Issue 1 / February 2021

An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area

Contract no. 309/10.07.2020

SMIS Code 2014+: 127065

Project co-financed by the European Regional Development Fund through the Competitiveness Operational Programme 2014-2020 (COP)

Beneficiary: ”Dunarea de Jos” University of Galati

An Integrated System for the Complex Environmental Research and Monitoring in the Danube River Area, REXDAN

Contract no. 309/ 10.07.2020, SMIS Code 2014+: 127065

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Priority axis: 1. Research, technological development and innovation (RTDI) to support economic competitiveness and business development;
Investment priority: IP 1a: Strengthening research and innovation (R&I) and infrastructure and building capabilities in order to develop R&I excellence, as well as promoting centers of expertise, especially those of European interest;
Specific objective: SO1.1. Increasing scientific capacity in the fields of smart specialization and health;
Action: 1.1.1 Large R&I infrastructures;
Area of intervention - 058 Research and innovation infrastructures (public)

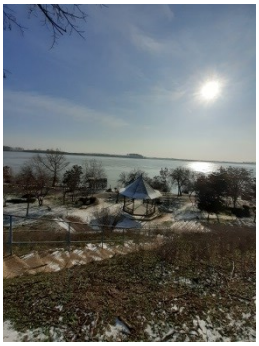
Beneficiary: "Dunarea de Jos" University of Galati, based in Galați, Domnească Street, no. 47, Tel: (+40) 336 130 108; Fax: (+40) 236 461 353; e-mail: rectorat@ugal.ro; www.ugal.ro

Project implementation period: 10. 07. 2020 - 31. 12. 2023

ABOUT THE PROJECT

The project ***An Integrated System for the Complex Research and Monitoring of the Environment in the Danube River Area*, REXDAN** aims at creating a reference research infrastructure in an interdisciplinary research direction which belongs to the field of intelligent specialization: *Energy, environment and climate change*.

The project will cover a wide geographical area (2000 km on the navigable sector of the Danube with extensive areas from the river basin) and research areas related to water, sediments, soil, air, biodiversity, bathymetry, hydromorphology, etc., thus approaching multiple domains: chemistry, biology, physics, environmental science, ecology, bathymetry, topography, atmospheric chemistry, sustainable development, etc.



Expected results: Creating a research infrastructure of excellence in the field of intelligent specialization *Energy, environment, climate change*, which consists mainly of a research ship; a fixed research center; a self-laboratory; 18 laboratories, equipped with state-of-the-art equipment.

The total value of the project is **91,972,096.30 lei**, and the total eligible value is **91,880,104.30 lei**, of which **78,098,088.74 lei** is the non-reimbursable eligible value from the European Regional Development Fund and **13,782,015.56 lei** is the non-reimbursable eligible value from the national budget.

The technical and scientific novelty of the project lies in:

- research activities of excellence carried out in the largest EU river basin, on an area covering 2000 km of the Danube navigable sector and the methodological qualitative integration of extensive aquatic ecosystems, integration which has been practiced, at the international level, only for limited areas;

- the complex approach to chemical, physical, biological and biodiversity factors in statistically calibrated interdisciplinary algorithms, which will lay the scientific foundations for introducing the global water quality index (GWQI) in water quality assessment and will justify its validation as a major parameter to be used at the EU level in the classification of surface waters according to the categories specified in the Water Framework Directive;

- a research ship built and equipped to host up to 10 researchers in march which will make it possible for experts from different countries to participate in multiple, successive or parallel research projects for longer periods of time;

- the assessment of the impact which hydro-technical works carried out for maintaining channel navigability may have on biodiversity (migratory species of ichthyofauna and birds);

- the continuous monitoring of climatic parameters and the periodic monitoring of atmospheric composition by means of fixed and mobile observation systems in an area where such measurements are sporadic or non-existent and where the continuity of these measurements is essential for determining events caused by climate change.

The holistic research proposed by REXDAN corresponds to the Joint Strategy for the Implementation of the Water Framework Directive which recommends the interconnection of research methods and targets on a large-scale at the level of important basins in the EU. The relevant area of the REXDAN infrastructure is clearly an extended European and international one.

