11th INTERNATIONAL RESEARCH SCHOOL
FUTURE IS YOU
JULY 4-15 2018 YAKUTIA RUSSIA

Research Project Application Form

1. Personal Data

1.1 Full Name:	Tim Prezelj and Zeljka Majic
1.2 Country/City:	Slovenia (Ljubljana) and Croatia (Slavonski Brod)
1.3 Date of Birth:	13th of June 1994 (Tim), 13th of February 1985 (Zeljka)
1.4 Education:	Tim: Microbiology at University of Ljubljana (Bachelor), Master student in Molecular and Functional Biology at the same university Zeljka: Master in Chemistry, PhD in Biology, Faculty of Science, Zagreb
1.5 Place of Work, Position:	Tim: Assistant for Cell biology at Medical Faculty, University of Ljubljana Zeljka: project advisor, part-time science writer, looking for new position in science (abroad)
1.6 Scientific Degree:	Tim: Bachelor, currently Master student Zeljka: PhD
1.7 E-mail:	tim.prezelj@gmail.com and majiczeljka@gmail.com

2. Express-project profile

* mandatory fields

2.1	**Scientific area ***	ecology, STEAM
2.2	**Name of the express-project***	STEAM study of Buluus glacier- the mystery of Yakutian nature
2.3	**Type of the express-project*** Please, put «X» in front of one of the option	○ Research [X] ○ Project [ ]
2.4	**Basic Scientific and/ or Educational Institution** **(**in case it provides advisory support on the scientific content)	
2.5	**Topicality ***: why the work can be interesting to the IRS participants, and its results can be useful for the region of Yakutia	2.4. We don't need support of institutions, but information from local people will be taken into consideration (local IRS 2017 friends) and maybe also Dr. Alexey Galanin (Laboratory of General Geocryology, Permafrost Institute, Yakutsk). 2.5. IRS participants will learn that multidisciplinary approach and creativity are very helpfull in solving problems and understanding complex systems such as glaciers. They will also experience unique fieldwork in hot summer days. As for Yakutia, Buluus can be considered as excellent indicator of regional and

2.6 **FOR RESEARCH**

The topical question *,which the group members will try to answer

How does global climate change influence Buluus glacier (or to be more poetic: is the Yakutian "ice diamond" disappearing?)

FOR PROJECTS

Problem *, which the group work will be focused on solving

Our project is "research", but because of STEAM approach, we also have "E-part" of research that can be treated as mini-project inside research itself. The fact is that we are limited with time and resources (and electrical engineering expertise) and therefore we would like to use "shortcut" to this problem and simply reuse Arduino sensors that were used on previous IRS. Our collegue Danica Despotovic informed us that there are sensors for temperature, air and soil humidity. Therefore we propose their reuse with short explainations about engineering behind it and testing before fieldwork.

2.7 **Possible solutions / answers / hypotheses** (if any)

Glaciers are the visible indicator of climate change. We'll determine how Buluus changes over time. There are 3 possible solutions to this:
1. no change (neutral, neither increasing or decreasing)
2. negative (decreasing, disappearing)
3. positive (increasing, not disappearing)

*According to Dr. Alexey Galanin (Principal Research Scientist, Laboratory of General Geocryology, Permafrost Institute, Yakutsk) the glaciers of Russia's Republic of Sakha have reduced by 70% for the past 50 years, Therefore, we expect to show similar result for Buluus glacier.

2.8 **Scientific context, theoretical basis for the project**
(theories, concepts, key works)

LITERATURE (key works):
Hubbard, B., and Glasser, N.F., 2005, Field techniques in glaciology and glacial geomorphology: West Sussex, United Kingdom, John Wiley and Sons, 400 p.
World Glacier Monitoring Service (WGMS) publications and webpage: http://wgms.ch/
J.A. Heginbottom, J.Brown, O. Humlum, H. Svensson : Permafrost and peroglacial environments: https://pubs.usgs.gov/pp/p1386a/pdf/pp1386a-5-web.pdf
Berthier, E., Vadon, H., Baratoux, D., Arnaud, Y., Vincent, C., Feigl, K.L., Remy, F., and Legresy, B., 2005, Surface motion of mountain glaciers derived from satellite optical imagery: Remote Sensing of Environment, v. 95, p. 14–28, doi: 10.1016/j.rse.2004.11.005.
THEORY: Glaciers are visible indicator of climate change. Mass balance, lenght and snow-melt runoff are some of the glacier parameters directly related to the climate. According to researchers, glaciers of Russia's Republic of Sakha have reduced by 70% for the past 50 years.

