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Promoting STEAM through participatory urban regeneration

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# Laboratory

# Ecosystem Services

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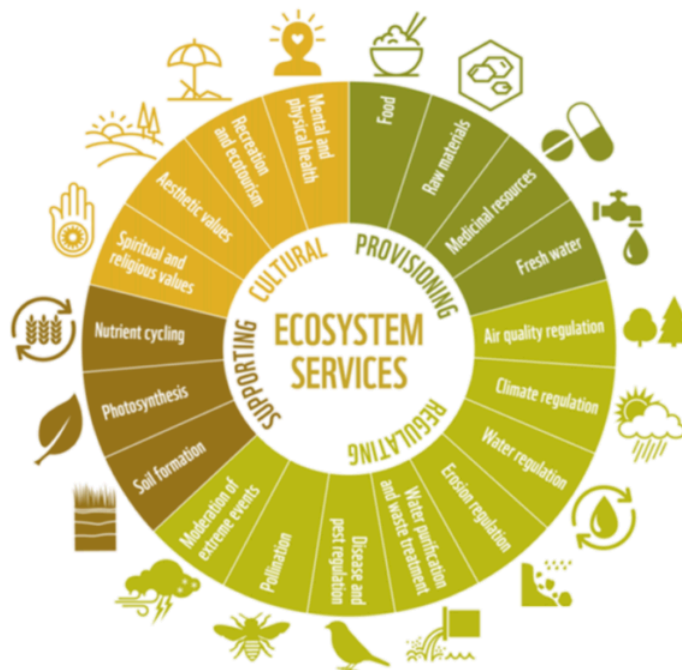
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FREELAND laboratories follow the structure of Inquiry Based Learning, in 5 steps (orientation, conceptualization, investigation, conclusion and discussion), and for each step we suggest activities and methodological approaches that are engaging for the students such as brainstorming, hands-on, creative works. The activities described in the laboratory are suggestions that teachers can adapt or replace with similar activities suitable to students' age and school type.

|                               |   |
|-------------------------------|---|
| <b>Laboratory</b>             | <b>Ecosystem Services Assessment</b>  |
| <b>Duration:</b>              | 1 hour outdoors & 1,5 hours indoors   |
| <b>Tools:</b>                 | Worksheet (printed or online) , Pen and notes, mobile phones for pictures   |
| <b>Technologies:</b>          | Mobile phones for photos and videos   |
| <b>Subjects:</b>              | Science (Biology), Maths, Civic education, Art  |
| <b>Students' age</b>          | Any   |
| <b>School type</b>            | Any   |
| <b>Disciplinary contents:</b> | <p>This laboratory is about the assessment of the Ecosystem Services that a green space provides to the community.</p> <p><b>Ecosystem services are divided into four types:</b></p> <p><b>Regulatory:</b> green spaces enable the regulation of</p> <ul style="list-style-type: none"> <li>• Climate (influencing air temperatures and humidity);</li> <li>• Water flows (canopies intercept rain) and quality;</li> <li>• Air quality (canopies trap particles, leaves absorb CO2 and other gases).</li> <li>• Pest dispersion, pollination</li> </ul> <p><b>Support:</b> green spaces support</p> <ul style="list-style-type: none"> <li>• Biodiversity (diverse plant species,y hosting living beings such as fungi, animals)</li> <li>• Soil formation and functions, nutrient cycling</li> <li>• Photosynthesis and plant functions</li> </ul> <p><b>Provision:</b> green spaces provide:</p> <ul style="list-style-type: none"> <li>• Raw materials and food (urban agriculture, timber, active principles)</li> </ul> |

**Culture:** green space allow people to

- Meet and socialize
- Play and do physical exercise
- Know new things and make tourism
- Feel connected to spirituality and religion
- Appreciate the beauty and feel mental distress



This laboratory aims at assessing the students' perception of the green space in terms of provision of ecosystem services and benefits and reflecting on how they can be improved.

**Learning objectives:**

Students will be able to

- Observe the environment around them
- Learn ecology and botany terminologies
- Reflect on sustainable development and management of green areas from different perspectives.

|  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>• Discuss scientific results and make relationships between diverse disciplines, in connection to the characteristics of the environment</li> </ul> |
|--|--|

For each phase of the IBL we provide a description of the suggested activities.

### Orientation

|               |                         |
|---------------|-------------------------|
| Duration:     | 15 minutes outdoors     |
| Tools:        | Pens, Post-it or papers |
| Technologies: | No                      |
| Subjects:     | Science (Biology)       |
| Method:       | Brainstorming           |

The teachers take the students outdoors to the neglected space, which should have some trees, and invite them to observe the area.

They give students 2 minutes to write in post-it or on paper their own personal opinion about what the vegetation provides to/gives them.

*“What does the vegetation provide to you and the community?”*

Students should recall their prior knowledge and express their own opinion to answer questions.

Then, all the opinions are classified according to common topics and the teacher can introduce the definition of ecosystem services and benefits.

