

Project Update: September 2018

INTRODUCTION

Biodiversity is the basis of our food, medicines, fuel and livelihoods. It is the source of our cultural and spiritual enrichment. By conserving, restoring and sustainably using biodiversity, we ensure that we have viable solutions to present and future challenges, including climate change, water scarcity, food security, sustainable development, peace and security¹.

In order to protect biodiversity on planet Earth, it is necessary to restore and conserve all valuable habitat types. In this respect, freshwater oligotrophic habitat types located on high mountains have a special value.

The main reason for their conservation and restoration is reflected in the fact that they represent a habitat for a large number of rare and endangered species, and that they support basic ecosystem processes and provide multiple ecosystem services. Unfortunately, today they are under a strong anthropogenic influences. For this reason it is necessary to establish a long-term monitoring and actively protect them.

Thanks to the grant, which was awarded by the Rufford Foundation, we started the implementation of the project entitled as: "Conservation of Freshwater Oligotrophic Habitats on Vranica Mountain and Establishment of Long-Term Monitoring of Biodiversity".

Through our Second project update, eight realized activities were presented:

Activity 1. *Purchase of equipment;*

Activity 2. *Detailed fieldwork;*

Activity 3. *Training of young researchers;*

Activity 4. *Promotion of our project through social media;*

Activity 5. *Establishment of database of abiotic parameters;*

Activity 6. *Establishment of database of biotic parameters,*

Activity 7. *Preliminary results of our project and*

Activity 8. *Other additional activities*

Activity 1. Purchase of equipment

In order to establish a long-term monitoring of freshwater oligotrophic habitat types in the wider area of Vranica Mountain, following field equipment and materials were purchased:

1. GPS device GARMIN eTrex 10,
2. Portable turbidimeter AQ3010,
3. Portable multimeter - Orion Star A329 and
4. Solution for calibration of turbidimeter and multimeter.

¹<https://www.unenvironment.org/news-and-stories/story/more-needs-be-done-protect-biodiversity>

In order to map the oligotrophic habitat types in the wider area of Vranica Mountain and to establish a long-term monitoring of biodiversity, GPS (Garmin eTrex 10) device has been purchased. A turbidimeter (AQ3010 Turbidimeter) with associated accessories has been purchased for monitoring of turbidity of water in selected freshwater oligotrophic habitat types. In order to perform complex measurements in the field, a portable multimeter (Orion Star A329) with associated accessories was also purchased. Associated equipment consist of a protective suitcase, portable multimeter and three electrodes with three meters of cable. The portable multimeter measures the following parameters of water: pH, conductivity, oxygen concentration in water and water temperature. In order for each measurement to be completely precise, it was necessary to purchase calibration solutions for both, pH and electrical conductivity electrodes. 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 authorized distributors, and it has original documentation and a valid two-year warranty.

Activity 2. Detailed fieldwork

After the purchase of the equipment, we started with detailed fieldwork. Fieldwork was conducted during the month of August and September. So far, a total of seven days have been spent on the field. Preliminary field research was carried out during April, and due to the adverse weather conditions during July, it was not possible to realize planned field activities. Detailed information on the weather conditions during the July in the study area is presented at the following link².

The First part of the field work (7/18) was carried out in terms of identification of freshwater oligotrophic habitat types and selection of representative sites for the establishment a long-term monitoring of biodiversity and for the sampling of algae of phytobenthos.

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

1. mountain springs,
2. mountain creeks,
3. mountain rivers,
4. mountain lake and
5. mountain peatlands.

In order to obtain comparable results, for each studied habitat types, a robust field protocol was used, which was previously prepared³ and introduced in our First project update.

