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CHANGES IN THE DISTRIBUTION OF VEGETATION AND ITS RELATIONSHIP WITH SOIL FORMATION ON THE DRIED BOTTOM OF THE ARAL SEA

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Annotatsiya. *Орол денгизининг қуриш жараёни унинг турли қисмида турлича вақтда кечган бўлиб, бу ҳолат ҳудуднинг тупроқ-грунтлар ва ўсимлик қопламаси шаклланишига катта таъсир кўрсатган. Тадқиқот натижаларига кўра, денгиз тубининг шарқий қисмида қуриш жараёни эртароқ бошлангани сабабли тупроқ шаклланиши ва ўсимлик дунёси ривожланиши юқори даражада кечган. Бу ҳудудларда ўсимлик турлари сони кўп бўлиб, уларнинг проектив қоплам даражаси ҳам юқори кўрсаткичга эга. Ғарбий қисмида эса қуриш жараёни кеч бошлангани сабабли ўсимлик турлари кам ва проектив қоплам паст кўрсаткичда аниқланди. Шарқий қисмида Haloxylon ammodendron, Haloxylon persicum, Alhagi pseudalhagi, Calligonum acanthopterum, Tamarix hispida каби турлар устунлик қилса, ғарбий қисмида Halostachys caspica, Tamarix ramosissima, Aeluropus littoralis, Bassia hyssopifolia каби турлар кенг тарқалган. Ушбу натижалар Орол денгизининг қуриш босқичлари билан ўсимлик дунёси тарқалиши ўртасидаги узвий боғлиқликни тасдиқлайди.*

Аннотация. *Процесс высыхания Аральского моря происходил в разные периоды на различных его участках, что существенно повлияло на формирование почвенно-грунтовых условий и растительного покрова региона. Согласно результатам исследований, восточная часть дна моря начала высыхать раньше, вследствие чего процессы почвообразования и развития растительного мира здесь протекали активнее. В этих районах наблюдается большее разнообразие растительных видов и высокий показатель проективного покрытия. В западной части, где высыхание началось позднее, количество видов растений меньше, а степень покрытия низкая. Для восточной части характерно преобладание таких видов, как Haloxylon ammodendron, Haloxylon persicum, Alhagi pseudalhagi, Calligonum acanthopterum, Tamarix hispida, тогда как в западной части преобладают Halostachys caspica, Tamarix ramosissima, Aeluropus littoralis, Bassia hyssopifolia и другие. Полученные результаты подтверждают тесную взаимосвязь между этапами высыхания Аральского моря и распределением растительности.*

Abstract. *The drying process of the Aral Sea occurred at different times in its various parts, significantly influencing the formation of soil and vegetation cover. According to the research*

results, the eastern part of the former seabed began drying earlier, which led to a more advanced stage of soil formation and vegetation development. This area exhibits a greater diversity of plant species and a higher percentage of projective cover. In contrast, the western part, where desiccation started later, has fewer species and a lower vegetation cover. In the eastern area, dominant species include Haloxylon ammodendron, Haloxylon persicum, Alhagi pseudalhagi, Calligonum acanthopterum, and Tamarix hispida, whereas the western part is characterized by Halostachys caspica, Tamarix ramosissima, Aeluropus littoralis, and Bassia hyssopifolia. These findings confirm a strong relationship between the stages of the Aral Sea’s desiccation and the distribution patterns of its vegetation.

