PLANT GROWTH AND DEVELOPMENT IN SOILS AROUND THE SHURTAN OIL AND GAS PLANT

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Abstract. This article investigates the morphological and chemical properties of soils surrounding the Shurtan oil and gas plant (Kashkadarya region, Uzbekistan) and their impact on plant growth and development. The study revealed that soil salinity, compaction, and the accumulation of heavy metals negatively affect seed germination, biomass accumulation, and flowering phases of plants. The vegetation cover is dominated by desert-steppe species, although anthropogenic and ruderal weeds tolerant to industrial conditions are also spreading. The findings are essential for ecological monitoring and the development of bioremediation measures in industrially impacted regions.

Keywords: Shurtan plant, soil salinity, plant development, anthropogenic weeds, ecological monitoring.

Introduction. In arid regions of Uzbekistan, the natural balance of soil and vegetation is highly sensitive to anthropogenic factors. Industrial activities, particularly oil and gas production, alter the ecological equilibrium. The Shurtan oil and gas plant emits gases, dust, and chemical compounds during production processes, which affect soil morphology, chemical properties, and water regime, consequently suppressing plant growth and development.

The objective of this research is to assess plant growth processes in soils around the Shurtan plant, identify correlations with soil changes, and highlight potential ecological risks.

Methods. The study was conducted in 2024 at five monitoring points around the Shurtan plant (500 m, 1 km, 2 km, 5 km, and 10 km as control).

Soil analysis included: Salinity (EC, dS/m), pH, bulk density, humus content.

Heavy metal concentrations (Pb, Cd, Ni, Cu). Plant analysis included: Germination percentage (%).

- Growth rate (plant height and biomass).
- Phenological phases (flowering and fruiting delays in days).
- Vegetation cover percentage using transect methods.

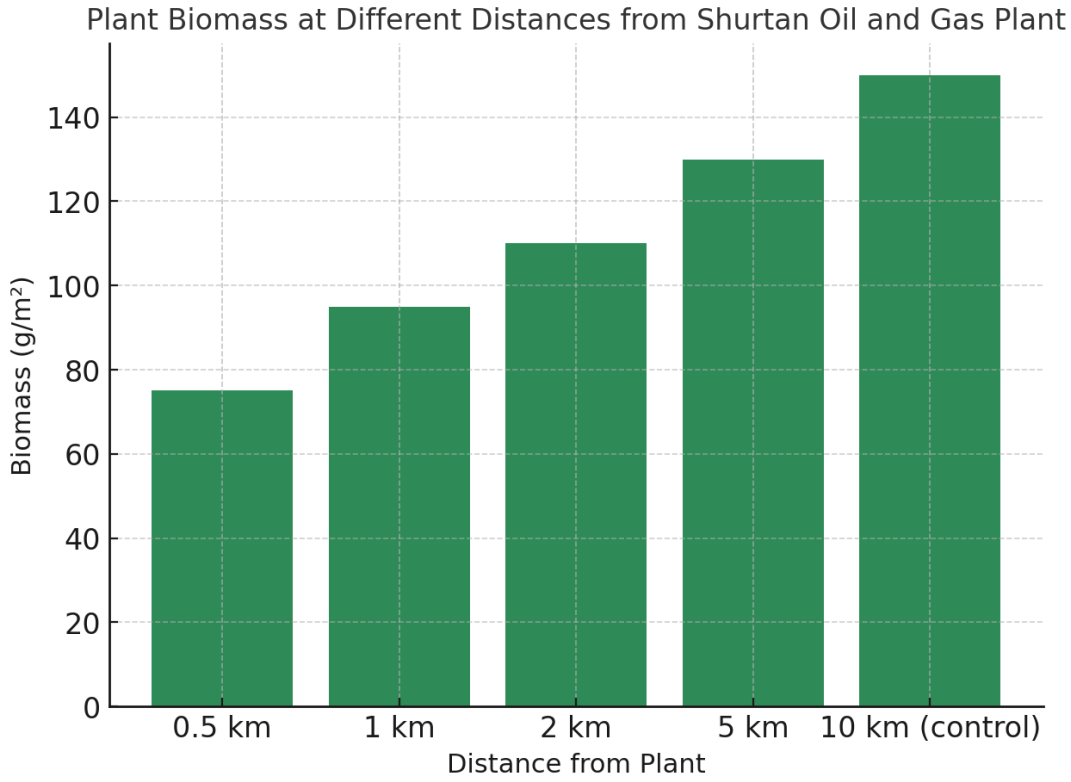
Seed germination

- At 0.5 km, germination was 52%, compared to 83% at the control site.
- High soil salinity resulted in early seedling mortality.

Plant biomass and height

- Average plant height at 2 km was 18 cm, while in the control area it reached 32 cm.
- Biomass (dry matter) was 75 g/m² at 0.5 km and 150 g/m² at the control site.

Phenological development



- Flowering was delayed by 10–12 days near the plant compared to the control.
- Sensitive species such as Haloxylon aphyllum failed to flower in the most affected zones.

Vegetation composition

- Dominant species: Artemisia diffusa, Salsola arbuscula, Poa bulbosa.
- Ruderal and anthropogenic weeds: Amaranthus retroflexus, Chenopodium album.
- Key desert ecosystem species such as Haloxylon and Calligonum were declining.

Discussion. The results demonstrate that soil salinity and chemical contamination around the Shurtan plant significantly hinder plant growth and development. Reduced seed germination, lower biomass accumulation, and delayed phenological stages were observed. The degradation of natural desert-steppe phytocenoses is evident, with ruderal weeds replacing sensitive native species. This trend undermines ecosystem stability. Similar ecological challenges have been reported near other industrial complexes in Uzbekistan (e.g., Mubarek gas processing plant, Navoi mining complex), emphasizing the necessity of nationwide ecological monitoring

Conclusion Soil salinity and elevated heavy metal concentrations near the Shurtan plant negatively affect plant growth and development. Plant biomass and height significantly decrease with proximity to the plant. Flowering is delayed, and sensitive species fail to reproduce. Desert-steppe species are declining, while ruderal weeds are spreading. Phytomelioration and bioremediation, including reintroduction of Haloxylon and other desert-adapted species, are required to restore ecological balance.

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