In each studied site, data was entered into the protocol in the following order:

1. Sample header,
2. Related sampling activities,
3. Physical site conditions,

²<https://www.accuweather.com/en/ba/fojnica/33132/july>

³<https://www.rufford.org/files/24578-1%20June%202018.pdf>

4. Water measurements and
5. Sampling information (QTHP and QMH sample).

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 for each sample. During the first seven days of the field work, 65 field protocols were filled and 130 samples of phytobenthos 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 same field protocol. By scanning unique QR code with 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. Training of young researchers

In order to transfer knowledge about restoration and conservation ecology, but also to acquire practices and skills for fieldwork, three highly motivated students from the Department of Biology at the Faculty of Science were invited. During these two days of intensive training, students were introduced to targeted freshwater oligotrophic habitat types and with the equipment which is necessary to establish a program of long-term monitoring. Also, students had the opportunity to learn the handling with equipment, fulfill the protocols for monitoring and sampled phytobenthos and aquatic macrophytes. One of the main goals of the conducted training is to increase the skills and competencies of students, but also preparing their own 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:

<https://www.facebook.com/media/set/?set=a.1397346087062903&type=1&l=92100e4e96>

Activity 4. Promotion of our project through social media

In order 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://sway.office.com/DyFZNyCLbFUD0F3w?ref=Link>
Day 2. <https://sway.office.com/imFxpDaGFpyixR5V?ref=Link>
Day 3. <https://sway.office.com/dOdIJ3phBkw6gdit?ref=Link>
Day 4. <https://sway.office.com/Or9lb9lvSUQU2xOV?ref=Link>
Day 5. <https://sway.office.com/iz2pCCFLaxmrqmKg?ref=Link>
Day 6. <https://sway.office.com/CTRE0FC3rFnTQMIP?ref=Link>
Day 7. <https://sway.office.com/TEITYS14Y4FK2zlh?ref=Link>

Activity 5. Establishment of database of abiotic parameters

In order to establish a long-term biomonitoring of freshwater oligotrophic habitat types in the wider area of the Vranica Mountain, a database of abiotic parameters will be established. Entering a data to this database will be possible through our newly prepare Android application. Access to the application and entering a data will be 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 Rufford Foundations grant and additional equipment owned by the Laboratory for Systematics of Algae and Fungi at Department of Biology. The following parameters of water were measured: water temperature, pH, dissolved oxygen, specific conductance, turbidity and TDS.

Activity 6. Establishment of 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 7. Preliminary results of our project

During month August and September next activities were carried out: identification of oligotrophic freshwater ecosystems on Vranica Mountain, recognition of abiotic parameters of selected sites and sampling of algae of phytobenthos. In this area we are find all freshwater habitat types which we are planned with the current project. As more interesting habitat types on Vranica Mountain are peatlands and springs, mountain lake, small creeks and streams are very prominent in this area. Preliminary research on the diversity of diatoms in the peatland ecosystems reveals a large number, which according to Lange-Bertalot & Steindorf (1996) have a certain degree of vulnerability, as follows: *Adlafia bryophila*, *Caloneis tenuis*, *Cymboppleura amphicephala*, *Cymbella aspera*, *Diploneis krammeri*, *Diploneis petersenii*, *Encyonema neogracile*, *Eunotia arcubus*, *Eunotia arcus*, *Eunotia glacialis*, *Eunotia tetraodon*, *Frustulia crassinerivia*, *Gomphonema parvulus*, *Neidium affine*, *Neidium biscalatum*, *Pinnularia subrupestris*, *Pinnularia microstauron*, *Placoneis ignorata* and *Stauroneis phoenicenteron*. In mountain springs and small creeks, during our fieldwork in August and September, one distinct species of macroalgae was discovered (*Hydrurus foetidus* (Villars) Trevisan). This species is an indicator of a good ecological state of freshwater oligotrophic habitat types, especially mountain springs and creeks. It is indicative that oligotrophic freshwater habitat types on Vranica Mountain are a "hot spot" of biodiversity. However, due to global climate change and variation in hydrological regime and strong anthropogenic influences, these habitat types and the species contained therein are extremely vulnerable. In order to protect these habitat types in the future, it is necessary to establish a long-term monitoring of biodiversity, as well as their condition.

The aim of this monitoring is to create a plan for the future restoration and conservation activities of these very unique and sensitive habitat types and to protect the high degree of species diversity. More detailed results of our project are present on International Rufford Small Grants Conference, Explore and protect

the natural beauty of Balkans from 27th to 28th September 2018 at Silver Lake in Serbia.