### Conceptualization

This phase concerns the creation of the question/s to be answered by an investigation.

|               |                     |
|---------------|---------------------|
| Duration:     | 15 minutes outdoors |
| Tools:        | No specific tools   |
| Technologies: | No                  |
| Subjects:     | Science (Biology)   |
| Method:       | Brainstorming       |

Following orientation, the teachers pose questions regarding the provision of services and benefits that the specific sites of the green space provide,

*Brainstorming: “Why is it important to assess the services and the benefits the site provides?”*

Some good reasons may arise are related to the importance of citizens’ awareness or to make the area more effective and efficient in the provision of such services. Conceptualization questions (suggestions):

*“How can we assess these services and benefits?”*

*“How do you think the services and benefits can be improved?”*

### Investigation

The investigation includes 1 activity that will answer the question posed in the Conceptualization *“How can we assess these services and benefits?”*

|               |  |
|---------------|--|
| Duration:     | 30 minutes outdoors  |
| Tools:        | Worksheet (Appendix) with the assessment tool (one format can be printed, it also is available online), camera |
| Technologies: | Mobile phone if online forms are used  |
| Subjects:     | Science (Biology), Civic education   |
| Method:       | Assessment by filling in a questionnaire (can be paper form or online)   |

If the green space is big enough and different environments can be identified (e.g. lawns or open areas, playground, woody area etc.), the students can work in groups, and each group can assess a specific site by using the worksheet. In this way they can assess the ecosystem services of different sites and make a comparison.

Species identification can be useful to assess some specific services. Then, in the classroom, students can elaborate the evaluation given to the specific sites.

### Planning and performing the activity

Note: 1) Teachers should make a field visit to the area prior to the activity with the students in order to be aware of the tree species, to see if there are many sites with different characteristics for group work etc.

2) Print the worksheet “Personal perception of ecosystem services” (Appendix) (one per student). Each student fills in the form referring to the assigned site in a green space or to the green space if this is small size.

### Conclusion

This phase concerns the analysis of the qualitative data gathered in the investigation that will be discussed in the next phase.

|               |  |
|---------------|--|
| Duration:     | 0,5 hour in maths indoors                          |
| Tools:        | Pencils and notes                                  |
| Technologies: | PC or notebook                                     |
| Subjects:     | Math   |
| Method:       | Simple data analysis (frequencies and percentages) |

In Maths, frequencies and averages of values of selections indicated in the worksheet (Appendix) can be calculated to assess the perception of the students and identify the most selected values. Students can save time by transcribing the values of their scores at home, then doing calculations at school. They should create a table with the numerical scores assigned to each (see the values of the Likert scale in the worksheet).

| <b>Provisioning services</b>   | <b>Average of the students evaluations</b> |
|--|--|
|  | <b>PARK X</b>                              |
| The plants of the site produce food (edible fruits, leaves, roots)                                 | 0.5  |
| The plants in this site are cultivated to produce materials such as timber, wood chips for pellets | 1.25                                       |
| The site has plants that can be potentially used for essential oil production                      | 1.25                                       |

| <b>Regulatory services:</b>   | Average of the students evaluations |
|---|-------------------------------------|
|   | PARK X                              |
| The plants in this site intercept rain and prevent floods since they are big and with dense foliage | 4.5                                 |
| The plants in this site retain pollutants since they are big and with dense foliage                 | 4.75                                |
| The plants in this site ameliorate climate by making a nice shade                                   | 4.5                                 |

| <b>Support services:</b>   | Average of the students evaluations |
|--|-------------------------------------|
|  | PARK X                              |
| This site has many different species of plants   | 2                                   |
| This site has many different environments (such as wood, lawn, meadows, ponds, dead trees) | 1                                   |
| The plants in this site are lush and green.  | 5                                   |

| <b>Cultural services:</b>                                  | Average of the students evaluations |
|--|-------------------------------------|
|  | PARK X                              |
| The site is visited by people of all ages                  | 5                                   |
| This site is used to host cultural events, exhibitions     | 0                                   |
| The area hosts classes for educational outdoors activities | 2                                   |

| <b>TOTAL SCORES</b>             | Total score of the ecosystem service |
|---------------------------------|--------------------------------------|
|                                 | PARK X                               |
| <b>Provisioning services *:</b> | <b>3</b>                             |
| <b>Regulatory services:</b>     | <b>13.75</b>                         |
| <b>Support services:</b>        | <b>8</b>                             |
| <b>Cultural services:</b>       | <b>7</b>                             |
| <b>Benefits</b>                 | <b>12</b>                            |

## Discussion

In this phase students reflect on the findings. They should be able to answer the original question and reflect on it.

|               |   |
|---------------|---|
| Duration:     | 1 hour indoors  |
| Tools:        | Pen/notes/Powerpoint  |
| Technologies: | PC  |
| Subjects:     | Civic Education, Art  |
| Method:       | Brainstorming, group work<br>Draws of student's ideas of improvements/design projects |

Circle time or brainstorming can be useful to involve the students in the discussion phase which will finally answer the initial questions. Based on the results obtained by the analysis of the data, students will be able to tell the types of ecosystem services provided and the most and the least perceived ecosystem services. This information can be added as additional information in the 3D model.

