

National Team Field Investigation (NTFI)

An NTFI is a mini-study pertaining to a significant earth system phenomenon at a field site that combines limited and short field and laboratory studies. In an NTFI a **focused research question** is formulated in terms of time and scope - a research question that can be answered in a mini-study of a few hours of field investigations and a few hours of laboratory research.

The following criteria may be borne in mind while selecting earth system phenomena:

- (a) The phenomenon represents earth system interactions.
- (b) The research question has an environmental component.
- (c) Data collection includes the use of up to date field instruments and up to date lab equipment.
- (d) A long-term data set may be provided to students following one-time measurements at the field site.
- (e) The NTFI is not a duplication of in depth academic studies (Ph. D. and M. Sc.). The evaluation panel will disqualify projects with a scope of more than 1-2 research days of data collection and analysis.

The NTFI should be based on modern lab analysis tools, but not too complicated or too expensive. Preferable methods include analyses that the students can carry out themselves with field instruments such as Multiparameter Water Quality Meters, or kits, and Field Spectrophotometers. Application of more complicated lab instruments is also possible, but only if the students can operate the instruments themselves or with minimal help from technicians. Even when the instruments are too complicated for operation by students themselves, they should at least prepare the samples for the tests.

Table 1 presents eight suggestions of generic NTFI projects. To meet the above NTFI criteria, mentors must closely collaborate with geoscientists from universities both in the design and implementation stages.

Table 1: Examples of NTFI projects

1. An example of a lake environment NTFI project:	
<i>Subject:</i>	Lake's water depth profiles
<i>Possible objective:</i>	To identify changes in the physical-thermal-chemical conditions in the water column in space and time
<i>Possible research question:</i>	What are the relationships between biological processes and physical-thermal development of the water column of the lake?
<i>The field tools</i>	Multiparameter Water Quality Meters or Field Spectrophotometers (temperature, pH, conductivity, contents of oxygen, nitrates, chlorides, phosphates)
<i>The lab tools</i>	Spectrophotometer, centrifuge for chlorophyll, microscopes
2. An example of a soil NTFI project:	
<i>Subject:</i>	Soil salinization
<i>Possible objective:</i>	Understanding the mechanism of soil salinisation in a specific basin; Forecasting soil salinization in future based on the current situation and past measurements
<i>Possible research question:</i>	What factors influence soil salinization? What is the rate of soil salinization?
<i>Field tools</i>	Conductivity sensor, Hand drill for soil sampling
<i>Lab tools</i>	Kiln, scales, granulometry

3. An example of a geological economy NTFI project	
<i>Subject:</i>	Prospecting for rare metals
<i>Possible objective:</i>	Understanding geo-economy principles and quantitative evaluation of metals that are discovered. Performing economic, environmental and ethical analyses.
<i>Possible research questions:</i>	What is the economic prospect of the rare metals found in this area? What is the economic profit of metal production compared to the environmental impact of the mining and processing of ores?
<i>Lab tools</i>	Table providing SEM + EDS or XRF data (if available at institute)
4. An example of an aquifer and springs NTFI project	
<i>Subject:</i>	Hydrological model of an aquifer and the ground water composition
<i>Possible objective:</i>	Understanding the interrelationships between rocks and water in the studied area
<i>Possible research questions:</i>	What influences the composition of spring water in a particular area? Do all sources represent one aquifer or aquitard?
<i>Field tools</i>	Multiparameter Water Quality Meters – Temperature, pH, Carbonates, Chlorides, or field spectrophotometer
<i>Lab tools</i>	Optional titration for bicarbonate and chloride, ICP (if available at institute)
5. An example of a seasonal pond (or wetland) environment NTFI project	
<i>Subject:</i>	Pond sediments as heavy metal pollution recorders
<i>Possible objective:</i>	Interrelationships between the earth system and environmental pollution
<i>Possible research questions:</i>	To what extent are pond sediments a good tool for monitoring heavy metal pollution?
<i>Field tools</i>	Sediment core sampler, Tools for digging and depth measurement (for dry sediment)
<i>Lab tools</i>	Optical granulometry (if available), Instrument for measuring organic Carbon, XRF (if available)
6. An example of a global warming NTFI project	
<i>Subject:</i>	The use of Recent benthonic foraminifera as a model system for rising ocean water temperature
<i>Possible objective:</i>	To identify foraminiferal species that can survive in heat spots of power plant turbines that cool wastewater. To determine the temperature range in which each species manages to grow its shell.
<i>Possible research questions:</i>	What is the influence of hot water on the skeletal growth of benthonic foraminifera?
<i>Field tools</i>	Sampling equipment, Thermometers, Rose Bengal
<i>Lab tools</i>	Binocular Microscopes (preferably with camera)
7. An example of a geosphere NTFI project	
<i>Subject:</i>	The development of crystalline basement of a specific area.
<i>Possible objective:</i>	Reconstruction of the sequence of geological processes and events.
<i>Possible research questions:</i>	What were the conditions of formation of the various rock bodies? In what tectonic environments did the processes take place? What are the relationships between the geological development and human life in this area today?
<i>Field tools</i>	Brunton compass
<i>Lab tools</i>	Preparation of thin sections, polarizing microscopes
8. An example of wetland with heavy human intervention NTFI project	
<i>Subject:</i>	Wetland as a nutrient sink.
<i>Possible objective:</i>	To understand the balance of nutrients in a wetland heavily influenced by human interference.
<i>Possible research questions:</i>	Is the wetland acting as a sink or source of nutrients? What influences the nutrient balance? How does the occurrence of nutrients in this wetland affect the environment downstream of the wetland?
<i>Field tools</i>	Multiparameter Water Quality Meters, Field spectrophotometer
<i>Lab tools</i>	