2.9 **Aim***

GENERAL AIMS of project (common to all IRS projects): introduction to research work, critical and logical thinking, processing and presentation of data, collaboration and teamwork.
MORE SPECIFIC AIMS learning more about Yakutian nature, glaciers, global warming, fieldwork, sample collection, using different methods of obtaining data and how these methods work together to prove or disprove hypotheses. Furthermore, experiencing synergistic relation between art and science and understanding that art is part of all creative and problem solving processes. Through the process of paint preparation (for artwork) we will introduce them to plants and soil around glacier.
ULTIMATE AIM: have fun while doing serious research and create wonderul memories of Yakutia and its nature. Also increase ecological awareness and respect for natural resources.

2.10 **Tasks***

(steps to achieve the goal)

Our tasks can be much easier explained if divided into project parts (but these parts will not be done in this order, they are organised in a way that fits tight IRS schedule).
S- collect and analyse ice, water and rock samples (on field and in lab), measure temperature on field (and maybe also pH and conductivity), do spectrophotometric analysis
T- obtain data using available technology (Google Earth Pro, various satellite images), process images and extract necessary information from existing databases (temperature changes in the previous years)
E- assemble various sensors (from previous IRS), test them and use the best ones for obtaining more data on the field
A- make alternative photograps and painting on ice, with previous preparation of materials (natural eco- friendly colours from plants and sediments around glacier)
M- do calculations on speed of glacier Buluus retreating

2.11 **FOR RESEARCH**

Methods * of data collection and processing

2.11.
S- on field collection, various simple instrumental analysis methods- using pH meter (or indicating sheets), thermometer, conductometer, scale, Arduino based modular portable spectrophotometer
T- using already existing information from various sources (from internet), image processing using software such as GIS or similar
E- sensor measurements (we will choose which sensors we will use after testing)
A- eco friendly method of antotypes process (for alternative photography), eco friendly painting using colours prepared from plants, soil, sediment (on site) and glacier melted water (with creating zero waste)
M- "degree day model" for calculation for year 2018. and satellite images for previous years,

FOR PROJECTS

Research part* Describe the stage of your work, where you going to do a research

2.12 **Experiments**
(if planned)

We will do some simple water, ice, soil analysis. Most of it will be based on instrumental methods, with short and easy measurements (which means just basically putting device into sample and recording readings). Just one analysis will be more "complicated" and that is determination of amount of carbonates in the soil. It will be done in the laboratory, in controlled conditions following safety regulations. We will determine the weight of the rock/soil samples before and after treating it with HCl that reacts with carbonates and not with other minerals in sample. Materials: scale (with atleast 3 reliable digits), HCl concentrated.

2.13 **Product**
(if it is planned to be created)

No creation of new product, just reuse of old ones (old sensors).

2.14 **Supposed results*:**
what you expect to show at the final presentation of the group work results

First, we plan to present results separately.
S- part- measured data that we got from collected samples
T- part- results we got from analysed data we collected using available online technology
E- we will present sensor results
A- presentation of glacier and photography artwork
M- our estimation/model of glacier melting/retreating
Collective result of all parts should give current glacier status and predict its future.

3. Project plan realization

3.1 **Requirements to the students (**age, essential and necessary knowledge of the subject, abilities etc.)	Since one day is reserved for field work, students need to be in good physical condition. There is no special requirement for this project- we can adjust lessons to age groups and no previous knowledge is necessary (except for good English language).
maximum students in the group	10-12
3.2 **Distant tests** before the IRS (if it is necessary to select the students)	No need for distant tests.
3.3 **Theoretical tasks** for the students before the School	No theoretical tasks to perform before the school.

3.4. Main steps of the projects*

Important! Your plan should have a certain flexibility: i.e. the amount of working time per day may be different, but totally it should't be less than 5 full working days (35 hours).

