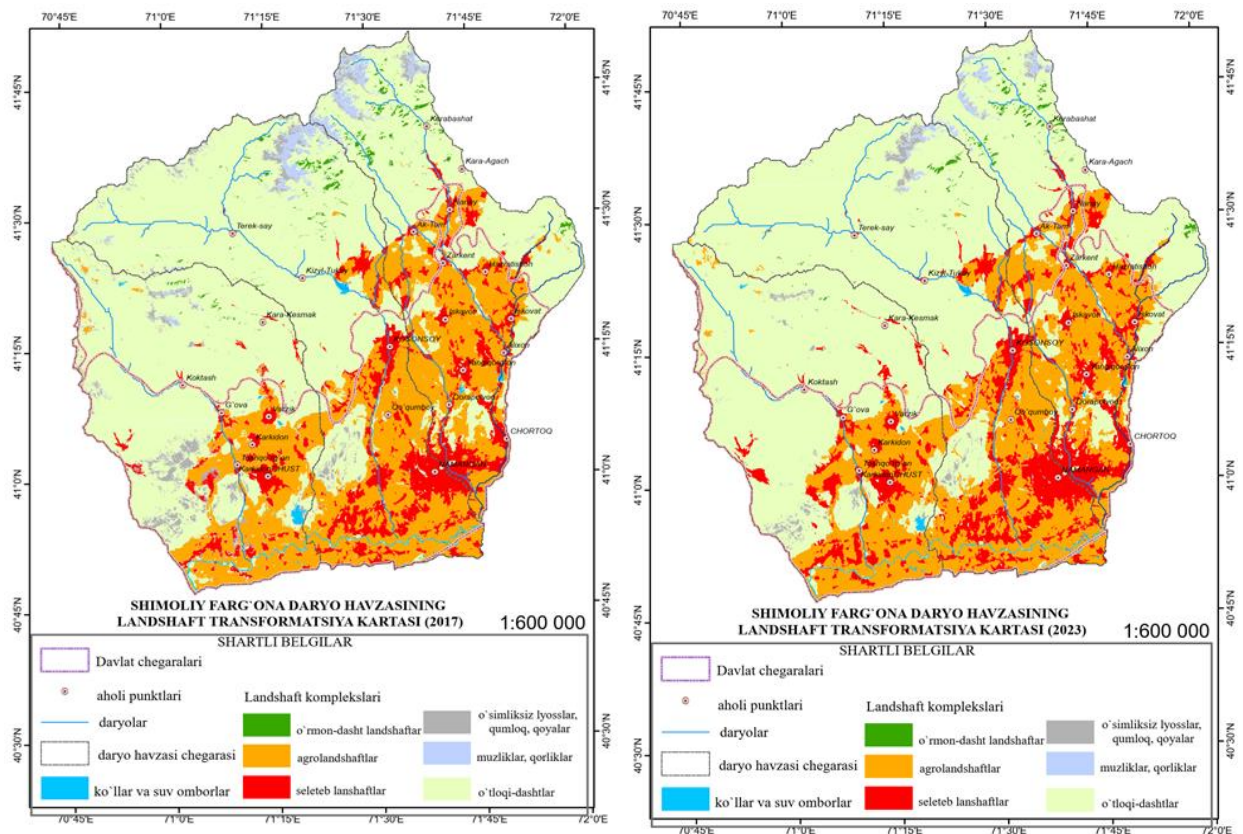


Figure - 3. Land use/land cover change of Northern Fergana between 2017-2023

#### 4. Analysis and results.

It was observed that the area of forest-steppe landscapes decreased in recent years (2017-2023) in all studied river basins. In particular, the highest rate of forest-steppe landscape reduction was 16.5 km<sup>2</sup> in the Kosonsoy river basin, 27.8 km<sup>2</sup> in the Pochchaotasoy river basin, and 12.7 km<sup>2</sup> in the Govasoy river basin. Decreasing the area of forests leads to a decrease in infiltration and evapotranspiration processes, and an increase in surface water flow. A decrease in natural infiltration reduces the filling of underground water reserves, surface runoff increases, soil moisture decreases, and as a result, the atmosphere receives less moisture. This increases the potential for drought and desertification. Deforestation in river basins significantly exacerbates water scarcity. Because fewer trees mean less moisture circulation in the atmosphere, which means less precipitation (Boyle 2024). As a result, changes in the hydrological regime of the rivers were observed. In Pochchaotasoy, the amount of flow has decreased in all months of the year. The main reason for this may be a decrease in the amount of precipitation in the river basin (Soliyev E 2014).

With the reduction of the area of forest-steppe landscapes in the river basins, it can be observed that the area of snow and glaciers in the river basins has also decreased. Because of this, forests regulate the temperature of the earth and protect against premature

melting of the snow cover. Removing tree cover exposes land to direct sunlight, increases the rate of snowmelt, and changes the timing and amount of water entering rivers. The largest decrease was 42.1 km<sup>2</sup> in the Kosonsoy river basin, 27.8 km<sup>2</sup> in the Pochchaotasoy river basin, and 12.7 km<sup>2</sup> in the Govasoy river basin, which had a direct correlation with the reduction of forest area.

