

| Nº | Project Name | Head of Project | Project start and end years | Volume (Amount) | Status Finished/Current | Grant Code |
|----|--|---------------------------------------|--------------------------------|-----------------|-------------------------|---------------------|
| 1 | Lisi Lake hydrobiochemical state | Liana Intskirveli Alexander Surmav | 11.09.2017 - 17.04.2018 | 6 000 GEL | finished | SCR/6/7/20917 |
| 2 | Investigation of manganese dioxide pollution in the environmental facilities of Zestafoni industrial area through numerical modeling | Natia Gigauri | 03.11.2017 - 03.11.2019 | 39 300 GEL | finished | PhD-F-17-192 |
| 3 | Blizzards on the territory of Georgia | Mikheil Pipi | 10.01.2017 – 10.01.2019 | 46900 | finished | YS17_49 |
| 4 | Assessment of Eco-efficiency of Separation of some Fractions of MSW on an Example of Georgia | Natela Dzebisashvili | 09.2018 | 2000 USD | finished | MG-TG-18-701 |
| 5 | Development of an Integrated Methodology for Determination of the Likelihood of Emerging Illegal Dumpsites in High Mountainous Rural Regions on the Example of Georgia | Natela Dzebisashvili | 21.02.2019- 21.02.2022 | 180 000 GE | finished | FR-18-718 |
| 6 | Study and forecast of Tbilisi city region pollution by dust, PM _{2.5} , PM ₁₀ particles | Alexander Surmava | 22.02.2019- 22.02.2022 | 224 280 GEL | finished | FR-18-3667 |
| 7 | Elaboration of waste-free method for obtaining alternative sorbents from solid organic polymer waste for the development of country's circular economy | Natela Dzebisashvili | 01.11.2021- 01.05.2023 | 31 500 GEL | Current | PHDF-21-268 |
| 8 | Study of microaerosol pollution of the atmospheric air of Rustavi city and its adjacent territories using numerical modeling | Natia Gigauri | 16.12.2021- 16.12.2023 | 53 235 GEL | Current | YS-21-132 |
| 9 | Research on the glacier degradation in Georgia over recent decades and creation of the "Electronic Atlas of Georgian Glaciers" | G.Khordzakhia | 21.03.2022 – 20.03.2025 | 240000 GEL | Current | FR-21-1996 |
| 10 | Avalanche danger on the roads of the mountainous regions of Georgia and recommendations for its mitigation | Mikheil Pipia | 17.03.2022 – 17.03.2025 | 229950 GEL | Current | FR-21-1677 |
| 11 | Study of arsenic pollution of natural waters, soils and food products of Racha-Lechkhumi and Kvemo Svaneti regions and soils phytoremediation | Lali Shavliashvili | 01.04.2022 - 01.04.2025 | 228.530 GEL | Current | Nº FR-21-427 |
| 12 | Study of climatic characteristics of the hazardous meteorological phenomena on the Territory of Georgia | Nazibrola Beglarashvili | 01.04.2023 - 01.04.2026 | 208390 GEL | Current | Nº FR-22-2882 |

Abstract

1. - specific result - recommendations

Analysis of results obtained in the research process showed that Lisi Lake water is highly ionized (2500-3000 mg/l), sulfatic, with high content of calcium and magnesium that predetermines high hardness of its waters within limits of 16-22 mg/l. In its turn, high sulfate content of Lisi Lake water is caused by sulfur thermal waters available in its surroundings. Among water quality sanitary indicators, only dissolved oxygen maximum concentration and ammonium ions in all cases exceed corresponding MPC in Lisi Lake waters. Concentrations of nitrites, nitrates and phosphates are far less compared to respective MPC values.

Microbiological monitoring carried out at Lisi Lake showed that in the research period high concentrations of EE-coli were not recorded, their values vary within 200-4000 unit/l. However, concentrations of identified coliforms and fecal streptococci point at small pollution of water. It should be noted as well that our observations were made in late autumn and in winter, where the intensity of biochemical processes in water is reduced, therefore it is necessary to carry out microbiological monitoring at Lisi Lake in spring-summer period over again, since the intensity of biochemical processes running in water may presumably change.