In Art, the ideas of improvements can be drawn as sketches and project designs, indicating what they would like to add or change in the area. These can be useful to list the elements and their characteristics that can be added in the 3D modeling platform for the final design of the area.

Outcomes:



- 3D visualization of the project (one student group will recreate the place virtually with the support of the [Platform](#)).
- Report or presentation or video, that can be evaluated by teachers following the school's evaluation grid.

## Additional reading materials:

- Green Infrastructure. Promoting the use of green infrastructure in all EU policies, to help restore nature and boost biodiversity.  
[https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure\\_en](https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en)
- Urban ecosystem services  
<https://www.cocity.se/om-oss/urban-ecosystem-services/>
- Integrated design for informal green spaces: Enhancing multiple ecosystem services  
<https://www.ams-institute.org/urban-challenges/resilient-cities/integrated-design-for-informal-green-spaces-enhancing-multiple-ecosystem-services/>

## Appendix:

### Worksheet: Personal perception of ecosystem services



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**Worksheet: Personal perception of ecosystem services**

**To what extent do you think this site provides the following ecosystem services?** Indicate how much you value each ecosystem service and benefit of the green space listed in the table (from 0 - not present/I don't know, to 5 very high) . The evaluation must be personal and specific for the site you are observing. The evaluation is anonymous and should reflect your personal opinion.






The analysis of the responses will help identify the most and least valued ecosystem services that should be improved.

**Date:**\_\_\_\_\_

**Town:**\_\_\_\_\_

**Location name:**\_\_\_\_\_

**Online version of the questionnaire:** <https://survey.mars.com/q/dnhtVZXBu>

|   |  |  |  |  |  |  |                           |
|---|---|---|---|---|---|---|---------------------------|
| <b>Provisioning services *:</b>   | <b>0<br/>Not present</b>  | <b>1<br/>Very low</b>   | <b>2<br/>Low</b>  | <b>3<br/>Moderate</b>   | <b>4<br/>High</b>   | <b>5<br/>Very high</b>  | <b>It can be improved</b> |
| The plants of the site produce food (edible fruits, leaves, roots)                                  |   |   |   |   |   |   |                           |
| The plants in this site are cultivated to produce materials such as timber, wood chips for pellets  |   |   |   |   |   |   |                           |
| The site has plants that can be potentially used for essential oil production                       |   |   |   |   |   |   |                           |
| <b>Regulatory services:</b>   | <b>0<br/>Not present</b>  | <b>1<br/>Very low</b>   | <b>2<br/>Low</b>  | <b>3<br/>Moderate</b>   | <b>4<br/>High</b>   | <b>5<br/>Very high</b>  | <b>It can be improved</b> |
| The plants in this site intercept rain and prevent floods since they are big and with dense foliage |   |   |   |   |   |   |                           |
| The plants in this site retain pollutants since they are big and with dense foliage                 |   |   |   |   |   |   |                           |
| The plants in this site ameliorate climate by making a nice shade                                   |   |   |   |   |   |   |                           |
| <b>Support services:</b>  | <b>0</b>  | <b>1</b>  | <b>2<br/>Low</b>  | <b>3<br/>Moderate</b>   | <b>4<br/>High</b>   | <b>5</b>  | <b>It can be improved</b> |

|  | Not present               | Very low              |                  |                       |                   | Very high              |                           |
|--|---------------------------|-----------------------|------------------|-----------------------|-------------------|------------------------|---------------------------|
| This site has many different species of plants   |                           |                       |                  |                       |                   |                        |                           |
| This site has many different environments (such as wood, lawn, meadows, ponds, dead trees) |                           |                       |                  |                       |                   |                        |                           |
| The plants in this site are lush and green.  |                           |                       |                  |                       |                   |                        |                           |
| <b>Cultural services:</b>  | <b>0<br/>I don't know</b> | <b>1<br/>Very low</b> | <b>2<br/>Low</b> | <b>3<br/>Moderate</b> | <b>4<br/>High</b> | <b>5<br/>Very high</b> | <b>It can be improved</b> |
| The site is visited by people of all ages  |                           |                       |                  |                       |                   |                        |                           |
| This site is used to host cultural events, exhibitions                                     |                           |                       |                  |                       |                   |                        |                           |
| The area hosts classes for educational outdoors activities                                 |                           |                       |                  |                       |                   |                        |                           |
| <b>Benefits</b>  | <b>0<br/>I don't know</b> | <b>1<br/>Very low</b> | <b>2<br/>Low</b> | <b>3<br/>Moderate</b> | <b>4<br/>High</b> | <b>5<br/>Very high</b> | <b>It can be improved</b> |
| The site is comfortable for its nice climate conditions                                    |                           |                       |                  |                       |                   |                        |                           |
| This site is aesthetically attractive  |                           |                       |                  |                       |                   |                        |                           |
| This site makes me feel relaxed  |                           |                       |                  |                       |                   |                        |                           |

\* You can search for information about this by using mobile phones or asking the teachers.

**What is the final score for the area?** (sum your scores) \_\_\_\_\_

**Divide the final score by 75:** \_\_\_\_\_ (closer to 1, better it is).

**What do you suggest to improve on this site?**

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