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Soil Algoflora And Salinity-Sensitive Seasonal Monitoring in Irrigated Soils of Yozyovon District, Uzbekistan: Quantitative Re-Analysis of Regional Evidence

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Abstract: Soil phototrophic microorganisms represent a poorly quantified but ecologically relevant component of irrigated soils in the dry continental landscapes of Central Asia. This study examines how documented soil chemical heterogeneity and a regional algal inventory can guide a reproducible monitoring strategy for Yozyovon district, Fergana Region, Uzbekistan. We performed a transparent secondary analysis of published topsoil measurements from six Yozyovon profiles and of the 159 species and infraspecific taxa reported for five soil types across the wider Fergana Valley. The published district profiles include four meadow-saz and two meadow-takyr soils, divided evenly between old and recently irrigated categories. Surface organic carbon spans 0.44–0.81% and surface pH spans 7.01–7.30 in those profiles. In the historical valley-wide algal list, Cyanophyta accounts for 63 taxa (39.6%) and Chlorophyta for 56 (35.2%); the two groups collectively represent 74.8% of the taxonomic list, not biological abundance. Regional soil-type richness ranges from 63 to 109 reported taxa, demonstrating the need to account for edaphic strata. Because available Yozyovon profiles lack paired algal counts and sampling dates, seasonal changes, local taxa and soil–algae correlation coefficients are not asserted. Instead, this paper integrates verifiable secondary statistics with a replicable scheme linking season, time since irrigation, salinity, soil chemistry and taxonomic observations. The results provide a quantitative environmental baseline and explicit hypotheses for future district-level algological fieldwork.

Keywords: Soil algae; Cyanobacteria; algoflora; Yozyovon district; irrigated soils; salinity; secondary quantitative analysis; seasonal monitoring.

1. Introduction: Soil algoflora comprises a diverse set of oxygenic phototrophs, including eukaryotic microalgae and cyanobacteria, that occupy illuminated surface layers, moist aggregates and other microhabitats. Although their biomass is often less conspicuous than that of vascular plants or larger microbial groups, soil phototrophs participate in carbon assimilation, the production of extracellular compounds and diverse interactions with bacteria, fungi and roots. These processes have renewed interest in terrestrial algal assemblages as potential indicators of soil ecological functioning (Abinandan et al., 2019; Joseph & Ray, 2024). The organisms are taxonomically heterogeneous: cyanobacteria are

prokaryotes, whereas the term microalgae covers several unrelated eukaryotic lineages. Consequently, a list of species should not be treated as a direct measure of nitrogen fixation, crop nutrition or aggregate stability.

In irrigated environments the water balance is created jointly by regional weather, groundwater exchange and agricultural management. An algal population sampled immediately after irrigation may have substantially different hydration and light exposure than a population sampled several days later in the same field. A comparison labelled solely as 'spring versus summer' can therefore confound seasonality with the interval since wetting, crop development, soil preparation and fertilizer application. This distinction is particularly important in dry regions where rapid evaporation and salt redistribution can produce highly variable near-surface conditions. Proper ecological attribution requires measured environmental covariates rather than assuming that a calendar season is a sufficient explanatory variable. Yozyovon district occupies part of Central Fergana, a landscape strongly modified by irrigation and drainage. A geographically explicit study by Turdaliev et al. (2023) analysed old and recently irrigated meadow-saz and meadow-takyr soils situated in the district. Its findings document heterogeneity in topsoil acidity, carbon, nutrient contents and salinity. This is valuable contextual information for soil biology, because the physiological performance of terrestrial algae depends on moisture, ionic composition and the stability of their surface microhabitats. Importantly, the published soil chemical profiles were not accompanied by a corresponding species-by-sample matrix of algae. They establish the environmental setting, not the algofloristic diversity of the six fields.

In the wider Fergana Valley, a botanical dissertation by Tukhtaboeva (2019) documented 159 taxa across five principal soil types and summarized their distribution by major divisions and growth forms. The survey presents an informative regional benchmark for potential taxonomic search effort, but its numerical totals cannot be transferred unchanged to the irrigated meadow soils of Yozyovon. In particular, light-gray, typical-gray and brown soil classes from a regional compilation should not be relabelled as the local meadow-saz and meadow-takyr profiles. The sampling frame, local management and historical taxonomic conventions differ. Explicit separation of these scales is necessary to prevent a seemingly precise but scientifically unsupported district estimate.

