



freeland

Promoting STEAM through participatory urban regeneration

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Ecosystem Detectives



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Ecosystem in an urban area

Description of the module:

This module helps teachers and students to explore the biodiversity and ecosystem services in a green urban area and if possible, to compare it with a natural area. A disciplinary content is reported in the Methodology book and the Module can apply hand-on laboratories to explore the plant biodiversity, soil characteristics and evaluate the ecosystem services, allowing to propose urban regeneration with the use of plants.

Learning objectives:

Students will be able to:

- describe observable and measurable indicators (species identification, shape of the leaves, botanical terms for the description of the parts of the plants, identify the properties of soils)
- use of Apps for the identification of the species.
- use mathematical formulas to analyse data, e.g. to calculate the Biodiversity Index
- learn concepts such as biodiversity, ecosystem, ecosystem services, plant functions, soil characteristics, and specific terminology
- discuss the results by comparing different ecosystems.
- present their projects to the public
- organize participatory events for the public

They will create presentations or videos of their own activities.

Methods that will be used:

Circle time, hands on, IBL

School subjects involved: Science, Maths, Civic education

Module duration and suggested time allocation:

Step	Estimated Duration (hours)	Description of methods <i>Count the methods that will be used</i>
Presentation of the place & problem discussion	Max. 0.5	Circle time Brainstorming
3 Outdoor laboratories for monitoring activities (one mandatory)	From 3 to 5 per laboratory	Group work Hands-on Data analysis and discussion
Designing	1	
Evaluation	2-3	Public presentation, participatory event
Project delivery	2-3	Participatory event

Step by step template

Step 1: Presentation of the place & problem discussion

In this step, the real-world problem of urban neglect is presented and conceptualised. The presentation/orientation could be in person (outdoor activity) or virtual. The goal of this step is to describe the place in terms of problems and opportunities. To identify the problem, a guided discussion utilizing the **Circle Time** tool is recommended, even by the use of post-it in order that all students can express their own opinion. During the Circle Time activities, questions can be used to start the discussion.

Duration: 0,5 hour

Activities and methods:

This activity aims to raise students' curiosity about the plants, their ability to withstand urban conditions and their functions. Through the circle time, possibly outdoors, the teacher stimulates students to give their own personal opinion about plants' functions, where they grow and what they need, and about their importance, by asking for instance,

“What is an ecosystem?”

“Why are all plants important?”

“What do they need to grow well?”

“What are their functions?”

Tips & Tricks:

This activity should be performed outdoors, in a place with some green, even where species grow spontaneously in the asphalt or sealed surface. If going outside is not possible, some photos can be shown instead. The brainstorming identifies the perception regarding the presence of plants, the ability of plants to grow in harsh conditions (e.g. asphalt, heat), about the functions and the ecosystem services they provide (e.g. regulation of CO₂ and pollutants, biodiversity, microclimate and water regulation etc.)

Resources needed:

- Presence of plants (trees, shrubs, grasses, forbes) or photos of plants in the built place.
- Knowledge on plants' functions and ecosystem services (see Methodology)
- Basic knowledge on the plant physiology and characteristics

Cross-curricular links: Science (botany, biology)

Step 2: Outdoor laboratories & research

After the brainstorming, one or more laboratories are proposed related to the monitoring of the site and its vegetation. These laboratories follow the steps of **Inquiry Based Learning** and they begin to focus on the topics emerged during the first step (e.g. biodiversity, characteristics of the plants and the ecosystem services, characteristics of the soil).

Duration: estimated maximum 3-5 hours per laboratory because they are carried out outdoors and take some time especially in sampling and analysing data (some activities can be done by the students at home)

Activities and methods: Three laboratories are related to the theme and their description contains the details of application.

- The Laboratory “Plant Biodiversity detectives” is about the assessment of plant biodiversity of an area by using a scientific method which includes the use of botany and mathematics. The laboratory includes the preparation of outcomes such as reports, videos and plant labels to be placed in the area.
- The Laboratory “Ecosystem Services” is about the estimation of the services and benefits provided by plants in a green space. This laboratory is a qualitative evaluation by using an evaluation worksheet.
- The Laboratory “Digging into the soil secrets” is about the assessment of the soil through different soil tests and the innovative “underwear test”.

Most laboratories include hands-on activities, data elaboration on PC, preparation of digital presentations but also a discussion phase which is meant as a participatory activity with the engagement of the local stakeholders.