Activity 8. Other additional activities

During all phases of the fieldwork, we actively promoted our project. It is important to note that we have talked with tourists who are visiting Vranica Mountain and Prokoško Lake, but also with the local people and employees who are concerned about this protected area. During one of our fieldwork, plastic and other types of waste were collected. The collected waste was disposed to the intended site. An important part of our project is the presentation of obtained results at the International Rufford Small Grants Conference which was held in the period from 27th to 28th September 2018, in Silver Lakes, Serbia. During last month I am participating in the Biodiversity Contest and shortly after that I was informed that my photo of Prokoško Lake, which is located on Vranica Mountain, is awarded and it will appear in the book "*Celebrating 25 Years of Biological Diversity*", under the country profile of Bosnia and Herzegovina. As an added bonus, my photo will also be a part of an exhibit taking place at the United Nations General Assembly in New York this September. At the conference entitled as: "*First International Conference "Nature in Southern and Eastern Europe Diversity, State and Governance"*" which was held from 27th to 28th September in Sarajevo, Bosnia and Herzegovina, I had a presentation, together with my colleagues, about state of peatland ecosystems in Bosnia and Herzegovina during which we mentioned characteristics and state of peatland ecosystems on Vranica Mountain (<https://www.nisee.org/>).

Further in this report, future planned activities are summarized.

PLANS FOR THE FUTURE

Realization of fieldwork is planned for the months of October and November. After completion of the first part of the fieldwork (7/18), an intensive laboratory phase is planned. In the laboratory phase of the work, the following activities will be realized:

1. Chemical Processing of collected samples of algae of phytobenthos;
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 promotive materials;
6. Establishment of a complex matrix with abiotic and biotic data;
7. Registration on different International Conferences;
8. Preparation of presentation for a workshop which will be held in schools;
9. Preparation of original scientific papers and short communication and
10. Preparation of materials for field workshop.

We continued also with the promotion of our work to the broad range of public through very popular media as follows: iNaturalist⁴ and Youtube⁵. More information about progress dealing with planned activities will be presented in our addition updates and also in our more detailed Third project update.

⁴<https://www.inaturalist.org/projects/conservation-of-freshwater-oligotrophic-habitats-on-vranica-mountain?tab=about>

⁵https://www.youtube.com/channel/UCSZBVEUVQG04oETRFVyGieA?view_as=subscriber

Progress about our project is also available on ResearchGate.



Fig. 1. Equipment (Portable multimeter - Orion Star A329 and Portable turbidimeter AQ3010)