Recent international reviews provide biological arguments for linking soil microalgae and cyanobacteria to aggregate stability, extracellular polymer production, biological nitrogen turnover and crop-related processes (Ramakrishnan et al., 2023; Rossi et al., 2022). However, the reviews also describe context dependence and limitations in transferring the benefits of inoculated organisms to cultivated fields. A cyanobacterial taxon recorded in soil is not automatically fixing nitrogen under the relevant field conditions, and an inferred soil health benefit cannot be established without a measured response variable. Such reservations are especially relevant when the proposed output is intended to support environmental monitoring or land management.

The present work was designed as an evidence-based quantitative re-analysis and methodology paper rather than as a report of new microbial collections. Specifically, it aims to characterize the documented topsoil range in six Yozyovon profiles; recalculate the composition and between-soil richness contrasts of the published regional algoflora; describe why cross-source data cannot identify local seasonal effects; and formulate a district-specific, seasonally repeated, salinity-sensitive protocol for acquiring the missing paired biological and physicochemical measurements. The contribution is a reproducible monitoring design grounded in numerical evidence, with a transparent boundary between findings already published and results that remain to be experimentally established.

2. METHODS

2.1. Study setting, source selection and evidence hierarchy

The geographical focus is the irrigated agricultural area of Yozyovon district in Fergana Region. To avoid mixing independently acquired datasets, the evidence was organised into three tiers. Tier A comprises published district-specific soil profiles that include their location, soil class, irrigation history and laboratory measurements. Tier B comprises an algal inventory gathered over the broader Fergana Valley, for which group counts and soil-type summaries are explicitly published. Tier C comprises peer-reviewed physiological and ecological reviews used exclusively to develop hypotheses about mechanisms and sampling design. These tiers contribute different information; they are not treated as observations from the same samples.

The district-specific Tier A material was taken from the peer-reviewed study of Turdaliev et al. (2023), which investigated six soil sections numbered 1, 12, 20, 24, 28 and 35. According to the study's materials section, sections 1 and 24 were meadow-takyr, while sections 12, 20, 28 and 35 were meadow-saz. Sections 1, 12 and 28 were described as old irrigated, and sections 20, 24 and 35 as recently irrigated. We transcribed the measurements for the uppermost published sampled

horizon of each profile, acknowledging that the upper horizon thickness differs among profiles. Thus, surface comparisons refer to reported horizons (approximately 0–28 to 0–35 cm), not a perfectly harmonized fixed depth interval.

For Tier B we used the freely accessible dissertation abstract of Tukhtaboeva (2019). The numerical transcription comprised 159 species and infraspecific taxa distributed among six historical divisions: Cyanophyta, Euglenophyta, Cryptophyta, Bacillariophyta, Xanthophyta and Chlorophyta. The five regional soil categories and corresponding taxon counts were retained exactly as published. Older division names were kept in the numerical figures to ensure exact reproduction of the source categories; current taxonomy would require name-by-name reconciliation before establishing a modern district catalogue. A later repository item co-authored by Askarov and Djorabayeva (2025) was consulted as contextual authorship information, not as proof that unpublished Yozyovon specimens were collected.

The chronological scopes are not identical: the local soil chemistry and the regional algal inventories were produced by different research projects. No temporal pairing, soil-to-algae joins or implied experimental replication was attempted. Likewise, ecological literature on dryland biological soil crusts was used as mechanistic background, not as direct evidence that crusts were sampled in the irrigated plots. All numerical tables below identify the original published source and the specific level of inference to which the values apply.

Table 1. Published Yozyovon soil-profile strata

Profile	Irrigation	Soil class	Surface horizon (cm)
1	Old	Meadow-takyr	0–29
12	Old	Meadow-saz	0–28
20	Recent	Meadow-saz	0–30
24	Recent	Meadow-takyr	0–30
28	Old	Meadow-saz	0–35
35	Recent	Meadow-saz	0–30

