

Project Update: January 2022

INTRODUCTION

The area of the Dinaric Alps (Bosnia and Herzegovina) is characterised by an extremely high degree of biodiversity. Due to the specific geological and pedological background and hydrological processes, a unique living world is represented. The processes of speciation and the emergence of new species in this area are still ongoing. Numerous rare and endangered plant and animal species of tertiary-relict character have been identified. The area is rich in numerous hydrological phenomena, which include mountain springs, streams, rivers, lakes and many other wetlands, including low and elevated peatlands. These freshwater oligotrophic habitats are characterised by a specific living world but due to numerous pressures acting on a global and local level, they are now highly endangered. In this regard, it is necessary to conduct systematic research, and to carry out their restoration and conservation, all with the aim of long-term protection of biodiversity.

Thanks to the grant, which was awarded by The Rufford Foundation, we started the implementation of the second project entitled: "Conservation and Restoration of Freshwater Oligotrophic Habitat Types in the Area of the Dinaric Alps (Bosnia and Herzegovina)".

Through our second project update, 10 realised activities were presented.

Activity 1. Purchase of equipment.

Activity 2. Detailed fieldwork (8/14).

Activity 3. Establishment of the first ecological station for biomonitoring of biodiversity and ecological state of freshwater oligotrophic habitat types on Vranica mountain.

Activity 4. Restoration of peatland ecosystems on Vranica and Zvijezda mountains (practical approach).

Activity 5. Transfer of knowledge and training of young researchers in the field of restoration and conservation ecology (working with young researchers).

Activity 6. Dissemination of knowledge and raising of ecological awareness about the values and importance of oligotrophic freshwater habitats (publications and promotional materials, social networks, etc.).

Activity 7. Establishment of a database of abiotic parameters.

Activity 8. Establishment of a database of biotic parameters.

Activity 9. Other additional activities.

Activity 1. Purchase of equipment

To establish long-term monitoring of freshwater oligotrophic habitat types in the area of Dinaric Alps (Bosna and Herzegovina), the following field equipment and materials were purchased:

1. Van Dorn bottle VD.
2. Utermöhl pack.
3. BS-2092 inverted biological microscope.
4. Digital camera.

<https://www.facebook.com/media/set/?vanity=107903224904126&set=a.136703898690725>)

1: Van Dorn bottle VD:

The Van Dorn Bottle allows samples to be taken at different water depths. The horizontal design of the bottle makes it ideal for sampling in stratified waters or areas with predominant currents. It consists of a transparent tube with plugs at either end, connected by a latex band. The plugs are kept open during the descent, which facilitates the passage of the water. Each plug has a tap so the sample can be retrieved.

2: Utermöhl Pack:

The Utermöhl Pack is a complete tool for quantitatively analysing phytoplankton using the Utermöhl method. It allows to sediment a sample of phytoplankton, and later analyse this in an inverted microscope.

3: BS-2092 Inverted Biological Microscope:

BS-2092 inverted biological microscope is a high-level microscope that is specially designed for medical and health units, universities, research institutes to observe cultured living cells. It adopts an Infinite optical system, reasonable structure and ergonomic design. With an innovative optical and structure design idea, excellent optical performance and easily operate the system, this inverted biological microscope make works enjoyable. It has a trinocular head, so a digital camera or digital eyepiece can be added to the trinocular head to take photos and videos.

4: Digital camera:

Digital camera can be connected with an inverted microscope and used for capturing photos and video of cyanobacteria and algae, and also other groups of microscopic organisms.

The amount planned by the project proposal was spent on purchasing these devices. All purchased items are attached to the respective invoices. All purchased equipment has been purchased from authorised distributors, and it has original documentation and a valid 2-year warranty.

Activity 2. Detailed fieldwork (8/14)

After the purchase of the equipment, we started with detailed fieldwork. Fieldwork was conducted during August, September, October and November 2021. So far, a total of 8 days have been spent in the field.

The first part of the fieldwork (8/14) was carried out in terms of identification of freshwater oligotrophic habitat types and selection of representative sites for the establishment of long-term monitoring of biodiversity and the sampling of algae of phytobenthos.

Special attention in this project is focused on the following habitat types.

- a) Mountain springs.
- b) Mountain creeks.

- c) Mountain rivers.
- d) Mountain lakes.
- e) Mountain peatlands.

To obtain comparable results, for each studied habitat type a robust field protocol was used which was previously prepared and introduced in our first Rufford project.

In each studied site, data were entered into the protocol in the following order.