On How to prepare and conduct NTFI

First stage – formulation of a research question together with a local researcher, who will provide field-measuring equipment and access to instruments in his/her lab. The research question **must lead to a small-scale, mini- study suitable for high school students**.

Second stage – preparation of students towards the study: A half day to one-day session **to introduce** students to the research question, the location, the theoretical background of the research, the stages of the NTFI, the schedule and the scientific background of the field-measuring equipment.

Third stage – the field study: A half day to one-day fieldwork to study the field phenomenon, to make field measurements and to collect samples for lab measurements. The students must carry out the study **by themselves**.

Fourth stage – the lab study: A half-day to one-day lab work that will include an introduction to measuring instruments/ tools, their scientific principles and lab measurements.

The students must be **actively involved** with sample preparation and **operation** of the lab equipment.

Fifth stage – getting the lab data and answering the research question: This stage must be carried out by **students ONLY and among themselves**, with no help from mentors or researcher.

Sixth stage – preparing the presentation: This stage too must be carried out by **students ONLY**. The mentors should provide the students with the **evaluation criteria** for the presentation, but should **not be involved in the preparation stage**.

The presentation process

The presentation event will be like a tournament – with four rounds.

Round 1: All the participating national teams will be divided into two sub groups.

Each group will be evaluated by an evaluation panel of three experienced EB members, who are not involved in the preparation and mentoring of the national teams.

Presentation and evaluation of the two groups will be done simultaneously and separately.

Each team will have 20 minutes: 15 minutes for presentation and 5 minutes for answering questions from the evaluators. After every four presentations, there will be a 15-minute break.

Thus, if the group has 20 national teams, the first round will take about 7 hours.

Half the national teams will continue to the second round (quarterfinals) that will be conducted the next day.

Round 2: The quarterfinals will be conducted in two groups. Each group will include 10 national teams (we started with 40 national teams). Each of the evaluation panels will listen to 10 presentations of the other group (the ones they did not hear in the first round).

Each national team will present its NTFI to the other teams of its group and the evaluation panel by a different member of the national team.

The presentation will be for 25 minutes: 15 minutes presentation and 10 minutes for answering questions from the evaluators. After every three presentations, there will be a 15-minute break.

Thus, with a group of 10 national teams, the second round will take about 5 hours.

Half of the national teams (10 in this case) will continue to the semifinals that will be conducted after a one-hour break.

Round 3: The semifinals will be conducted in two groups. Each group will include 5 national teams (we started with 40 national teams).

Each national team will present its NTFI to the other teams of its group and the evaluation panel by a third member of the national team, who did not present it in the previous rounds. The presentation will be for 25 minutes: 15 minutes for presentation and 10 minutes for answering questions. In this round, each national team will have to ask one question to each of the presenters. All six evaluators will evaluate the presentations and the answers to questions.

After three presentations, there will be a 15-minute break. Thus, for a group of 5 national teams, the second round will take about 2.5 hours.

Four countries will continue to the finals that will be conducted after a one-hour break.

Round 4 – the Finals: The finals will include presentations by the top four national teams before the six evaluators. Each national team will present its NTFI to the other teams of its group and the six evaluators by the fourth member of the national team, who did not present it in the previous rounds.

The evaluation process

Evaluation will be based on the regular rubric of the NTFI and the following amends:

- 1. Originality:** The evaluation panel will disqualify a NTFI if it is a duplication of in-depth academic studies like Ph. D. and M. Sc.
- 2. Scope:** The evaluation panel will disqualify a NTFI if it is based on more than 1-2 research days of data collection and analysis and reasonable research equipment similar to the examples given above.
- 3. Independence:** The evaluation panel will disqualify a NTFI that does not show clear evidence that the students themselves collected samples in the field and tested them by themselves in the laboratory.
- 4. Logical sequence:** The conclusions should be based on the data that were collected by the students. They could collect and present data that were not collected by them, but only if they are about the same analysis. For example, if the students measured some geochemical characteristics at a specific location on a specific date, they could use the **same** geochemical characteristics that were measured at different locations and on different dates.