2- specific result - recommendations

As a result of studies the numerical model and software package of atmospheric air polluting aerosols propagation for Zestafoni city and its adjacent territory has been created for the first time in Georgia according to up-to-date requirements. This model describes with high spatial resolution the polluting ingredients' distribution in the boundary and surface layers of the atmosphere at the territory of region with complex terrain for cases of different synoptical and emergency situations.

Project implementation results will enable the wide range of customers to use the developed database for accomplishment of such practical tasks as the issues of urban air ecological safety planning, construction and design works, recreational and ecological tasks etc.

3. - specific result - recommendations

The long-term trend in the number of snowstorm days from 1966 to the present is generally characterized by a downward trend.

Under conditions of climate change, especially with the onset of intense global warming (1990), both the average and the maximum number of snow days are decreasing. The reason can be considered that in connection with the development of global warming in winter, the amount of solid precipitation (in the form of snow) decreases, which is directly related to the decrease in snowstorms.

A study of the average annual number and duration of blizzard days showed that blizzards are especially high at passes where both national and international highways pass. Prolonged snowstorms, which pose a threat to the country's economy, are mainly observed in mountain passes, where their average annual duration is in the range of 600-900 hours, and in some areas exceeds 1000 hours.

4. - specific result - recommendations

Systematization of data on the number and composition of MSN for each region of Georgia Statistical data for each region of Georgia (population number, number of factories and others) collection and systematization; Impact of MSN sorting on climate change for all regions of Georgia until 2030 with the help of IPCC-2006 methodology; Assessment of the potential of secondary raw materials in case of introduction of MSN sorting in Georgia

5- specific result - recommendations

The aim of the study is to develop and use a comprehensive methodology for determining the likelihood of illegal dumping for the most densely populated highland rural areas of Georgia. The scientific novelty of the project lies in the development and implementation of a comprehensive methodology for determining the likelihood of illegal dumps, which involves a combination of theoretical, experimental and practical approaches to the problem. A comprehensive study carried out within the framework of the project will be the first step in accounting for natural dumps in the most densely populated mountainous regions of the country and in deciding on liquidation measures. It should be noted that such studies have not been carried

out in Georgia at any stage of time. As a result of the project, the identification of areas degraded by unauthorized dumps and the development of reclamation plans will contribute to the harmonization of waste management in the country with EU standards, which will further improve the environmental and economic situation of the regions. .

6. - specific result - recommendations

Atmospheric air pollution of Tbilisi city and its adjacent territory by dust, $PM_{2.5}$, PM_{10} microaerosols has been studied through numerical modeling and statistical analysis of field data. The mentioned issue is a modern-day problem of great relevance regarding the ecological safety of large cities and industrial centers of the world, since it is directly related to human health. According to the World Health Organization conclusion, Tbilisi city is ranked among the cities, where the atmosphere pollution level by dust, $PM_{2.5}$, PM_{10} microaerosols 2-times and more exceeds their maximum permissible concentrations.

7. - specific result - recommendations

The improvement of municipal solid waste (MSW) management in Georgia is implying harmonization of the on-going process of the development of waste management system with the European Waste Management Policy is one of the State priorities. At present, the major percentage (90%) of municipal solid waste generated throughout Georgia goes to landfills. Waste landfilling leads to the contamination of the environmental constituents (soil, water, air), which in turn negatively affects human health.

Waste utilization or else, the process of converting waste materials into new, harmless materials is one of the main trends of waste management. The most of the municipal, agricultural and other wastes generated in the country is recyclable.

Our research includes development the rational and green method of municipal solid waste minimization, in particular, the most harmful and hardly degradable polymers and other biodegradable organic fractions (plastics, paper / waste, food, hygienic) into alternative sorbents with a developed surface, for treatment wastewater and exhaust from harmful impurities, study of their sorption potential and determination prospect of application for them.

Rational re-use and green utilization of mixed municipal solid waste is an important step for the development of a circular economic policy of every country. The results of the study will propose solutions and recommendations, along with advanced technology, having a significant impact on improving the ecological condition of environment objects and as a consequence – positively influence human health, both in for the country, region and the world.

8- specific result - recommendations

Rustavi city is selected as the subject of research in the presented project, since it is one of the largest industrial regions of Georgia, where many chemical, metallurgical, cement and other plants function. Rustavi atmospheric air quality is measured by means of only one automated background monitoring station and 7 quarterly indicating measurements. Based on the results of current monitoring it is impossible to obtain desirable particularization of the urban atmosphere pollution.