3.4.1. Day 1

Aim	Introduction to project and focus on E-part of our project
Tasks	1. meeting students (interactive games) 2. have short lectures about project and different parts of project, 3. working on E-part of project (sensors assembly and testing), 4. preparing everything for fieldtrip
Theoretical part	Glaciers and global warming, glaciology, STEAM, step by step guidance through project, a bit about final presentation (how to collect, organise data and have them prepared for presentation). Sensors and how they work (simplified version). Field trip instructions.
Practical part	sensors assembly and testing
Comments	On Day 1 we will meet our students and based on that, we will adjust our lectures to their age and/or previous knowledge. At some point we would like to introduce them to local expert (Dr. Alexey Galanin or maybe some of his collegues). Dr. Galanin has done a lot of research on glaciers and his information would be valuable. Depending on his time and availability, we could invite him for short lecture on Day 1 or field trip on Day 2.

3.4.2. Day 2

Aim	Fieldwork- visit to glacier Buluus (and if time allows also visit to nearby Turuuk Khaia Cliff and/or Kyuryulyur Waterfalls)

Tasks	1. visit the subject of our study, 2. collect samples (for scientific part (S-part) of our project, 3. do measurements on field, 4. collect plants for alternative photography 5. painting workshop (preparation of colours and painting)
Theoretical part	More short lectures and instructions on site, about all interesting subject related facts that we come across.
Practical part	sample collection, measuring on field, artwork
Comments	We would prefer field trip to be organized on the second day (alternative is day 3), but no later than that, because other parts of project depended on it. For trip we need one whole day (to start as soon as possible in the morning).

3.4.3. Day 3

Aim	Finishing S-part of project (all measurements and analysis), finishing an A-part (there will be some small after-fieldwork things to be done)
Tasks	1. do laboratory analysis of collected samples (CO_2 amount, spectrophotometry analysis), 2. organise all results, put them into sheets, make them ready for final presentation, 3. finish all artwork (antotypes process)
Theoretical part	Theory will be based on analysis that they are going to do (how and why we measure)
Practical part	laboratory work (meaurements and analysis)
Comments	It would be really helpful if we could get final program of IRS before school starts so we can adjust this schedule, if necessary. For example- some analysis can be done on the next day, but once started we can not stop them (like CO_2 amount determination)

3.4.4 .Day 4

Aim	solving T-part of project and if time allows start to work on M-part
Tasks	1. find data sources on internet (satellite images, weather and meteorological reports, temperature databases, 2. extract information, 3. process information
Theoretical part	about technology used (how it works, why we use this data), what can be done with images, using software such as GIS
Practical part	image and data processing
Comments	We will instal all necessary softwares on computers (that can be easily removed later). For that we need computers in good contidion and permission to do instalation.

3.4.5.Day 5

Aim	finishing M-part of project, round up (making presentation)
Tasks	1. from temperature information (internet+recorded) and satelite images make model of glacier retreating, 2. make presentation
Theoretical part	theory behind mathematical model used to describe glacier retreating ("degree day model")
Practical part	making final report
Results desigh	Results will be presented based on individual parts of project (S, T, E, A, M). All results will be presented in short, clear way that either supports or disproves our hypotheses.
Features of your presentation	"Classical" features of presentation: 1. introduction (Buluus glacier, why we choose this topic) 2. material and methods (how we obtained our data), 3. results (with short discussion), 4. conclusion (is glacier disappearing or not).

4. Technical requirements

4.1 **Room facilities***
(size, acoustics, elictricity, water etc.)

No special requirements for room- just basic room with chairs, tables, windows, blackboard for writing and some computers with internet connection. Water is not required.
We would like to have few electrical plug ins. If there is just 1-2, then we would need extension cable (cord).
Projector would be also very valuable.

4.2. **Technical equipment ***

Minimum laptops

Depending on number of students in group. No more than 2 student to share computer/laptop. Computers will be very much used during project, so they need to be fast, in good condition and with internet connection.

The techniques, that you can bring which is yourself (name, quantity)

Tim will bring some small equipment from his lab (Arduino based modular portable spectrophotometer, pH meter).