Keywords: *Aral Sea, soils, vegetation, projective cover degree, salinity.*

Introduction. The Aral Sea, located among the deserts of Central Asia, has dried and refilled several times over the past 10,000 years [Micklin, P. 2007]. The most recent desiccation of the Aral Sea, situated in Central Asia, began in 1960, and by now only about 10% of its water remains. As a result, approximately 5 million hectares of sandy areas have appeared on the dried seabed [Jabbarov, Z. et al., 2024; Mayar, M.A. et al., 2024; Su, Y. et al., 2021]. The drying of the Aral Sea is recognized as one of the world’s largest man-made environmental disasters [Waltham, T. et al., 2001]. The main cause of this desiccation was the rapid development of irrigation systems [Breckle, S.W. et al., 2012]. At present, 90% of the sea has already dried up, and scientific research is being conducted to restore the ecosystem. However, some proposals—such as transferring water from the Siberian rivers or the Caspian Sea—pose serious environmental risks and could cause new large-scale ecological problems [Badescu, V. et al., 2010]. Therefore, such measures are considered impractical [Aslanov, I. et al., 2024]. Scientists emphasize the need to resist traditional landscape preservation methods that merely aim to halt or reverse ecological degradation. Instead, a new paradigm of anthropogenic landscape design in the Aral region is proposed—not only to preserve what remains but also to ensure a meaningful adaptation to decline. This approach suggests that the aesthetics of designing anthropogenic landscapes should focus on reflecting the human impact on the land and mitigating the resulting ecological grief, where non-human elements and their agency play a vital role in overcoming environmental loss [Wong, E.O.L. 2024]. Environmental changes in the Aral Sea region cannot be attributed to a single factor; multiple interacting factors must be considered. There are indeed limiting factors that require significant investment to overcome, but doing so will contribute meaningfully to the long-term restoration of the area.

Materials and Methods. The study was conducted on the dried bottom of the Aral Sea, covering both its eastern and western parts. The distribution of vegetation was studied in accordance with the “Methodical Guidelines for Geobotanical Survey of Natural Forage Lands of Uzbekistan.”

Results and Discussion. The drying of the Aral Sea occurred at different times in different areas. The eastern part of the sea dried first, while the western part began drying approximately 30 years later and continues to desiccate to this day. Consequently, the soil-forming processes and vegetation development have occurred under distinct conditions, leading to differences in both soil composition and plant distribution. There is a significant difference between the eastern and western parts in terms of vegetation types and projective cover. The eastern part is characterized by a higher diversity of species and greater projective cover, whereas in the western part, the number of plant species and their cover degree are relatively low. This pattern is explained by the fact that soil formation began earlier in the eastern region, as desiccation there started first. According to the research results, the eastern part of the Aral Sea hosts species such as *Haloxylon ammodendron* (C.A.Mey.) Bunge ex Fenzl, *Alhagi pseudalhagi* (M.Bieb.) Desv. ex Wangerin, *Haloxylon persicum* Bunge, *Lepidium perfoliatum* L., *Calligonum acanthopterum* I.G.Borshch., *Ammodendron conollyi* Bunge ex Boiss., *Phragmites australis* (Cav.) Trin. ex Steud., *Astragalus villosissimus* Bunge, *Climacoptera lanata* (Pall.) Botsch., *Caroxylon scleranthum* (C.A.Mey.) Akhani & Roalson, *Bassia eriophora* (Schrad.) Asch., *Halostachys caspica* (M.Bieb.) C.A.Mey., *Tamarix hispida* Willd., *Climacoptera aralensis* (Iljin) Botsch., *Peganum harmala* L., *Suaeda microsperma* (C.A.Mey.) Fenzl, *Eremopyrum triticeum* (Gaertn.) Nevski, *Atriplex fominii* Iljin, *Ephedra strobilacea* Bunge, *Xylosalsola richteri* (Moq.) Akhani & Roalson, and *Stipagrostis karelinii* (Trin. & Rupr.) H.Scholz. In contrast, the western part contains *Halostachys caspica* (M.Bieb.) C.A.Mey., *Tamarix hispida* Willd., *Phragmites australis* (Cav.) Trin. ex Steud., *Aeluropus littoralis* (Gouan) Parl., *Alhagi pseudalhagi* (M. Bieb.) Desv. ex Wangerin, *Tamarix ramosissima* Ledeb., *Haloxylon ammodendron* (C.A.Mey.) Bunge ex Fenzl, *Climacoptera aralensis* (Iljin) Botsch., *Bassia hyssopifolia* (Pall.) Kuntze, *Haloxylon persicum* Bunge, and *Caroxylon scleranthum* (C.A.Mey.) Akhani & Roalson (Figures 1 and 2).