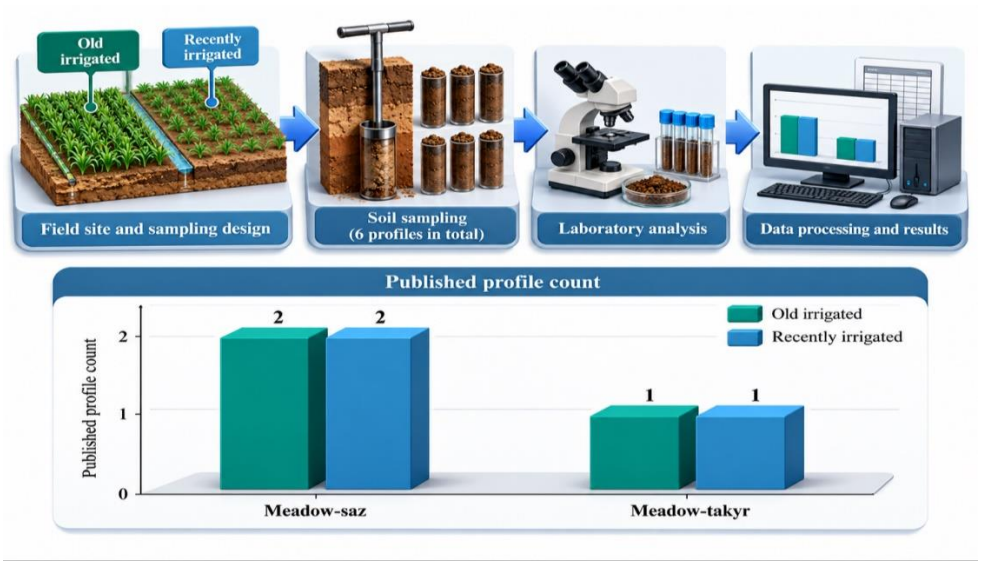


Figure 1. Published soil-profile sample composition (n = 6); bars are counts of reported soil pits rather than areal estimates.

2.2. Data extraction, numerical transformations and reproducibility

For each published topsoil horizon we entered profile identifier, irrigation class, soil class, pH measured in water, total organic carbon (TOC, percent), and plant-available phosphorus (mg kg−1). The resulting six rows are reproduced in Table 2. Numerical quality control consisted of matching the transcribed values against the published Table 1 and checking that each profile appeared exactly once. Means were calculated as the arithmetic sum divided by n = 6, and ranges were expressed as the observed maximum minus minimum. The sample standard deviation, when reported, is defined as the square root of the sum of squared deviations divided by n − 1. This is a description of six published soil profiles, not an estimate of the district population without a probability-based sampling frame.

Taxonomic proportions were recalculated as 100 × n_j / 159, with the denominator set to the total number of

species and infraspecific taxa in the original regional inventory. Shares describe representation in the compiled list, not relative cell abundance or biomass. To compare soil types in the regional record, we reported absolute contrasts in richness and simple ratios between the largest and smallest counts. No significance tests were applied to these five aggregate counts, because the numbers are not replicated independent field measurements with known effort. No Shannon–Wiener diversity index was estimated from division-level totals: such a calculation would quantify the balance among broad taxonomic labels, not within-field species diversity.

A major design constraint concerns inference. The joint distribution required to estimate algal sensitivity to salinity, r(EC, algal abundance), is unavailable: the district soil dataset does not contain algae and the regional algal table does not provide matching Yozyovon EC observations. Any numerical correlation would be artificial. This limitation applies even where ecological hypotheses are highly plausible. In the proposed field protocol, a correlation can only be calculated after the response and predictors have been measured on the same spatiotemporal unit.

Figures were produced from source-labelled numeric arrays using computer-based plotting. Values in the regional graphics can be recalculated directly from the printed tables and have no additional unpublished sampling provenance. Conceptual flowcharts are clearly designated as proposed monitoring designs. We intentionally omit simulated observation points, hypothetical p-values and unverifiable sampling dates. These decisions preserve the scientific difference between quantitative secondary analysis and original field experiment.

Table 2. Original published topsoil measurements for six Yozyovon profiles

Profile	pH (H_2O)	TOC (%)	Available P (mg kg−1)	Irrigation
1	7.01	0.66	19.6	Old
12	7.10	0.69	20.1	Old
20	7.30	0.48	17.8	Recent
24	7.10	0.44	17.0	Recent
28	7.10	0.81	20.7	Old
35	7.20	0.55	17.1	Recent



Figure 2. Two published soil indicators arranged on separate scales; each bar/point belongs to a documented Yozyovon soil profile.

2.3. Protocol proposed for detecting genuine seasonal patterns

A subsequent original survey should sample independently selected irrigated fields across validated soil classes and measured salinity strata. At least three seasonal visits (spring, summer, autumn) are conceptually appropriate, but greater temporal resolution is preferable because wetting events may trigger short-lived responses. Sampling should be timed with respect to irrigation, and each record should contain both the calendar date and days since the most recent irrigation. The upper 0–5 cm should be sampled for illuminated algal communities, alongside a separate deeper interval if vertical distribution is of interest; any deviation from these depths must be documented to

preserve comparability.