OBJECTIVES

GENERAL OBJECTIVES

GO1: Increasing the research capacity of “Dunarea de Jos” University of Galați in the field of intelligent specialization: *Energy, environment, climate change* in the Danube river basin with the aim of including the infrastructure financed by the project in the National Roadmap of research infrastructures in Romania 2017- 2027, approved by the Ministry of Research and Innovation Order no. 624 / 03.10.2017 and of ensuring synergies with the projects Danubius RI and ACTRIS, both of which are included in the European Strategy Forum on Research Infrastructures (ESFRI).

GO2: Intensifying the Romanian contribution to the progress of multidisciplinary knowledge in research areas of complex interest. REXDAN approaches both fundamental areas such as: ecology, chemistry, physics, biology, environmental science, etc., and areas such as: aquatic ecosystems including water, soil, sediments, flora, fauna, environment, climate change, the impact of anthropogenic activity, sustainable development, etc.

REXDAN creates opportunities for a unique experimental base on inland waters in Europe and facilitates Romania's participation in top multidisciplinary research projects which combine fundamental and applied research. These activities are carried out in collaboration not only with representatives of the academia, but also with other state and private structures.

SPECIFIC OBJECTIVES

SO1: Increasing the scientific capacity of "Dunarea de Jos" University of Galati in the field of intelligent specialization *Energy, environment, climate change*, its institutional visibility at European and international levels and the applicability of those research results with direct effect on the economic and social development by exploiting the opportunities created within large research infrastructures. "Dunarea de Jos" University of Galati has contributed, to a great extent, in the research related to River Danube and to its associated ecosystems, especially on issues concerning the environment and climate change.

SO2: Combining scientific objectives with objectives aimed at developing the society.

SO3: Supporting research excellence, a basic condition for the future involvement in major international projects and strategies, by including the distributed research infrastructures, DANUBIUS and ACTRIS, in the *European Strategy Forum on Research Infrastructures*.

SO4: Creating the appropriate conditions for enlarging and multiplying European partnerships, through the active involvement of the G13 countries, including Romania.

SO5: Establishing partnerships with the countries bordering the Danube based on the possibility offered by the **REXDAN** mobile infrastructure to carry out interdisciplinary research along 2000 km of the Danube navigable sector, which highlights the internationalization capacity of **REXDAN**.

LABORATORIES / THE FIX RESEARCH CENTER

The Fix Research Center includes 9 laboratories, as follows:

- **the Laboratory for Sample Conservation and Preparation (LP Fix)**
- **the Chromatography Laboratory (LCR Fix)**
- **the Instrumental Analysis Laboratory (LAI Fix)**
- **the Spectrometry Laboratory (LSP Fix)**
- **the Ecology Laboratory (LE Fix)**
- **the Genetics Laboratory (LG Fix)**
- **the Bathymetry, Hydrology, Topometry Laboratory (LBHT Fix)**
- **the Climate Change Observation Laboratory (POSC Fix)**
- **the Data Storage / Processing Laboratory (IT Fix)**

The Laboratory for Sample Conservation and Preparation (LP Fix) is used for conditionings, extractions, concentrations, dehydration, etc. which are necessary when preparing solid or liquid samples for analysis in the dedicated laboratories: the Chromatography Laboratory (LCR Fix), the Instrumental Analysis Laboratory (LAI Fix), the Spectrometry laboratory (LSP Fix) and the aquatic Ecology Laboratory (LE). The samples to be analysed in the Genetics Laboratory (LG Fix) are prepared separately.

The Instrumental Analysis Laboratory (LAI Fix) uses less precise, but generally, more rapid methods for a fair orientation of the activity and of the methodologies to be considered in the other laboratories. High precision determinations are performed for solid and liquid samples in the **Chromatography Laboratory** (LCR Fix) by using Gas Chromatography /Mass Spectrometry (GC/MS) technologies, in the case of volatile systems, and Liquid Chromotography /Mass Spectrometry (LC/MS) technologies in the case non-volatilizable ones (which degrade when exposed to heating). The determinations envisage organic chemical species, in particular, except for the ion chromatography, which is used in the case of inorganic species.