1. Sample header.
2. Related sampling activities.
3. Physical site conditions.
4. Water measurements.
5. Sampling information.

Field protocols are stored in the Dropbox database and it can be accessed by scanning a QR code that is unique for each location, but also each sample. During the first 8 days of the fieldwork, 50 field protocols were filled and 50 samples of phytobenthos/phytoplankton were collected. For each studied site, two phytobenthos samples were collected. One sample is for diatoms and the second sample is for other algal groups. Samples of phytobenthos were fixed with formalin 4% and stored until laboratory analysis. Each collected sample contains a unique QR code, which is related to the same field protocol. By scanning a unique QR code with a QR scanner (android application) it is possible to access the database and reach general information about habitat characteristics from which the sample was collected. On each investigated site sampling of aquatic macrophytes (bryophyte and vascular plants) was carried out. During the fieldwork, plant materials were collected in plastic bags and in laboratory conditions they were dried. Collected samples of phytobenthos and aquatic macrophytes were stored in the Laboratory for Systematics of Algae and Fungi at the Faculty of Science, University of Sarajevo.

Activity 3. Establishment of the first ecological station for biomonitoring of biodiversity and ecological state of freshwater oligotrophic habitat types on Vranica mountain

Thanks to the grant, the first ecological station for biomonitoring of freshwater ecosystems in the area of Vranica Mountain was established. The goal of the ecological station is to monitor the state of freshwater ecosystems and establish permanent monitoring in the area of Vranica Mountain. The ecological station is installed above Prokoško Lake in the original part of Razvalinski creek, which continuously supplies Prokoško lake with water throughout the year. The stream springs at the foot of Krstac, which is 2000 m above sea level. The practical significance of the ecological station for biomonitoring is reflected in the fact that over a long period it will be possible to monitor the state of freshwater ecosystems in this unique area, primarily mountain springs and peatlands, but also other types of rare and endangered habitats identified in this area. It is important to note that for long-term monitoring, in addition to detailed analysis and monitoring of Razvalinski creek, 20 previously selected sites will be taken into account. In addition to these water bodies, special attention will be paid to temporary water bodies established from time to

time. In this area in the form of smaller wetland-marsh complexes, and are distributed at altitudes above 1650 m above sea level. The theoretical significance is reflected in the fact that this is the first monitoring station in the area of Vranica Mountain, and probably in the area of B&H. In the future, it is planned to establish an ecological station in some other selected localities to form an ecological network that can serve to collect a large amount of information on rare and endangered habitat types and prepare original scientific papers and graduate and master's theses.

Activity 4. Restoration of peatland ecosystems (practical approach)

Peatland ecosystems are extremely rare and endangered habitat types in Bosnia and Herzegovina. Unfortunately, today they are under pronounced anthropogenic pressures. Peatland ecosystems in the area of the Vranica and Zvijezda mountains are in an extremely critical condition and they need help in this regard through ecological restoration processes. Restoration of the peatland ecosystem through this project at selected sites will be realized *in situ* conditions. Namely, germinal niches will be established at the place where the degraded peat bog is located. Germinative niches are made of biodegradable material and will not further disrupt the structure and function of the peatland ecosystem. Germinative niches are made of fir board and dimensions 50 x 50 cm. Two germinal niches have been installed in the area of Vranica Mountain and the area of Zvijezda Mountain. Germinative niches will be monitored during the next period, and abiotic and biotic parameters will be analysed within the experimental plot. Special attention will be paid to the study of microclimatic characteristics of selected areas as experimental samples, but also the rest of the peatland ecosystem as a control sample. This is a new method and is used for the first time for the restoration of peatland ecosystems in B&H. If it proves to be effective, the method will be further applied and with some new improvements.

Activity 5. Transfer of knowledge and training of young researchers in the field of restoration and conservation ecology (working with young researchers)

To transfer knowledge about restoration and conservation ecology, but also to acquire practices and skills for fieldwork, seven highly motivated students from the Department of Biology at the Faculty of Science were invited. During this intensive training, students were introduced to targeted freshwater oligotrophic habitat types and with the equipment which is necessary to establish a programme of long-term monitoring. Also, students had the opportunity to learn about handling the types of equipment, fulfilling the protocols for monitoring and sampling phytobenthos and aquatic macrophytes. One of the main goals of the conducted training is to increase the skills and competencies of students but also prepare their projects in the field of restoration and conservation ecology.