The techniques which is to be provided (the exact name and number, where better to buy)

No need to buy any techniques.
But we would like to use sensors from previous IRS (temperature, air and soil humidity, IR and any other sensor that might give useful information on field).
We will also need scale with atleast 3 precize digits, because we can't bring it with us. But we need it just for one day, so borrowing from some Yakutsk lab seems like the best idea.

4.3 **Consumables *** (reagents, batteries etc.)

What and how many you can bring yourself	At the time of writing this proposal we don't think we will need any special consumables. But if we realise that we do, we will bring it.
What and how many we have to provide	We will need small amount of concentrated HCl (there was some in chemistry laboratory last year, a whole gallon under the table). We will also need to borrow some glassware and mortar with pestle from chemistry lab (for 1-2 days).

4.4 **Stationary*** (tick and number)

- **flipchart**	0 (no need for flipchart, blackboard and chalks will be fine)
- **A1 format paper**	some paper for writing (recyled one or the one already used on one side)
- **paper**	thick white paper (mat), for pictures painting and photography.
- **markers**	2 markers for labelling (black or blue)
- **sponge**	1 sponge (for blackboard)
- **pencils, pens**	0 (no need for them)
- **other**	paint brushes of different sizes (for aquarell techique). Atleast 2 brushes per student.

Promotional annotation of the project (to be published on the website in the case your project will be selected and approved (200-300 words)

The Buluus glacier is a unique natural landscape of great importance. It is located approximately 100 km from Yakutsk, on the opposite bank of the Lena River and has total area of more than 1100 hectares and thickness of the ice up to 3 meters. This huge accumulation of ice does not disappear even during hot summer days, when temperature goes over 30 degrees Celsius. In the warm season, glacier starts to thaw and develops cavities resembling to a crystal labyrinth. Water from thawed ice is fresh and clean and is perfect refreshment for hot weather. This remarkable mystery of nature is the theme of this project. From day to day we hear about global warming, climate and landscape changes. Glaciers are maybe the best visible indicator of these changes, because most of them are actually reducing in size. In order to determine how Buluus glacier changes over time, we plan to make a small study using STEAM approach. Our project will consist mostly of filedwork and laboratory work. One small part will be dedicated to art and painting on ice, but also to compuer work and data analysis. We will try to use multidisciplinary approach and creativity in understanding complex systems such as glaciers. Beside serious research work you will have opportunity to run on the ice, play snowballs in the middle of the summer, explore glacier ice caves and simply enjoy astonishing views.

Your biography
(to be published on the website in the case your project will be selected and approved (no more than 140 words)

Tim Prezelj
I graduated from Microbiology at the University of Ljubljana, Biotechnical Faculty, where I continue to study Molecular and Functional Biology. I worked at Department of Agricultural Sciences, Biotechnical Faculty (topic of agricultural entomology). Then I moved to National Institute of Chemistry, field of synthetic molecular biology and nano-biotechnology (4 years). I have been working in Institute of Cell Biology for the last five years (main research focus-cell and tissue cultures and organoids as model system for basic cancer research). I teach medicine students practical part of Cell Biology lectures and lecture evolutionary psychology at Philosophical Faculty. My passion to connect humanistic and natural sciences concepts began when I was still student at Diocesan Classical Gymnasium. I participate at many MILSET events as delegation leader. I am responsible for IntelISEF, GENIUS Olympiad and other international science fairs for Slovenian delegations.

Zeljka Majic
I do different stuff related to science: from being project advisor, volunteer on summer schools of science and science festivals to being part-time science writer and from time to time even a real scientist working in the laboratory. I love to do experiments, I love even more when they succeed. Some technical specifications about myself: born, raised and educated in Croatia. I have Master in Chemistry and PhD in Biology, with different skills and knowledge gathered through years and various positions. I like to read, listen to music, take care of my pets, travel and spend time in nature. Fun fact: the root of my name is actually Croatian word for "wish" (želja). This year I teamed up with my good friend Tim and together we made project about one small part of beautiful Yakutian nature.

Please fill in the form and send it to
ksbarkova@yandex.ru before December 25, 2017