Fig. 2. Basic equipment for sampling of phytobenthos

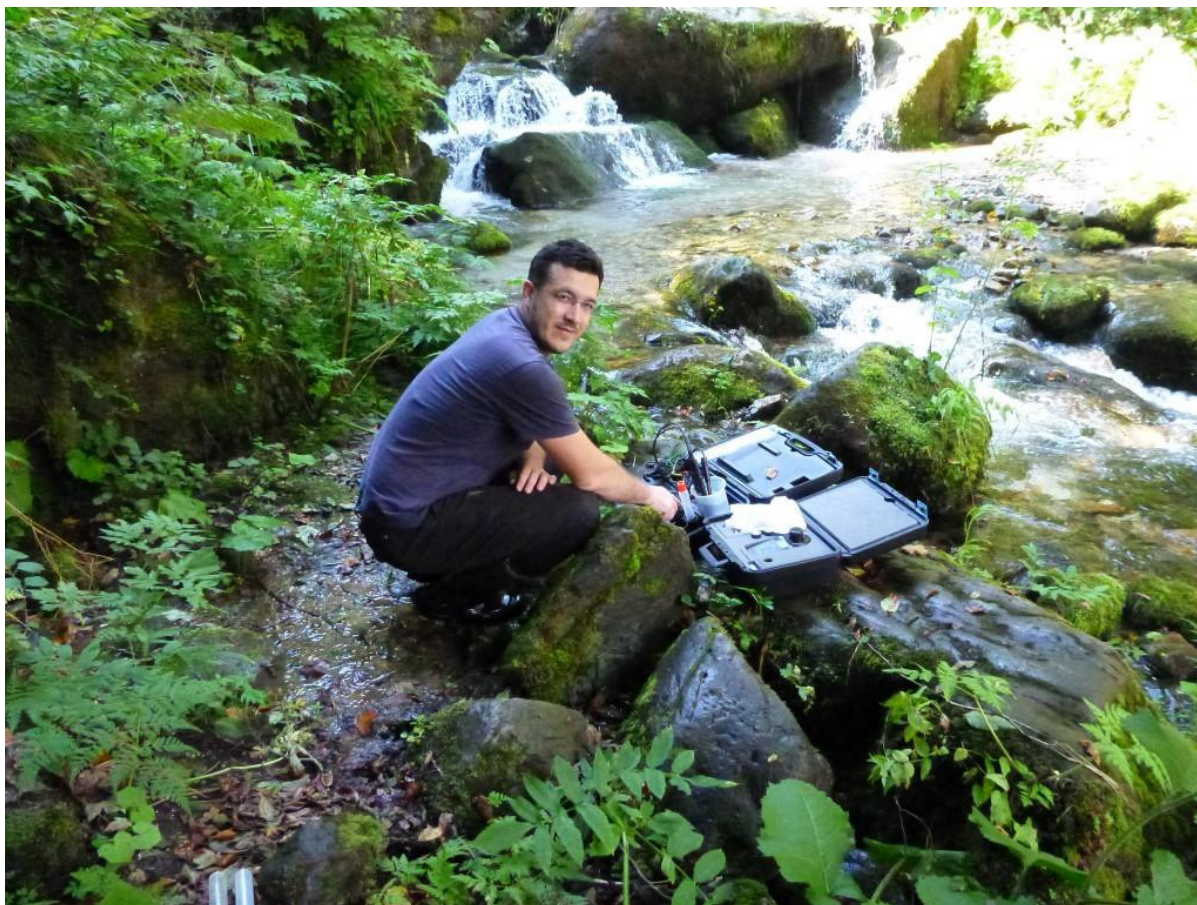


Fig. 3. Testing the equipment during the fieldwork



Fig. 4. Plastic and other types of waste were collected in the near of Prokosko Lake



Fig. 5. Training of young researchers on the field



Fig 6. Second session of training of young researchers



Fig. 7. Mountain spring as habitat a very rare algal species *Hydrurus foetidus* (Villars) Trevisan



Fig. 8.A. Macroscopic and **8.B.** microscopic appearance of a *Hydrurus foetidus* (Villars) Trevisan