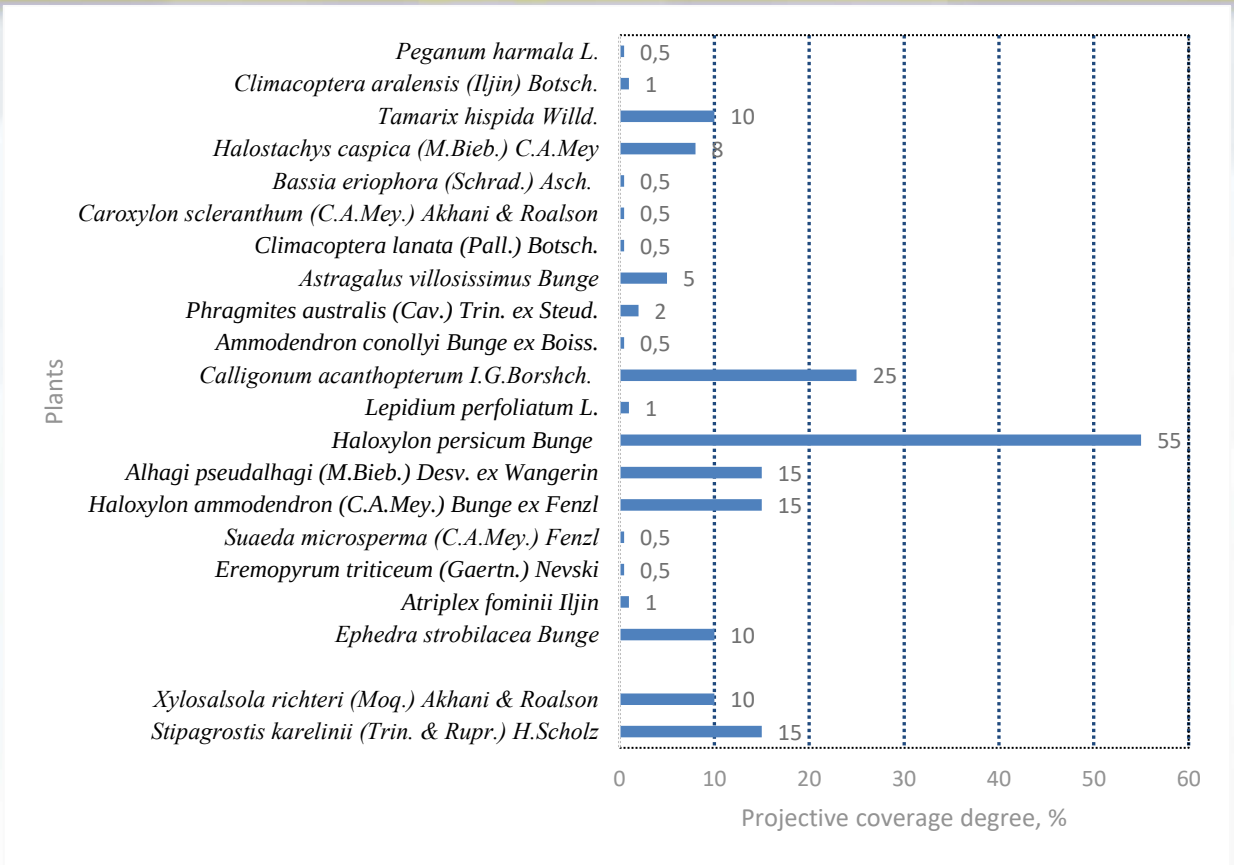

Figure 1. Plant species distributed in the eastern part of the dried Aral Sea bed and their projective coverage degree, %

