



Project goal

The main goal of this activity is for students to gain theoretical and practical knowledge and experience in the analysis of ecosystems after fires, as well as training in the use of geoinformatics tools for terrain mapping and analysis.

The goal is also to provide a complete overview of the condition of the areas affected by forest fires, which can then serve as a basis for developing measures for rehabilitation and maintenance of the ecosystem. Field mapping provides the experts a detailed review to make the right decisions for the restoration of the areas affected by forest fires. This includes documenting the impact of fires on ecosystems, plants, animals and other natural resources.

The main objectives of post-fire field mapping include

- ✓ Determining the extent of the damage: Assessment of the extent of burned landscape, as well as determining the degree of damage to plants, the soil and other components of the ecosystem.
- ✓ Identification of damaged areas: Mapping of specific areas where the fire had the greatest impact, including areas where the damage and pollution of the vegetation are highest.
- ✓ Recognising the regenerative areas: Identifying the areas where the flourishing and regeneration of new plants is possible.
- ✓ Analyzing the impact fires have on animals: Comparison of presence of different species of animals before and after the fire, in order to understand the impact on biodiversity.
- ✓ Erosion and stream risk assessment: Field analysis to identify zones that may be subject to erosion or streams as a result of the fire.

Year of education

First and second year of high-school education

Benefits for students

The students will acquire:

- ✓ Development of scientific skills: Students will have the opportunity to develop their own scientific skills through observing the ecological and biological consequences of fires on nature and biodiversity.
- ✓ Improving analytical skills: The activities included in this lesson will improve students' analytical skills, such as training for the use of Geographical Information Systems (GIS) and other geoinformatics tools for post-fire terrain analysis and mapping.
- ✓ Development of critical skills: Encouraging students to develop analytical and critical skills in the process of analysis and interpretation of data.
- ✓ Development of cooperation and teamwork skills: Through group activities, students will have the opportunity to collectively deal with certain challenges, mutually cooperate and



share ideas to achieve the set goals. As well as encouraging students to work as a team and share experiences and knowledge together.

- ✓ Bridging the gap between theory with practice: This teaching activity will enable the students to connect their theoretical knowledge with practical problematicsituations, so that they will be more prepared for different situations with which they can face in real life. Students will apply the theoretical knowledge inpractice through field mapping and analysis.

Prior knowledge

The students will require more comprehensive understanding, especially considering that this project requires them to apply their knowledge and skills in different areas of natural sciences. For successful participation in the project, students should have and should expand the following competencies and knowledge with new information.

Before beginning post-fire field mapping instructions, it is important to assess the previous knowledge of the students and to prepare appropriate activities and materials.

Below are some aspects of prior knowledge that may be important:

- ✓ General Knowledge of Ecosystems: Students need to have a basic understanding of how ecosystems work and why they are important to biodiversity and human survival.
- ✓ Basics of Geography: Students need to have an idea about the different geographical regions and terrain features where fires may occur.
- ✓ Geoinformatics tools: Students need to be familiar with geoinformatics tools like GIS.
- ✓ Basic knowledge about fires: Students need to have an idea about the occurrence of fires, how fires can affect the surrounding environment and how they can be managed.

Biology:

Previous knowledge of students related to biology, specific to terrain mapping after fire, includes the following aspects:

- ✓ Understanding the impact of fires on plants: To be familiar with the way fires affect plants and how it can have long-term effects on biological systems.
- ✓ Basics of animal protection biology: To have basic knowledge of how biologists monitor and analyze the impact of natural disasters, including fires, on the animal and plant worlds.
- ✓ Understanding biodiversity research methods: To have prior knowledge of the methods biologists use to study biodiversity and how terrain mapping could be involved in those studies.



Chemistry:

Previous knowledge of students related to chemistry and terrain mapping after fire, includes the following aspects:

- ✓ Fire gas characteristics: Students understand the composition and characteristics of gases emitted by fire, such as water steams, fertilizers, and other chemicals
- ✓ Impact of fire on land and soil: To understand how the fire affects the composition of the soil, including chemical changes, such as the release of minerals and other substances.
- ✓ Chemical changes in plants: Understand the chemical processes that occur in plants after fire, including plant regeneration.

Physics:

Previous knowledge of students related to physics and terrain mapping after fire, may include the following aspects:

- ✓ Heat effects of the fire: Students understand how the fire generates thermal effects and how they affect the environment.
- ✓ Field temperature changes: Students should be familiar with physical changes in terrain temperature that may occur as a result of the fire

Mathematics:

Mathematical aspects related to forest fires are most often related to the geometry of the affected areas, statistical analysis of data, geoinformatics and cartography, graphical representation of data, algorithms and modeling.

ACTIVITY DESCRIPTION

Activity 1: Terrain mapping using a GPS device

GPS (Global Positioning System) terrain mapping is a process that involves using GPS technology to determine and record the exact location of certain objects or phenomena on the ground.

