Monitoring and assessing the anthropogenic influence on soil health

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Laboratory of methods for remediation of technogenic landscapes
The Laboratory of methods for remediation of technogenic landscapes at SRCES RAS is dedicated to fundamental and applied research that supports soil function preservation and restoration and sustainable redevelopment of Russian regions and cities that carry the burden of anthropogenic pollution.
Current research activities are mainly focused on monitoring and assessing exposure and effects of anthropogenic pollution on soil evolution, plant formation, soil and sediment microorganisms, allelopathic effects, polycyclic aromatic hydrocarbons (PAH) and oil in natural environment.
The ultimate goal of the lab’s research is to promote protection of soil and water resources through understanding of biogeochemistry of natural and technogenic landscapes, stability and resistance of ecosystems to anthropogenic impact.

The research helps to assess the long-term acclimation and adaptation of soil biota to pollution, and the consequences for soil function and resilience to change.
The effects of oil contamination and different remediation strategies (natural attenuation, biostimulation, and bioaugmentation) on physico-chemical and biological parameters of soils were studied.

Various aspects of soil biological activity proved to be powerful tools for the assessment of long-term changes in oil-contaminated podzolic soil.

The addition of oil-degrading bacteria (bioaugmentation) enhance biodegradation rates only temporarily indicating that biostimulation is a better remediation strategy for podzolic soil in the field.

IMPACT OF OIL-CONTAMINATION ON THE ALLELOPATHIC ACTIVITY OF SOIL FUNGI

- Toxicity assessment of oil-contaminated soil with allelopathic activity bioassay can provide important information regarding soil ecotoxicity and evaluation of ecological risks associated with oil contamination.
- Allelopathic activity indices ($K_a$) can be used as potentially valuable indicators to assess soil quality dynamics and soil health.

The biological effects of metal contamination were evaluated in cultivated urban soil under field conditions. The methods of bioindication and bioassay indicated high toxicity, deterioration in biochemical properties and slow recovery of contaminated soil. Soil dehydrogenase is a sensitive indicator of metal contaminations, which allows identifying the biological effects that occur even in slightly polluted soils.


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Application of high doses of chloride reagents led to an increase of salt concentration in soil up to level of slightly saline soils. However, under field conditions soil salinity eventually decreased due to salt washout by atmospheric precipitation.

Contaminated soils had salt levels high enough to be toxic to plants and soil microorganisms.

Acetate and formate de-icing agents demonstrated the least environmental effect.


ECOLOGICAL ASSESSMENT OF THE SOILS FROM THE BROWNFIELD SITE

• All ecotoxicity bioassays revealed a dangerous level of toxicity at the brownfield site.
• Both eluate and contact bioassays are well-suited and should be used together for ecotoxicological assessment of brownfield soils.
• A distinctive feature of the initial stage of soil formation at the dump site is low biological activity of soil.

The objective of the project is adaptation and implementation of uniform biological indicators for assessment and control of environmental quality in the eastern GoF.

• The most relevant factors, playing major role in the coastal sediments of the eastern Gulf of Finland were identified.
• Anthropogenic activities leading to deposition of pollutants are harmful to sediment environment and influence benthic organisms and the activities of sediment microbiota.


Thank you for your attention!

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