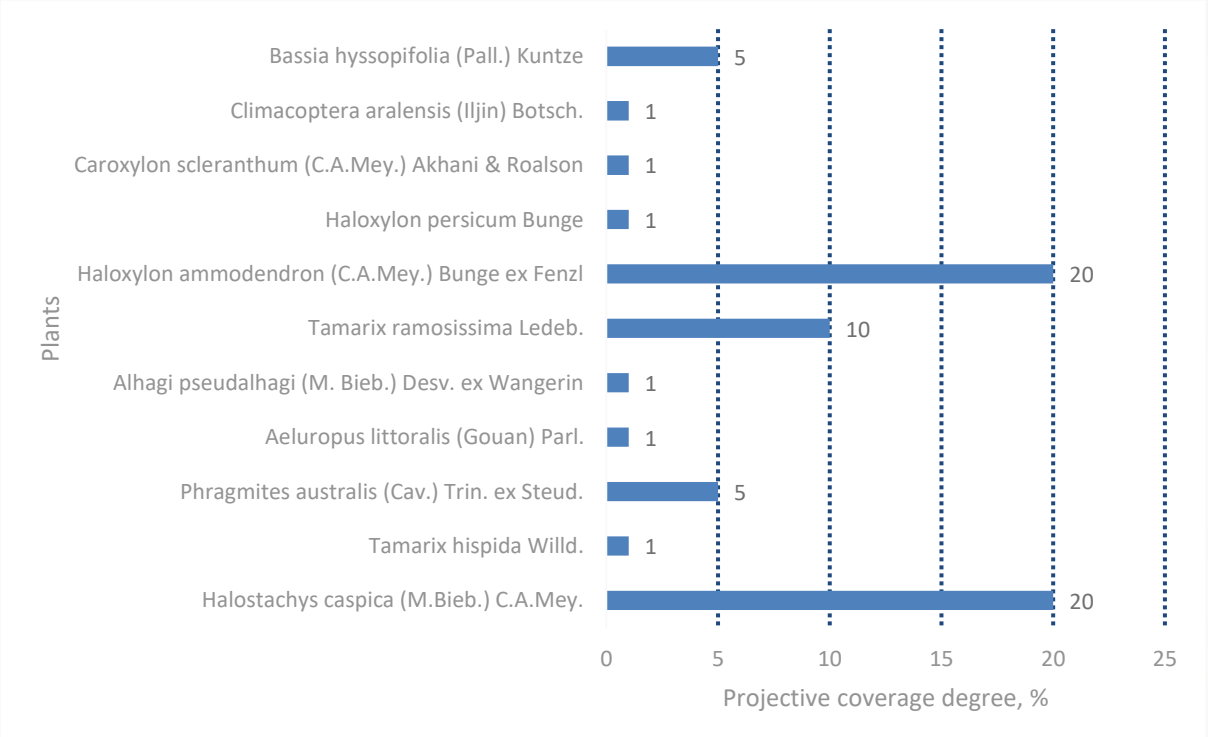

Figure 2. Plant species distributed in the western part of the dried Aral Sea bed and their projective coverage degree, %

From the figures above, it is evident that the composition of plant species and their projective coverage degree in the eastern and western parts of the dried Aral Sea bed differ significantly. This difference can be explained by the time of the Aral Sea’s desiccation and the properties of soil and ground materials.

Conclusion and recommendations. Due to the fact that the drying process of the Aral Sea occurred at different stages in its eastern and western regions, the development of vegetation also varies. In the eastern part, soil formation and plant community development are more active, resulting in a greater number of plant species and higher coverage degree. In the western part, since the drying began later, the number of plant species is lower, and the biological activity of the soil is weak. This condition is closely related to the age of the soil, moisture content, salinity level, and environmental factors.

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