Rangelands are semi-natural landscapes along with forest lands. However, as a result of excessive use of the foothills and dry steppes, they are being degraded. This degradation occurs in the form of the invasion of weeds and bushes that are not consumed by animals. It is known that the increase of bushes leads to a decrease in fodder for livestock. Also, increasing shrub dominance changes the hydrological cycle and the distribution of soil nutrients. As a result of human activity, the following factors cause the increase of bush plants:

- Overgrazing of livestock with grass reduces their ability to compete with invasive shrubs;
- Climate change (especially rainfall regime) favors the growth of shrubs rather than grasses;
- An increase in carbon dioxide (CO<sub>2</sub>) in the atmosphere increases the growth of cool-season shrubs compared to warm-season grasses (West, 2003).

In 2023, the area occupied by agricultural estates in the Kosonsoy river basin was 703.8 km<sup>2</sup>, which decreased by 4.8 km<sup>2</sup> compared to 2017. In the

Pochchaotasoy river basin, it was 665.2 km<sup>2</sup> and decreased to 40.5 km<sup>2</sup>. On the contrary, in the basin of the Govasoy river, it increased by 17 km<sup>2</sup> to 567.6 km<sup>2</sup>. The basis of land resources of Namangan region is the land used in agriculture. Horticulture, viticulture, vegetable growing, fodder crops and potato growing are highly developed in several farms in the studied river basins.

The possibilities of using land resources in the region are directly characterized by the growth of the population and the specifics of providing food products behind it. We can see that the area used for agriculture in the region has decreased by 8.3% in the next decade. The following are the main reasons for the reduction of arable land. In particular, factors such as the formation of housing and infrastructures for the population, the expansion of transport routes and production areas, the transfer of land from the state share to the population, the expansion of salinization land areas and in need of recultivation (Abdurahmonov, 2022).

Also, in the summer season, there is a shortage of water in the irrigated fields. In the Namangan region, the water supply deficit in summer is 0.9 km<sup>3</sup>, and in the year with average water, the water deficit is around 57-61 percent. Especially by the summer months, water scarcity reaches 85% (Baratov 2014).

It was observed that the area occupied by urban landscapes increased by 67.4 km<sup>2</sup> in 2023 compared to 2017, by 49.9 km<sup>2</sup> in the Kosonsoy river basin, and by 46 km<sup>2</sup> in the Pochchaotasoy river basin. The increase in the area of impervious surface which is the main feature of urban landscapes, is accompanied by the loss of natural landscapes, changes in water quality and hydrology. Residential construction or agriculture leads to increased water demand, increased potential impacts on water quality associated with wastewater discharges and surface runoff. Population growth increases the demand for infrastructure and encourages development, resulting in an increase in impervious surfaces. Urbanization processes replace natural land cover with roofs, asphalt or concrete pavements, and other hard, impermeable surfaces and change the local water balance.

The areas with impermeable hard cover have a significant impact on hydrological processes and microclimate. Such areas include features that prevent water from seeping into the ground and increase surface runoff. Imperviousness is the degree to which a land area is covered by roofs, asphalt or concrete pavements, and other hard, impermeable surfaces (Sanchez, 2012). Imperviousness can also exacerbate the "heat island" effect – a phenomenon where urban areas experience warmer temperatures than rural areas. Among the studied river basins of Northern Fergana, the largest impermeable layer belongs to the Kosonsoy river basin, occupying 12 % (or 127.6 sq km) of it. In the next places, 8 % (77.68 sq. km.) of the Pochchaotasoy river basin, and 3% (26.4 sq. km.) of

the Govasoy river basin were occupied by impervious cover.

In the research of T. Schueller (1994), rivers were divided into three classes based on the analysis of changes in the quality of river water with the increase of surface areas with impervious surface. In this case, if the areas with waterproof cover make up to 10 % of the river basin, such rivers are classified as stressed, rivers of the basin that reach 10-25 % are impacted, and if they exceed 25%, they are classified as degraded. Therefore, it can be said that the streams of the Kosonsoy river basin in impacted condition.

## 5. Conclusion/Recommendations.

In sum, the analysis land use/land cover change between 2017-2023 shows that the area of urban landscapes has increased in all river basins. The area of agro-landscapes increased in the basin of the Govasoy river, and on the contrary, it decreased in the basin of the Kosonsoy and Pochchaotasoy rivers. The reduction of forest-steppe landscapes in all river basins may have contributed to the reduction of their area due to the early melting of snow. Because the largest reduction of both landscape areas was observed in the basin of the Kosonsoy river, followed by the basin of the Pochchaotasoy and Govasoy rivers. Therefore, land use/land cover change of the Northern Fergana river basins leads to a decrease in the natural water regulation function of the landscapes.

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