Biological measurements should distinguish incidence of taxa from cell density, biomass and pigment content. Morphological microscopy can provide taxon identification and cell counts, supported where possible by voucher photographs and culture verification. Molecular approaches may supplement classification but require methodological standardization and attention to primer bias. Physicochemical analyses should include gravimetric water content, pH, electrical conductivity with a stated extraction ratio, soluble ion composition when feasible, carbon and nitrogen contents, texture and plant-available nutrients. Crop cover, tillage, fertilizer history, groundwater depth and weed-control operations are relevant recorded covariates.

Repeated sampling produces a hierarchical dataset: subsamples nested within plot, plots within field, and visits within season or irrigation phase. Treating every microscope field or subsample as an independent experimental unit would inflate degrees of freedom and overstate significance. For richness or cell count outcomes, a mixed-effects count model or an appropriate zero-inflated alternative could include field-level random effects after inspecting dispersion. Community composition can be evaluated with ordination and permutation procedures respecting repeated measurements. Prespecified contrasts and uncertainty intervals are preferable to exploratory screening of many soil variables.



Figure 3. Prospective scheme for seasonally repeated paired soil and algoflora observations; no stages represent completed sampling in this manuscript.

3. RESULTS

3.1. Documented surface physicochemical heterogeneity

The six published Yozyovon surface horizons display a TOC minimum of 0.44% (profile 24) and maximum of 0.81% (profile 28), a spread of 0.37 percentage points. Their arithmetic mean is 0.605%. The pH values range from 7.01 in profile 1 to 7.30 in profile 20, with a mean of approximately 7.135. Available phosphorus ranges from 17.0 to 20.7 mg kg−1 (mean approximately 18.72 mg kg−1). These are transparent computations from a published soil table, not the outcome of new laboratory analysis. The variation reinforces why a seasonal microbial comparison must measure local edaphic conditions rather than assigning a single district-wide value.

The lowest carbon content among the six selected upper horizons occurred in a recently irrigated meadow-takyr profile, while the highest occurred in an old-irrigated meadow-saz profile. However, only one or two fields represent several combinations of class and irrigation age. The apparent pattern could reflect soil formation, drainage, management history, inherent parent material or unobserved field factors. Neither a controlled irrigation-age effect nor an influence of carbon on algae can be identified. Figure 4 shows the scatter of the six published pH and TOC pairs solely to visualize heterogeneity.

The reported salinity information in Turdaliev et al. (2023) emphasizes chloride–sulfate chemistry and depth-dependent accumulation in irrigated soils. This finding gives electrical conductivity, soluble chloride, sulfate and gypsum an explicit role in future algological monitoring. Salt transport is spatially and temporally heterogeneous, especially where groundwater, irrigation water and evaporation jointly influence the near-surface soil solution. The algal physiological response to any single 'salinity level' therefore cannot be inferred without recording the time of sample collection, the extraction protocol used for salinity testing and the actual species present.