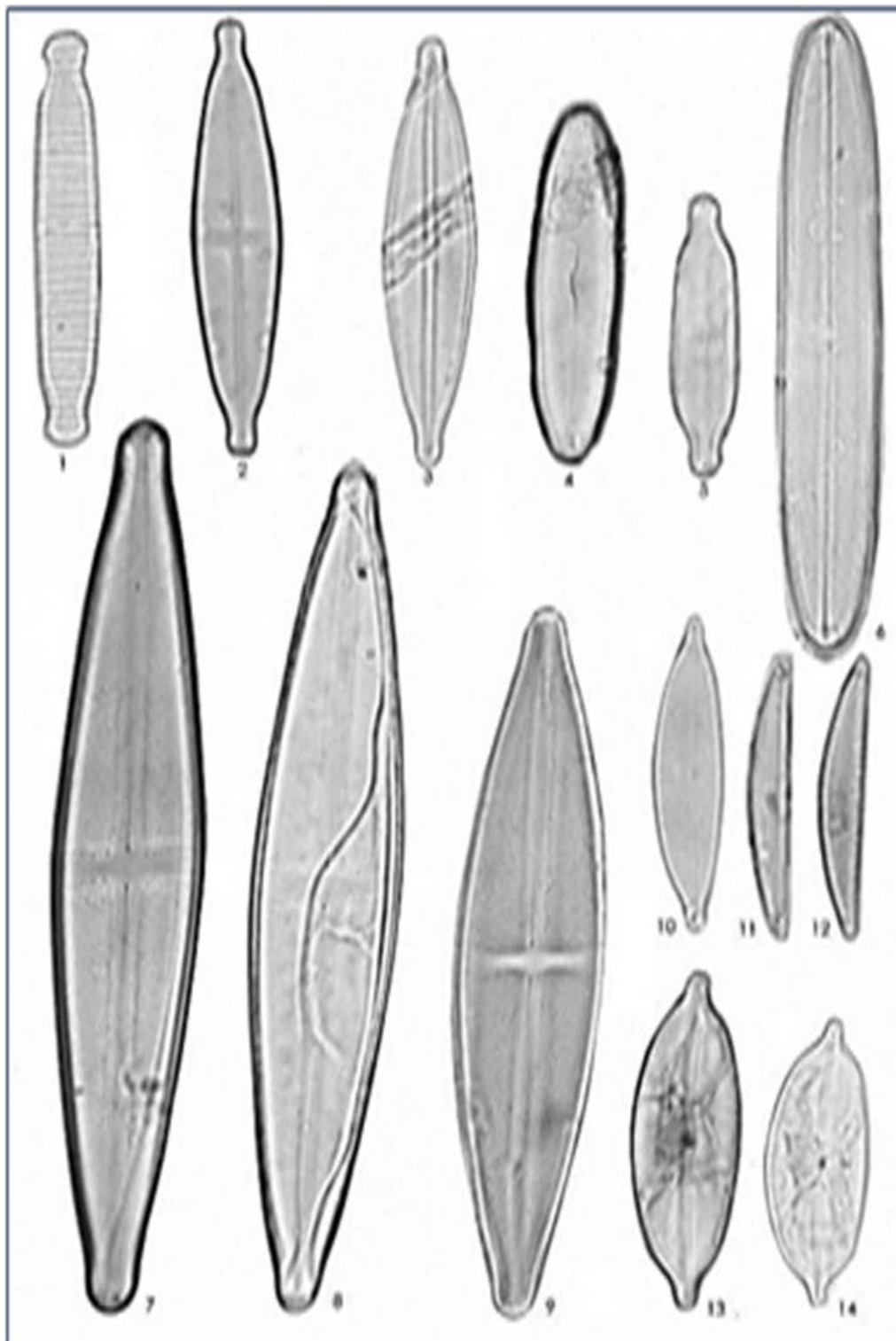


Fig. 9. Bryophyte from genus *Sphagnum* build peatland ecosystems on Vranica Mountain



Fig. 10. Peatland ecosystems on Vranica Mountain

1. *Diatoma ehrenbergii* Kützing,
2. *Stauroneis anceps* Ehrenberg,
3. *Frustulia crassinervia* (Bréb. ex W. Smith) Lange-Bertalot & Krammer,
4. *Caloneis silicula* (Ehrenberg) Cleve,
5. *Neidium longiceps* (W. Gregory) R. Ross,
6. *Neidium bisulcatum* (Lagerstedt) Cleve,
- 7-8. *Stauroneis phoenicenteron* (Nitzsch) Ehrenberg,
9. *Stauroneis gracilis* Ehrenberg,
10. *Cymbopleura naviculiformis* (Auerswald ex Heiberg) Krammer,
- 11-12. *Encyonema neogratile* Krammer,
- 13-14. *Cymbopleura cuspidata* (Kützing) Krammer.



- 15-16. *Diploneis krammeri* Lange-Bertalot & E. Reichardt,
 17. *Pinnularia grunowii* Krammer,
 18. *Pinnularia borealis* Ehrenberg,
 19-20. *Odontidium mesodon* (Kützing) Kützing,
 21. *Hannaea arcus* (Ehrenberg) R. M. Patrick in R. M. Patrick & C. W. Reimer,
 22. *Meridion circulare* (Greville) C. Agardh,
 23. *Eunotia bigibba* Kützing,
 24. *Eunotia valida* Hustedt,
 25. *Eunotia mucophila* Lange-Bertalot in Metzeltin & Lange-Bertalot,
 26-30. *Eunotia nymanniana* Grunow in Van Heurck,
 31. *Eunotia arcus* Ehrenberg,
 32. *Eunotia boreoalpina* Lange-Bertalot & Nörpel-Schempp
 33-34. *Eunotia incisa* W. Smith ex W. Gregory,
 35-38. *Eunotia tetraodon* Ehrenberg.

