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STUDY ON THE IMPACT OF ALTITUDINAL VARIATION ON THE FORMATION OF FLORA COMPOSITION IN THE FERGANA VALLEY

Rakhmatov Akhror Lutfidinovich
Namangan State University
PhD student, Department of Biology
E-mail: axror0908@mail.ru

Abstract: the thesis provides brief information about the geographical location, characteristics, and natural conditions of the Fergana Valley, highlighting that the altitudinal gradient is a key ecological factor determining plant community structure and species diversity.

Keywords: depression, floristic zonality, differentiation, altitude gradient, phytocoenosis, altitudinal zonation, flora zonality, xerophytes, mesophytes, geobotany, endemic species, relict species, psammophytes, ephemerals.

The Fergana Valley is a large intermountain depression located at the junction of Uzbekistan, Kyrgyzstan, and Tajikistan, surrounded by mountain ranges (Chatkal, Qurama, Alay, Fergana, and Turkestan ranges) from the north and south. In geography, a depression refers to a lowland, sunken area, or basin. In other words, it denotes a large hollow or valley located between mountain ranges. The Fergana Valley is, in fact, one of the largest intermountain basins of this type.

The variation in altitude from 300 m to about 4000 m causes floristic zonation. Each altitudinal belt is characterized by specific ecological conditions:

-Decrease in temperature
-Increase in precipitation
-Changes in soil moisture and type
-Intensity of solar radiation

As a result, unique plant species and phytocoenoses are formed within each altitudinal range.

The Fergana Valley, being one of the largest intermountain depressions in Central Asia, extends from about 300 m in the lowlands up to nearly 4000 m at the highest mountain peaks. Such an altitudinal gradient plays a crucial role in the distribution of plants and the formation of floristic composition. Each altitudinal zone has distinct climate, soil, moisture, and light conditions, leading to the ecological adaptation of plant species and the differentiation of phytocoenoses. Differentiation here means separation, stratification, and diversification. In phytocoenoses, this refers to differences in species composition and structure of plant communities. Thus, each altitudinal belt develops distinct plant communities shaped by its environmental conditions.

With increasing altitude, temperature decreases, precipitation increases, and the physical and chemical properties of soils change, resulting in floristic zonation and sub-zonation. In the lowland and foothill areas, desert-steppe and foothill vegetation dominate; in mid-altitudes, mountain meadows, shrublands, and forest-steppe formations appear; at higher elevations, subalpine and alpine meadows develop. Moreover, slope exposure also directly affects floral composition: southern slopes are dry and warm, dominated by xerophytes, while northern slopes are relatively moist and cool, rich in mesophytes.

Currently, climate change, anthropogenic pressure, and changes in natural landscapes significantly influence the dynamics of flora distribution along altitudinal zones. Therefore, studying flora diversity and composition along the altitudinal gradient in the Fergana Valley is important not only from a theoretical but also from a practical perspective.

Studying the distribution of flora across altitudinal gradients is one of the main directions of geobotany. Many studies confirm that the altitudinal gradient is a leading ecological factor determining plant community structure and species diversity (Körner, 2007; Sundqvist et al., 2013). Climate, soil, hydrology, and anthropogenic impacts are cited as the main reasons for floristic zonation along elevation (Rahbek, 2005).

In Central Asia, particularly in the mountainous and foothill regions of Uzbekistan, a number of studies have been conducted on altitudinal zonation. The works of E.P. Korovin (1934) and V.P. Drobov (1950) provide detailed descriptions of the floristic zonation and phytocoenotic structure of Central Asian flora. In recent years, the relationship between species diversity and ecosystem services in mountain ecosystems has also been widely studied (Pauli et al., 2012; Chen et al., 2015).

Species richness along elevation usually follows a hump-shaped curve, where the highest species diversity is found at mid-elevations (Rahbek, 1995). This is explained by optimal climatic conditions, resource availability, and balanced ecological interactions.

Due to the unique geological and climatic conditions of the Fergana Valley, its flora includes many endemic and relict species (Tojibaev et al., 2018). Relict species are plants or animals that were widespread in ancient geological periods but now survive only in limited areas. They are often considered "living witnesses" of ancient floras and faunas. For example, some plants that were widely distributed before the glacial period are now confined only to certain mountain ranges or depressions.

Thus, the study of flora composition along the altitudinal gradient provides a scientific basis for the conservation of biodiversity and the development of sustainable landscape management strategies in the region.

Conclusion. In the Fergana Valley, the composition and diversity of flora vary significantly along the altitudinal gradient. In the lowlands, drought-resistant psammophytes and ephemeral plants dominate; in mid-altitudes, semi-forests and shrublands develop; while in high elevations, subalpine and alpine meadows are typical. With increasing altitude, climatic conditions (decreasing temperature, increasing precipitation) and soil types change, resulting in vegetation zonation. Historically, ephemeral and ephemeroid associations covered much of the valley, but today almost all fertile lands have been converted for agriculture. Only mountain slopes and rocky areas still preserve natural flora. The findings provide scientific foundations for understanding ecological adaptation of plants, conserving biodiversity, and ensuring sustainable landscape management in the Fergana Valley.

REFERENCES

1. Korovin E.P. (1934). Flora i rastitel'nost' Sredney Azii. Tashkent: Izd-vo AN SSSR.
2. Drobov V.P. (1950). Ocherki po geobotanike Sredney Azii. Tashkent: Izd-vo AN UzSSR.
3. Rahbek C. (1995). The elevational gradient of species richness: a uniform pattern? Ecography, 18(2), 200–205. https://doi.org/10.1111/j.1600-0587.1995.tb00341.x
4. Rahbek C. (2005). The role of spatial scale and the perception of large-scale species–richness patterns. Ecology Letters, 8(2), 224–239. https://doi.org/10.1111/j.1461-0248.2004.00701.x
5. Körner C. (2007). The use of 'altitude' in ecological research. Trends in Ecology & Evolution, 22(11), 569–574. https://doi.org/10.1016/j.tree.2007.09.006
6. Sundqvist M.K., Sanders N.J., & Wardle D.A. (2013). Community and ecosystem responses to elevational gradients: Processes, mechanisms, and insights for global change. Ecology and Evolution, 3(16), 457–4585. https://doi.org/10.1002/ece3.782
7. Pauli H., Gottfried M., & Grabherr G. (2012). High mountain summits as sensitive indicators of climate change effects on vegetation patterns: The Global Observation Research Initiative in Alpine Environments (GLORIA). Global Change Biology, 18(2), 565–579. https://doi.org/10.1111/j.1365-2486.2011.02500.x
8. Chen I.C., Hill J.K., Ohlemüller R., Roy D.B., & Thomas C.D. (2015). Rapid range shifts of species associated with high levels of climate warming. Science, 333(6045), 1024–1026. https://doi.org/10.1126/science.1206432
9. Tojibaev K.Sh., Beshko N.Yu., Khassanov F.O., et al. (2018). Endemic flora of Uzbekistan: Distribution, conservation status and use. PhytoKeys, 109, 67–96. https://doi.org/10.3897/phytokeys.109.27706
10. Arifkhanova M.M. (1967). Rastitelnost' Ferganskoy doliny. Fan, Tashkent.
11. Bondarenko O.N. (1955). Rastitelnost' Namanganskoy oblasti i ee khozyaistvennoe znachenie. Dissertation, Tashkent.