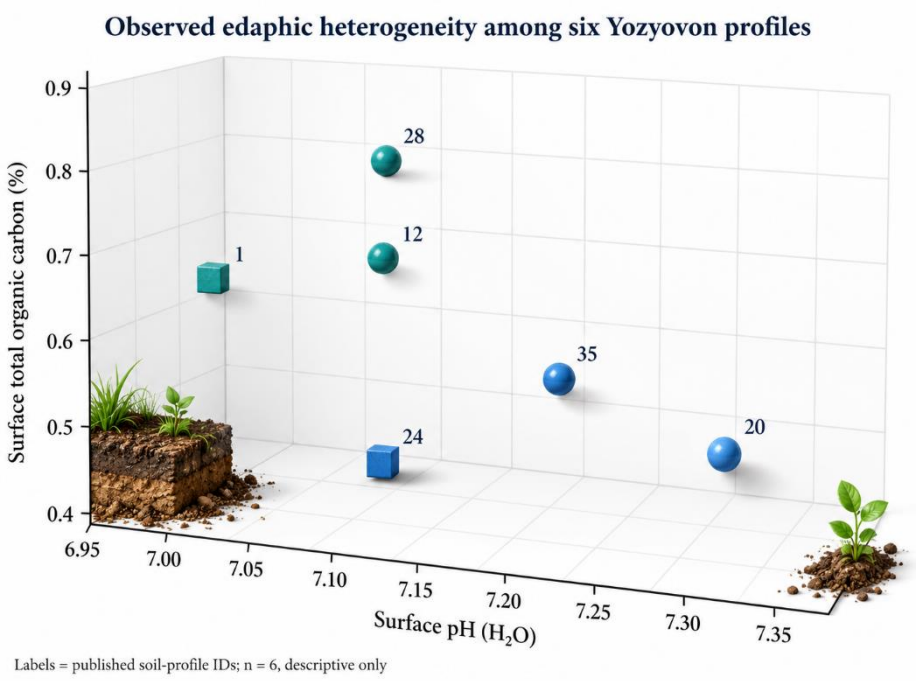


Figure 4. Six published Yozyovon pH–TOC pairs, identified by original profile number; descriptive plot, with no fitted regression or algal response data.

Table 3. Recalculated descriptive statistics for six published Yozyovon surface horizons; not district population estimates.

Soil indicator	Mean	Minimum	Maximum	Range
pH (H_2O)	7.135	7.01	7.30	0.29
TOC (%)	0.605	0.44	0.81	0.37
Available P (mg kg−1)	18.72	17.0	20.7	3.7

3.2. Re-analysis of the Fergana Valley algoflora baseline

The regional taxonomic list comprises 159 species and infraspecific taxa distributed among the six historical divisions. Cyanophyta contributes 63 taxa, corresponding to 39.62% of the regional total; Chlorophyta contributes 56 (35.22%); Xanthophyta 19 (11.95%); Bacillariophyta 17 (10.69%); Euglenophyta 3 (1.89%); and Cryptophyta 1 (0.63%). Cyanophyta and Chlorophyta collectively account for 119 of 159 reported taxa, or 74.84%. These quantities indicate concentration of the taxonomic list in two broad groups, not dominance of either group in soil biomass or photosynthetic activity.

The historical classification requires care in modern comparisons. In contemporary terminology many taxa historically reported as Cyanophyta are treated as cyanobacteria, a bacterial lineage. Both phylogenetic revision and changes in species concepts may alter counts when older records are reconciled. For this reason, retaining original labels is justified when recalculating source-derived proportions, while newly identified specimens should receive current accepted names and associated synonym information. Combining lists without synonym checking could create false gains in richness that are actually nomenclatural changes.

The six-group composition is plotted in Figure 5. The distribution illustrates a practical identification consequence: a prospective Yozyovon laboratory needs procedures appropriate to filamentous and coccoid cyanobacteria, chlorophytes and diatoms, rather than relying on a single culture or microscopic preparation. Yet the regional inventory was not sampled from the six Yozyovon soil profiles and cannot show which species were actually present there. It is consequently a regional reference pool, not a site-level inventory.

Table 4. Recalculated regional taxonomic composition; NOT an inventory from Yozyovon.

Reported division	Taxa	Share (%)
Cyanophyta	63	39.62
Euglenophyta	3	1.89
Cryptophyta	1	0.63
Bacillariophyta	17	10.69
Xanthophyta	19	11.95
Chlorophyta	56	35.22
Total	159	100.00

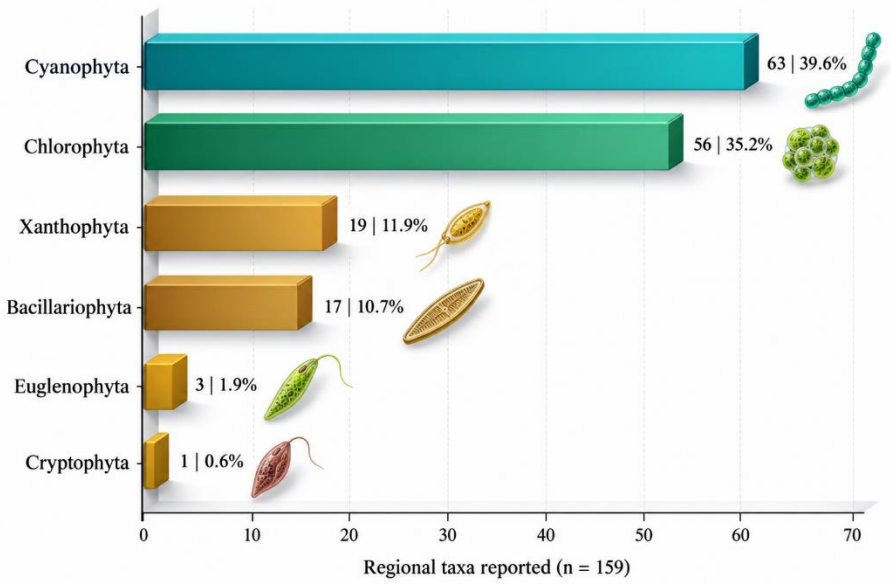


Figure 5. Taxonomic list proportions calculated from 159 valley-wide reported taxa.