The **Spectrometry Laboratory** (LSP Fix) uses various techniques such as: XRF, ICP / MS, spectrophotometry, etc. for inorganic determinations, in particular, both at the elemental level and at the level of ionic species present in aquatic ecosystems.

The **Ecology Laboratory** (LE Fix) is complementary to the corresponding laboratory on the research ship, but the analyses made in the fix research centre have a higher level of precision as compared to those made on the research ship.

The **Genetics Laboratory** (LG Fix) will be used for making determinations and analyses on aquatic species which are influenced by the pollution of the aquatic environment, especially on ichthyofauna, commonly affected by the metabolites present in some drugs entering the surface waters through the sewerage systems and the municipal wastewater.

The **Climate Change Observation Laboratory** (POSC Fix) includes three main pieces of equipment, i.e. a cloud radar, a radiometer and a cellometer, whose characteristics have been selected so as to observe the standards imposed by the ACTRIS community. This observation laboratory, ACTRIS-RO, will become part of the pan-European research infrastructure ACTRIS. The other two pieces of equipment, namely the weather station and the particle concentration and identification analyzer, are complementary tools for the research on weather parameters and atmospheric composition elements, necessary for comparative studies and for studies regarding the relationship between environmental components (aquatic systems-atmosphere) in the context of climate change.

A series of bathymetry, hydrology and topometry instruments will be stored in the fixed laboratories area and will be used especially for determinations in the shallow waters of the tributaries, in the predeltaic area and in the Danube Delta. These instruments will be used on the small boats and on the land auto-laboratory.

LABORATORIES / THE MOBILE RESEARCH CENTER

The **Mobile Research Center** on the ship includes **9 laboratories**, as follows:

- **the Systems for Sample Collection and Conservation (SP Ship)**
- **the Sample Preparation Laboratory (LP Ship)**
- **the Radiometry Laboratory (LR Ship)**
- **the Physical and Chemical Analysis Laboratory (FC Ship)**
- **the Aquatic Ecology Laboratory (LE Ship)**
- **the Air/ Atmosphere Laboratory (LA Ship)**
- **the Systems for Biodiversity Observation (SBI Ship)**
- **the Bathymetry Systems (SBA Ship)**
- **the IT Laboratory (IT Ship)**

The main **Systems for Sample Collection and Conservation** (SP Ship) on the Danube include: a dredger for sediment samples, a water sampling system for extracting water from determined-depth waters and a soil sampling system. The sample distribution is performed, on the one hand, for preparing the samples devoted to physico-chemical and ecological analysis and, on the other, for radiometry which requires distinct, specific preparation. The **Sample Preparation Laboratory** (LP Ship) is equipped with both separation/concentration systems (extractors, distillers, etc.) and cold-preservation ones.

The **Physical-Chemical Analysis Laboratory** (FC Ship) includes systems for determining inorganic and organic species, both at the level of some global determinations (for example hydrocarbons), and at the level of some species (portable GC/MS). Specifically oriented high precision determinations will be performed in the laboratories of the **Fix Research Center** (according to the determinations on the ship).

The basic determinations with optical means, in particular, are performed in the **Aquatic Ecology Laboratory** (LE Ship). Highly precise determinations are performed, by complementary means, in the **Fix Aquatic Ecology Laboratory** (LE Fix).

The determinations on liquid and solid samples extracted and prepared according to standard procedures are performed in the **Radiometry Laboratory** (LR Ship).

The instruments corresponding to the **Air / Atmosphere Laboratory** (LA Ship) are positioned on the ship deck in various open areas, free of interference, especially at the bow of the ship.

The high-performance **Bathymetry/Hydrology Systems** (SBA Ship) are used for determining the morphology and evolution of river sections, specific velocities, the riverbed structure, as well as elements of migratory fish species, etc .;

The **Biodiversity Observation / Monitoring Systems** (SBI Ship), located in the outer area of the research ship, together with the additional means (boat, self-laboratory, etc.) are used either on the ship in motion, or on the stationary ship, covering, with the help of drones on board, large areas of aquatic and associated ecosystems.

The primary information and the results obtained are stored and processed in the **IT Laboratory** (IT Ship), the global data processing and results centralization being performed in the IT fix laboratory.

www.rexdan.ugal.ro

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