This process can be useful in various contexts, including terrain research, cartography, environmental monitoring, etc.

In the context of terrain mapping after a fire, using a GPS device can be of great importance.

Here are a few aspects related to terrain mapping with a GPS device:

- ✓ Location determination: The GPS device allows precise determination of the location where different objects are located on the terrain, such as damaged regions after fire.
- ✓ Points of interest: Users can use the GPS device to record points of interest, such as areas with burned plants, regenerative zones, and other important locations.



- ✓ GIS technology integration: Data obtained through the GPS device can be integrated with Geographic Information Systems (GIS), which allows the creation of detailed and interactive maps.
- ✓ Real-time data monitoring: GPS devices can be connected to applications or systems that allow real-time data monitoring, which is useful for operational management of activities after fires.
- ✓ Working together on terrain mapping: GPS devices can be used in a team environment, where different users can contribute to terrain mapping and share information.

GPS technology contributes significantly to improving efficiency and precision in terrain mapping and analysis of the effects of fires.

Activity 2: Identification of tree species that have been affected by forest fires.

Identification of tree species affected by forest fires is an important part of post-fire analyses and terrain mapping processes.

Here are a few aspects that may be involved in this process:

- ✓ Tree species recognition: The ability to recognize different types of wood is essential. For identification, physical characteristics such as leaves, bark, tree shape, etc. can be used.
- ✓ Determining the state of the trees: Affected trees can show different degrees of damage. When mapping, the state of each tree should be documented – whether it is completely burned, whether there is damage to parts of the tree, etc.
- ✓ Photographs and graphic writing: Photos and graphic records can be useful for identification. Images of the leaves, bark, and the entire tree can serve as references for identification and documentation.
- ✓ Cartographic marking: To obtain a viewing card, trees that have been occupied may be marked with different colors, symbols or numbers, depending on the type of tree.

Activity 3: Data collection for statistical calculations on the number of stems per hectare covered by fires, which will then be used to calculate the loss of the fires.

Collecting data on statistical calculations for the number of stems by hectare affected by fires is an important process for accurately measuring the values of loss due to fires.

Here's how this process can be performed:

- ✓ Selection of research areas: Designated research areas that will be presented as specimens for statistical calculation. These areas should be representative, including different types of wood.
- ✓ Random location selection process: Random selection is used to select specific locations in each selected area. This guarantees objectivity and representativeness of your sample.
- ✓ Tree state record: Each location records the number of stems occupied, as well as their condition (completely burned, partially burned, damaged, etc.).



- ✓ Calculating the number of stems per hectare: Convert data to measures that meet the standards for the production of reports, such as the number of stems per hectare (trees per hectare).
- ✓ Loss calculation: Data on the number of stems per hectare are used and the loss, represented in the volume of wood, wood value or other measures used, is calculated.
- ✓ Documenting and report: All rates of research are documented and a report is produced to present your statistical calculations and conclusions.

Activity 4: Using the mobile application "PlantNet" for identification of the types of vegetation that have been restored on the terrain affected by forest fire.

Using a mobile application like "PlantNet" for identification of species of vegetation that has regenerated on terrain affected by forest fire can be too much useful. "PlantNet" is an application that uses technology to recognize herbs with help of pictures.

Here's how it can be used to identify plants in reclaimed areas:

- ✓ Downloading and installing "PlantNet": Downloading and installing "PlantNet" application on our mobile device. The application is available for different operative system.
- ✓ Photographing the Plant: When we will be an interesting growth in the field, use the application to take a photo of the leaf, flower or other details that are required for identification.
- ✓ Plant recognition application: We use the recognition option of plants in "PlantNet". The app will process an image and provide suggestions for possible types of plants.
- ✓ Verification of proposals and information: We verify the proposed species and we read information that the application provides for each species. That's how we get more details about the characteristics of the plant.
- ✓ Documentation of plant species: We document the identified one species of plants and enter them into our mapping system or research record.
- ✓ Collection additional data: We collect additional data about the plants, such as the condition of the number, the height, whether it regenerates from the fire, etc.
- ✓ Data Processing: We process the data collected and we use for mapping and analyzing the vegetation on the ground.



Activity 5: Flying a drone and making field photos for area mapping affected by fires.

Short training on flying a drone and making photos from the field:

✓ Step 1: Security and Legal Aspects

Knowledge of Laws: Familiarity with related laws and regulations using drones in the country.

Flight Safety: Wearing protective equipment and maintaining the environment during the vacation.

✓ Step 2: Preparing the Drone

Drone check: We check the drone before every summer. We take care of the batteries, propellers, sensors and other parts.

GPS Sync: We make sure the drone is successfully connected to GPS for accurate flying and geo-referencing the photos.

✓ Step 3: Basic Flying

Getting to know the remote control: We look at the functions of the remote control, including orientation and elevation controls.

Practice of basic controls: Performing exercises in controlled conditions such as raise, lower, fly forward/backward, left/right.