3.3. Regional richness contrasts and their geographic limitations

The five soil-type lists in Tukhtaboeva (2019) include 63 taxa for light-gray soils, 67 for typical-gray soils, 104 for dark-gray soils, 108 for typical-brown soils and 109 for light-brown soils. Their maximum–minimum contrast equals 46 taxa; the largest list is approximately 1.73 times the smallest. This is a comparison of taxon lists assembled from distinct soil classes, not a time series. Accordingly, connecting these categories with a temporal trend line would be misleading. In Figure 6 a categorical bar plot is used to represent the appropriate inferential structure.

An important statistical property of the regional lists is non-additivity. Adding the five soil-type totals gives more than 159 because a taxon may occur in several soil categories. The source values are class-specific richness counts, and the grand list is the union of taxa across classes. The number shared by any two classes cannot be reconstructed from their aggregate totals alone. A Venn diagram, Jaccard coefficient or turnover partition would therefore require the full species-by-soil presence matrix, which was not available for the present reconstruction.

The difference between the two ends of the regional richness range is ecologically suggestive but not causally interpretable. A soil class may have been sampled with different effort, seasons, detection techniques or land-use history. Its taxa may also include non-irrigated or less disturbed sites. For this reason, it would be incorrect to attribute the 46-taxon contrast to salinity, organic carbon or irrigation without matched observations. The contrast instead motivates explicit stratification and balanced detection effort in Yozyovon.

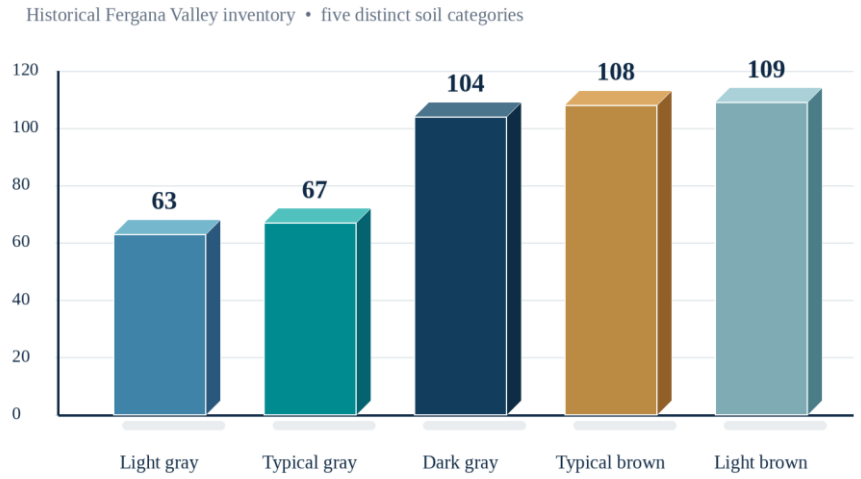


Figure 6. Regional counts for five soil types, shown as categorical data; categories are not seasons or Yozyovon soil-profile groups.

4. DISCUSSION

4.1. Interpretive value of published chemical measurements

This evidence synthesis demonstrates that soil physicochemical heterogeneity can be documented quantitatively even where a district-specific algological inventory remains unavailable. For Yozyovon, the differences in TOC and pH between published profiles are large enough to warrant stratified sampling but do not themselves specify the biological response. An analysis that replaces measured cell density with inferred values based on regional taxonomy would collapse the distinction between predictor and response and create an entirely artificial regression. The preferable approach is to make the gap in data explicit and use it to set priorities for the next monitoring cycle.

Salinity deserves attention because the movement of salts under irrigation affects near-surface osmotic conditions that constrain soil microbes. Nonetheless, salinity is not a single homogeneous stressor. Electrical conductivity summarizes total ionic strength, whereas the physiological effects of sodium, chloride, sulfate, calcium or magnesium depend on both ion identity and concentration. In Yozyovon, reported gypsum and chloride–sulfate chemistry suggest that future sampling should record EC together with major ions at least for representative plots. The influence of each variable should then be evaluated while accounting for texture, soil moisture and agricultural operations, rather than treating a marginal correlation as a mechanism.