Highlights from the first part of the training of young researchers in the field of restoration and conservation ecology are available at the following link:

Link 1: <https://www.facebook.com/media/set/?set=a.136703358690779&type=3>

Link 2: <https://www.facebook.com/media/set/?set=a.151067343921047&type=3>

Activity 6. Dissemination of knowledge and raising of ecological awareness about the values and importance of oligotrophic freshwater habitats (publications and promotional materials, social networks, etc)

To raise ecological awareness about the importance of freshwater oligotrophic habitat types, during the current phases, continuous promotion of our project was carried out.

For the promotion of results and current activities, we are used social media. These photo albums and other information about current project activities are available at the following links:

Day 1: <https://www.facebook.com/media/set/?set=a.136702528690862&type=3>

Day 2: <https://www.facebook.com/media/set/?set=a.136702765357505&type=3>

Day 3: <https://www.facebook.com/media/set/?set=a.136702845357497&type=3>

Day 4: <https://www.facebook.com/media/set/?set=a.136702945357487&type=3>

Day 5: <https://www.facebook.com/media/set/?set=a.136703105357471&type=3>

Day 6: <https://www.facebook.com/media/set/?set=a.136703222024126&type=3>

Day 7: <https://www.facebook.com/media/set/?set=a.136703292024119&type=3>

Day 8: <https://www.facebook.com/media/set/?set=a.136703358690779&type=3>

Activity 7. Establishment of a database of abiotic parameters

To establish long-term biomonitoring of freshwater oligotrophic habitat types in the wider area of the Dinaric Alps, a database of abiotic parameters will be established. Entering data into this database is possible through our newly prepare Android application. Access to the application and entering data is possible through a tablet or smartphone. More information about the process of entering data in the form via the Android application and management with the database will be available in our third project update. Measurement of basic parameters of water in the field was carried out using equipment purchased through the 1st Rufford Small Grant and additional equipment owned by the Laboratory for Systematics of Algae and Fungi at the Department of Biology. The following parameters of water were measured: water temperature, pH, dissolved oxygen, specific conductance, turbidity and TDS.

Activity 8. Establishment of a database of biotic parameters

In addition to the prepared database of abiotic parameters, which contains the basic characteristics about habitats from which sampling was carried out, a long database for diatoms and optional for other algae groups was established. This database will be updated with the species and their ecological guilds in the next period. More information will be available in our next project update.

Activity 9. Other additional activities

Various planned activities were realised within the project, however, thanks to good promotion and interest of students, various additional activities were realised, which include the following:

- A 2-day workshop at the Faculty of Natural Sciences and Mathematics in which 1st year students of the Department of Biology participated (first cycle) and students of the new Master's study for the first time at the Faculty of Natural Sciences and Mathematics related to biological monitoring of aquatic ecosystems.
- A show about our project is being prepared, which will be broadcast on the National television BHT1 as part of the show New Adventure.
- We continuously promote the project through social networks (IG, FB and YT).
- Promotional materials for three mountain lakes are being prepared which are also the subject of our research, namely Boračko, Prokoško and Kukavičko lakes.
- Promotional materials for species on the EU IUCN list are being prepared: *Bombina variegata*, *Morimus funereus*, *Lycaene dispar* and *Lullula arborea*.
- Equipment purchased with funding from The Rufford Foundation was presented to the Faculty of Science, Department of Biology.
- Finally, it is important to point out that two students realise their final theses and one Master's thesis with the support of equipment purchased thanks to The Rufford Foundation.

PLANS FOR THE FUTURE

The realisation of fieldwork is planned for October and November 2021. After completion of the first part of the fieldwork (8/14), an intensive laboratory phase is planned. In the laboratory phase of the work, the following activities will be realised.

1. Chemical processing of collected samples of algae of phytoplankton.
2. Preparation of permanent slides of diatoms.
3. Establishment of a database of biotic parameters and diatom collection.
4. Processing of permanent slides and determination of diatoms.
5. Preparation of promotional materials.
6. Establishment of a complex matrix with abiotic and biotic data.
7. Preliminary results.
8. Registration at different International Conferences.
9. Preparation of presentation for a workshop which will be held in Faculty of Science in summer semester.
10. Preparation of materials for field workshop.
11. Preparation of original scientific papers and short communication.

We continued also with the promotion of our work to the broad range of public through very popular media as follows, iNaturalist and YouTube. More information about progress dealing with planned activities will be presented in our addition updates and also in our more detailed third project update.

Progress about our project is also available on ResearchGate.

On the next pages of our second project update, we present our activities through very interesting pictures.