Tips & Tricks: It is suggested to perform the activities in the spring or late summer/early autumn when the plants are green. In winter, deciduous trees do not hold leaves and the species and the state of vigor are difficult to assess.

Resources needed: The list of tools is reported in the description of each laboratory.

Cross-curricular links: Science, Maths, Informatics.

After the laboratory/ies are performed, the groups will gather the results and summarize them in a report or a video that can be evaluated by teachers following the school's evaluation grid.

Eventually, a student group will import the data into the [Platform](#) to recreate the place virtually with the support of the partners (See next Step 3: Designing).

Step 3: Designing

With the support of the teachers, students think of possible solutions to any problems or assessments that they have noticed in previous steps.

Specifically, they can think of a project i) to increase the biodiversity of the area by identifying species (not invasive!) that can be introduced, ii) to improve some ecosystem services, iii) to ameliorate the soil quality.

The project must impact the social aspect of the place, by involving the local community and citizens (family members, stakeholders that follow the project) and must be inclusive, collecting different experiences and knowledge from native and foreign students.

Therefore, the students should think about several aspects: not only the technical aspects such as the selection of the species, the care of the new plants (e.g. irrigation, maintenance etc.), but also the way to communicate the project to the local people and municipality to engage them in the sustainability of the project.

The **Platform** is used to visualise the variations of the place (e.g. planting different species, creating more shaded areas, increasing the organic carbon in the soil) with a 3D model simulator, to visualize the changes as a digital twin of the real area.

In order to attract neighbors and parents, students can organize a public open-day for the presentation of their regeneration project .

Duration: 1 hour

Activities and methods:

Students, divided in groups plan different parts of the regeneration project:

- One or more groups plan the solutions that improve the sustainability of the area (e.g. species that can be introduced in the selected site to increase biodiversity, tree size and species that increase ecosystem services, method to improve soil quality). They have to justify their choices.
- One group will work on the 3D Model platform to virtually visualize the changes.

Tips & Tricks: The definition of solutions might take an extra-effort for the students, therefore the teachers may indicate some sources (internet sources) or invite experts to speak about possible solutions to improve the biodiversity, ecosystem services and the quality of soil.

Resources needed:

- Notes and pens
- Internet for collecting information on the species

Cross-curricular links: Civic education, Informatics, Art, Science.

Step 4: Data Evaluation

This is a work-in-progress step where the project is proposed to peers, teachers or the local community in a participatory discussion.

The school is in charge of inviting citizens and stakeholders, collecting feedback and improving the final design of the regeneration project.

Duration: 2 hours

Activities and methods:

Organization of events open to stakeholders to present the Freeland project, the results of the laboratories performed by the students and their regeneration project. These events can be outdoors, at the place, and the students can suggest some attractive activities for the youth of the neighborhood (e.g., seed-bombing).

Evaluation by the public to understand the value and the sustainability of their initiative, and list of stakeholders interested to actively participate in the project.

Tips & Tricks: ?

Resources needed: Projector, computer, other materials for the entertaining activities planned by the students.

Cross-curricular links: Civic education, Art, Science

Step 5: Project delivery & civic engagement plan announcement

The students plan the civic engagement of their own regeneration project.

Schools with stakeholders propose a civic engagement plan or actions to solve the problems of the place through an approach based on actions, civic engagement and, if possible, urban regeneration principles.

Suggested civic engagement plan:

- Monthly, a maintenance session with photographic reports will be organized to see the evolution of the area.

Duration: ?

Activities and methods:

Seed-bombing sessions, photographic reports, maintenance activities, organisation of art or music events in the place.

Tips & Tricks: If no one will express availability to actively participate in the regeneration project, students can make an effort to ask the municipality or the school director help for the maintenance.

If no practical activities can be performed, students can make a plan.

Resources needed: Water for maintenance, tools for caring for the vegetation, camera, practical experience.

Cross-curricular links: Civic education

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Additional reading materials:

- *Biodiversity:*
<https://www.jove.com/science-education/v/10596/measuring-biodiversity>
- *Biodiversity index:* <http://www.countrysideinfo.co.uk/simpsons.htm>
- *Ecosystem services:*
<https://www.millenniumassessment.org/documents/document.354.aspx.pdf>
- *Soil fertility:*
<https://plantrevolution.com/blogs/news/ways-improve-soil-quality-garden>

Appendix:

- [Laboratory “Plant Biodiversity detectives”](#)
- [Laboratory “Ecosystem Services”](#)
- [Laboratory “Digging into the soil secrets”](#)

Sources:

- *FREELAND Methodology*