Water availability may reverse ecological interpretations if it is poorly timed. A sample taken two days after irrigation could display more active phototrophs than one taken at the end of a drying cycle irrespective of which calendar month is warmer. Recording precipitation totals alone does not correct this bias when irrigation inputs dominate field wetting. A dual temporal design—regular seasonal visits and targeted observations tied to a defined interval after irrigation—could disentangle seasonal forcing from shorter wetting pulses. Mixed models incorporating date, field and soil class can support this structure once true paired measurements have been made.

4.2. Taxonomy, function and agricultural interpretation

The dominance of Cyanophyta and Chlorophyta within the published valley-wide list should be interpreted as a statement about recorded richness. Cyanobacterial taxa differ fundamentally in nitrogen-fixation capability, ecological tolerance and extracellular polymer production. Similarly, morphological identification of chlorophytes does not demonstrate that they enhance soil fertility in a particular agricultural field. Critical reviews discuss promising mechanisms but also highlight variation among strains, climate regimes and agronomic conditions (Abinandan et al., 2019; Ramakrishnan et al., 2023). Quantifying a functional claim requires measurements such as nitrogen fixation activity, soil aggregate stability or crop response under an appropriate comparison design.

Biological soil crust studies offer useful mechanisms and methodological options, especially for understanding how photosynthetic filaments and exopolysaccharides can alter sediment stability (Rossi et al., 2022; Garcia-Pichel, 2023). But undisturbed dryland crusts are not identical to regularly tilled and irrigated fields. Surface disturbance, crop shading, flooding duration and fertilizer management can disrupt or reorganize phototrophic communities. Thus, a soil-restoration claim should specify whether the studied organisms occurred as natural assemblages, actively growing cultures or intentionally applied

inocula. A conclusion established in one of these settings cannot be directly generalized to the others.

A complementary concern is taxonomic detectability. Morphological keys may overlook cryptic species and life stages, whereas culture enrichment can preferentially recover organisms that grow under the selected laboratory conditions. DNA-based surveys are sensitive to reference coverage and primer choice. Current field inventories are therefore best supported by transparent protocols and archived voucher evidence, with the same detection approach across repeated seasons. Reported richness should ideally be accompanied by sample coverage or effort measures so that temporal changes in observed taxa are not simply artifacts of varying sampling intensity.

4.3. Statistical designs required for original district-level results

A defensible seasonal hypothesis would be formulated before collecting samples, for example: after accounting for moisture, EC, soil class and field identity, algal cell density differs among seasonal windows. A second hypothesis could concern the interaction between salinity and wetting interval, while a third could test compositional turnover among management strata. Different endpoints demand different data structures. Richness is a non-negative count of detected taxa; cell density is an abundance measure requiring a consistent extraction and counting method; species composition is multivariate. A single model and summary graph cannot faithfully represent all three.

The experimental unit must be the field or plot, not each microscope image. Multiple counting chambers from the same homogenized soil core are technical replicates that mainly measure analytical precision. Multiple soil cores from one field assess within-field heterogeneity but may remain spatially dependent. When computing uncertainty, field-level clustering and repeated visits must be recognized. The prospective model should also consider overdispersion and a high incidence of zeros, which are frequent features of microbial observations.

If the intended claim concerns the effect of algae on soil properties, observational correlation will generally be insufficient. Fertilizer addition, crop residues, irrigation and soil texture can independently influence both microbial abundance and organic carbon. To attribute a physicochemical effect to algal activity, a controlled inoculation or exclusion study, ideally with randomized field or mesocosm units, is required. Until then, associations should be presented as associations with confidence intervals rather than labelled as evidence of direct causal improvement in soil fertility.

An efficient monitoring programme can initially focus on reproducible high-priority variables—taxon identity, abundance per dry soil mass, moisture, EC, pH, TOC, available nutrients and days since irrigation—rather than measuring many analytes without adequate replication. A metadata dictionary should define units, measurement depth, sample preservation, extraction ratios and taxonomic codes. Preserving raw replicate observations makes it possible to calculate temporal turnover and robust mixed-effects estimates later, and allows an independent laboratory to reanalyse results.