The problem is studied in an integrated manner, by means of atmosphere hydro thermodynamics, a numerical model based on integration of the system of non-linear, non-steady, three-dimensional equations of polluting substances transfer and diffusion, field observations and statistical analysis of experimental measurement data. The model takes into account a complex orography of the region, thermal and dynamical inhomogeneity of the underlying surface, and uses modern parametrization models of the surface layer of the atmosphere. Integration is performed at the high-resolution numerical grid, using the implicit schemes based on explicit and splitting method.

Experimental measurements will be carried out for both $PM_{2.5}$ and PM_{10} , while the numerical modeling will study the propagation of PM_{10} microaerosols only, since the particles of this size include $PM_{2.5}$ particles, as well. Though their concentrations exceed two times the concentrations of $PM_{2.5}$, the nature of their change curve is similar and the results obtained via modeling will make it possible to characterize $PM_{2.5}$ change dynamics, too. Modeling will run for different meteorological situations, taking the prevailing wind directions into account. Spatial distribution patterns for PM_{10} microaerosol concentrations will be obtained. The impact of horizontal and vertical orographic turbulence, and advective processes on their atmospheric propagation will be analyzed. Sources of Rustavi city atmospheric air polluting aerosols and their components, as well as their impact on Tbilisi city atmospheric air quality will be studied. Data obtained via modeling will be compared to the materials of field observations and experimental measurements and the modeling accuracy will be established.

Unification of the carried out research makes it possible to adjust the software package to the exploration of ecological problems of Georgia and other regions of Caucasus.

9. specific result - recommendations

For a scientifically based answer to the problem of glacier degradation due to the impact of climate change, it is necessary to use high-resolution satellite remote sensing (RSS) which allows simultaneous study of glaciers for regions with the necessary detail and accuracy. The non-linear nature of climate change leads to the intensification of glacier retreat and melting, which is why the characteristics of glaciers have changed significantly over the last decade.

10. specific result - recommendations

The goal of the project is to study the avalanche danger of highways in the mountainous regions of Georgia. A database of the avalanche danger of highways will be created and their statistical analysis will be carried out. An avalanche danger map will be created for each section of the road. The main areas and duration of avalanches will be determined, and the geographical patterns of these features will be identified. Long-term trends in avalanche arrivals at the study sites will be assessed. Recommendations will be identified to reduce the expected risks of avalanches. The research results will be used to mitigate the negative impact of avalanches. Knowing long-term avalanche trends will allow us to predict the severity of anticipated natural disasters. The results, maps and database will be used in the educational process. Using the results of the project in the educational process is part of the plan for disseminating the results of the project.

11. specific result - recommendations

In Georgia, an arsenic technogenic pollution is especially high in Racha-Lechkhumi and Kvemo Svaneti regions, that can be explained by arsenic mines extraction, processing and manufacturing of arsenic-containing compounds for decades. Today the both mines are closed down and no more arsenic production exists, but more than 130 tons of waste containing 4-9% of white arsenic, which were not safely disposed, are still kept at the territory of mining and chemical combines in Uravi and Tsana villages. For years, the main mechanism of arsenic waste spread has been related to toxic residuals washing-out and transition by atmospheric precipitations and waters of overflowing rivers. They are accumulated in soils, where soil contamination with arsenic substantially exceeds the limits. In acidic environment, after a definite time, arsenic of sulfide ores and burnt deposits may pass into moving (soluble) forms easily transferred with plants and living organisms.

12. specific result - recommendations

- Complex investigation of hazardous meteorological phenomena in Georgia, their statistical analysis, integral environmental impact assessment, which implies
- Using the developed intensity scale, for the first time the intensity of hazardous meteorological phenomena on the territory of Georgia (heavy rainfall, drought, frost, strong wind, hail, fog) will be assessed. As it is known, each meteorological phenomena is characterized by peculiarities and the research needs to take into account these peculiarities, it is on this principle that it is planned to develop a scale for the intensity of each hazardous meteorological phenomena.
- Using data until 2023, climatic characteristics of hazardous meteorological phenomena such as number of days, areas, duration, probabilities and recurrences will be estimated;
- A series of geo-information maps will be created - a study of the intensity, average and the largest number of days, areas of hazardous meteorological phenomena;