✓ Step 4: Camera control

We study drone camera features including resolution and modes painting.

We perform a test recording to understand the procedure and the quality of the images.

✓ Step 5: Flying and taking pictures

Flight planning: Before flying, we plan the routes we want to cover and the points where we want to take shots.

Ensuring good shooting conditions: We avoid flying in bad weather conditions.

We make sure that the light and angles are suitable for good shots.

Manual and automatic recording: We record manually when, but we also try and the automatic options to get different perspectives.

✓ Step 6: Processing the Recordings

Editing of footage: We use appropriate software to edit footage, adding marks and corrections.

Geo-referencing the footage: We must Geo-reference the footage to be known where exactly they were filmed.

✓ Step 7: Safe descent and completion

Landing Preparation: We make sure the drone has enough battery to be safely descended.

Safe Landing: We land the drone in a safe place and remove the batteries if any necessary.



Activity 6: Taking samples from the bark of trees that were not affected by fire as wellburned wood, and then those samples will be observed under the microscope in order todetermine the presence of insects (Bark Beetles).

The process of taking samples from the bark of trees, especially trees that have beenaffected byfire, and then the observation of the samples under the microscope can bea significant part of the research on the impact of fires on the forest ecosystem andthe presence of insects, such as bark beetles.

Here's what this process might look like:

✓ Step 1: Identification of sites and sampling

Sampling: We use tools like shears or sliders to take samplestree bark samples. We take samples from both busy and unoccupiedtrees.

Labeling samples: We label samples with information aboutlocation, type of tree, and fire status.

✓ Step 2: Preparation for microscopic observation

Sample preparation: Bark samples should be prepared formicroscopic observation. This may involve cutting thin sections of bark.

✓ Step 3: Microscopic Observation

Setting up the Microscope: We place the sample on a glass plate and place itunder the microscope.

Observation of insects and pests: We examine the sample under the microscope forpresence of insects such as bark beetles, grubs, or other pests.

Photography and records: If possible, we take photos for documentation. Thewe write down the observations and the results of the observation.

✓ Step 4: Analysis of the Results

Determining the impact of the fire: We compare the samples from the affected andthe uninfested trees to determine possible differences in insect or biological presencealtered states.

Conclusions and Recommendations:

We make conclusions and recommendations based on the results of microscopic observation.

If there is a presence of insects, we identify species and determine possibleconsequences.

This process can be essential for studying the impact of fireof the forest ecosystem, as well as for a detailed understanding of tree condition and presenceof insects.



Materials

For a successful realization of field teaching for terrain mapping after a fire, the list below includes the required materials and instruments:

- ✓ GPS device: For precise terrain mapping
- ✓ A mobile phone/tablet: To use apps for terrain mapping, image processing, and communication.
- ✓ A laptop: For analyzing and processing the gathered information on terrain.
- ✓ A camera/drone: For aerial or ground-based image and video capture, which can be used for mapping and research purposes.
- ✓ A portable microscope: For a closer inspection of the tree core while on the field.
- ✓ Sampling bags: To preserve samples of dirt or other materials for future research purposes.
- ✓ Markers: For marking locations, samples, and other aspects of the terrain
- ✓ GPS integrated mobile application: Applications like ArcGIS, QGIS, Google Earth, or other applications that can help in real-time while mapping the field.
- ✓ Mobile applications for identifying vegetative life: There are applications such as "PlanetNet" that can be used to identify and classify vegetation types.
- ✓ Maps and local data: For additional research support and locating of mapping areas.

These instruments and materials are of essential meaning for successful field schooling and areas affected by fire.

Here are some ideas to check the learned knowledge from this activity.

To evaluate students' understanding of mapping fields after a fire, various methods and activities will be implemented. Here are some ideas:

- ✓ Making a report: The students can prepare a report which will include details about the chosen area, methods of mapping and results of the field analysis. It can also include pictures, maps and/or conclusions.
- ✓ Presenting in front of the group: The scholars can present their presentation and findings to the group. This can be achieved by oral presentation, power point or just a discussion.
- ✓ GIS mapping: Students can use the Geographical Information System (GIS) for creating interactive maps that will display the different aspects of the terrain. This can be a part of additional classes or homework.,
- ✓ Practical tests: Practical tests including tree identification, mapping processes and data analysis.
- ✓ Short quizzes: Quizzes consisting basic knowledge and concepts gathered from field activities.
- ✓ Debate and discussion: Organizing debates and discussions where the pupils can share their experiences, challenges, and suggestions for mapping methods improvement.



- ✓ Practical scenarios: Creating scenarios for practical activities where the students have to apply their knowledge in existent situations.
- ✓ Project grade: If the students are preparing a project as a part of the terrain teaching, use grades to grade their efforts, creativity, and detailed analysis.

Every one of these ideas can be adjusted for the needs and goals of the teaching topic, for mapping the field after a fire. These activities not only will test the student's knowledge, but also support their studies with practical experience.