4.4. Scope, uncertainty and contribution

The principal limitation of this manuscript is not numerical processing, but the absence of matched district algological samples. The six published soil profiles are a real Yozyovon dataset; the 159-taxon list is a real regional dataset; and the field protocol is a proposal. They should not be combined as if all variables were acquired at the same sites or dates. The published profile proportions are determined by the authors' purposive study design, not by a representative district-wide survey. The regional soil-class richness values also lack a harmonized record of sampling effort sufficient for formal statistical tests.

The contribution of the study is therefore methodological and evidentiary: it converts scattered published values into a clearly labelled district-relevant baseline, quantifies the environmental variability that future sampling should control, and identifies the precise observations required for an original algological seasonal model. This is a narrower claim than reporting newly discovered species or definitive effects of salinity, but it is scientifically testable and reproducible. Publishing the final experimental study should follow collection of raw algoflora data that satisfy these conditions.

5. CONCLUSIONS

Published data demonstrate measurable physicochemical variation among six irrigated Yozyovon soil profiles: the upper horizons have TOC between 0.44 and 0.81%, pH between 7.01 and 7.30, and available phosphorus between 17.0 and 20.7 mg kg−1. Regional algofloristic literature independently lists 159 taxa, of which Cyanophyta and Chlorophyta account for 74.84% in total. Richness differs substantially among the five regional soil types, but those counts cannot be assigned to Yozyovon or interpreted as seasonal changes.

The essential next step is a paired, seasonally repeated programme in which algae, soil moisture, salinity and chemistry are determined on the same georeferenced samples while recording time since irrigation. Such a design permits legitimate investigation of algal dynamics and soil-property associations and creates

the experimental basis for later tests of causal functional effects. The present article should be identified in submission materials as a quantitative evidence synthesis, not a new district-level algological field experiment.

REFERENCES

1. Turdaliev, A., Askarov, K., Abakumov, E., Makhkamov, E., Rahmatullayev, G., Mamajonov, G., Akhmadjonov, A., & Axunov, A. (2023). Biogeochemical state of salinized irrigated soils of Central Fergana (Uzbekistan, Central Asia). Applied Sciences, 13(10), 6188. https://doi.org/10.3390/app13106188
2. Tukhtaboeva, Y. A. (2019). Algoflora of the main soil types of the Fergana Valley [PhD dissertation abstract]. Institute of Botany / Namangan State University. https://api.ziyonet.uz/uploads/books/251467/5d27044e0470a.pdf
3. Koriyev, M., Mirzahmedov, I., Boymirzaev, K., & Juraev, Z. (2025). Effects of mulching, terracing, and efficient irrigation on soil salinity reduction in Uzbekistan's Fergana Valley. Cogent Food & Agriculture, 11(1), 2449201. https://doi.org/10.1080/23311932.2024.2449201
4. Abinandan, S., Subashchandrabose, S. R., Venkateswarlu, K., & Megharaj, M. (2019). Soil microalgae and cyanobacteria: The biotechnological potential in the maintenance of soil fertility and health. Critical Reviews in Biotechnology, 39(8), 981–998. https://doi.org/10.1080/07388551.2019.1654972
5. Ramakrishnan, B., Maddela, N. R., Venkateswarlu, K., & Megharaj, M. (2023). Potential of microalgae and cyanobacteria to improve soil health and agricultural productivity: A critical view. Environmental Science: Advances, 2, 586–611. https://doi.org/10.1039/D2VA00158F
6. Joseph, J., & Ray, J. G. (2024). A critical review of soil algae as a crucial soil biological component of high ecological and economic significance. Journal of Phycology, 60(2), 229–253. https://doi.org/10.1111/jpy.13444
7. Tukhtaboeva, Y. A., Krivina, E. S., Redkina, V. V., & Temraleeva, A. D. (2024). Microalgae from eroded soils in the northern Fergana Valley, Uzbekistan. Microbiology, 93(4), 397–413. https://doi.org/10.31857/S0026365624040024
8. Rossi, F., Mugnai, G., & De Philippis, R. (2022). Cyanobacterial biocrust induction: A comprehensive review on a soil rehabilitation-effective biotechnology. Geoderma, 415, 115766. https://doi.org/10.1016/j.geoderma.2022.115766
9. Garcia-Pichel, F. (2023). The microbiology of biological soil crusts. Annual Review of Microbiology, 77, 149–171. https://doi.org/10.1146/annurev-micro-032521-015202
10. Askarov, K. A., & Djorabayeva, M. A. (2025). Algoflora of the main soil types of the Fergana Valley [Repository record]. Zenodo. https://doi.org/10.5281/zenodo.15716276.