



STEAM Project
School Ecosphere Initiative

Main school subjects involved

Ecology / Environment / Science / Biology / Chemistry / Geography / Global Perspectives

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Participant Schools

School 1 Logo	School 2 Logo	School 3 Logo	School 4 Logo
School 1 Name	School 2 Name	School 3 Name	School 4 Name

Supporting Organizations

Academic Advisor	Organizational Endowment	Academic Advisor
Logo (Advisor To confirm)	International Schools Association	Logo (Advisor to Confirm)
Foundation for Environmental Education - FEE (Denmark)	International Schools Association (Switzerland)	UN Environment Programme - UNEP

School term:

September 2024 - April 2025

Introduction

The Ecosphere Project is designed to engage students in the exploration and analysis of environmental factors around their schools. By monitoring pollution levels, classifying insects, plants, and birds, and measuring air quality during the school year, in different seasons, students will contribute to a better understanding of local ecosystems.

For this purpose, several secondary schools from different countries will form teams of students (ages 12 to 18) to work on this project throughout the school year under the supervision of a lead teacher. Each school will form one student team and appoint a teacher leader. The project encourages collaboration among these schools through a shared online platform, like Discord, fostering a global exchange of data and insights.

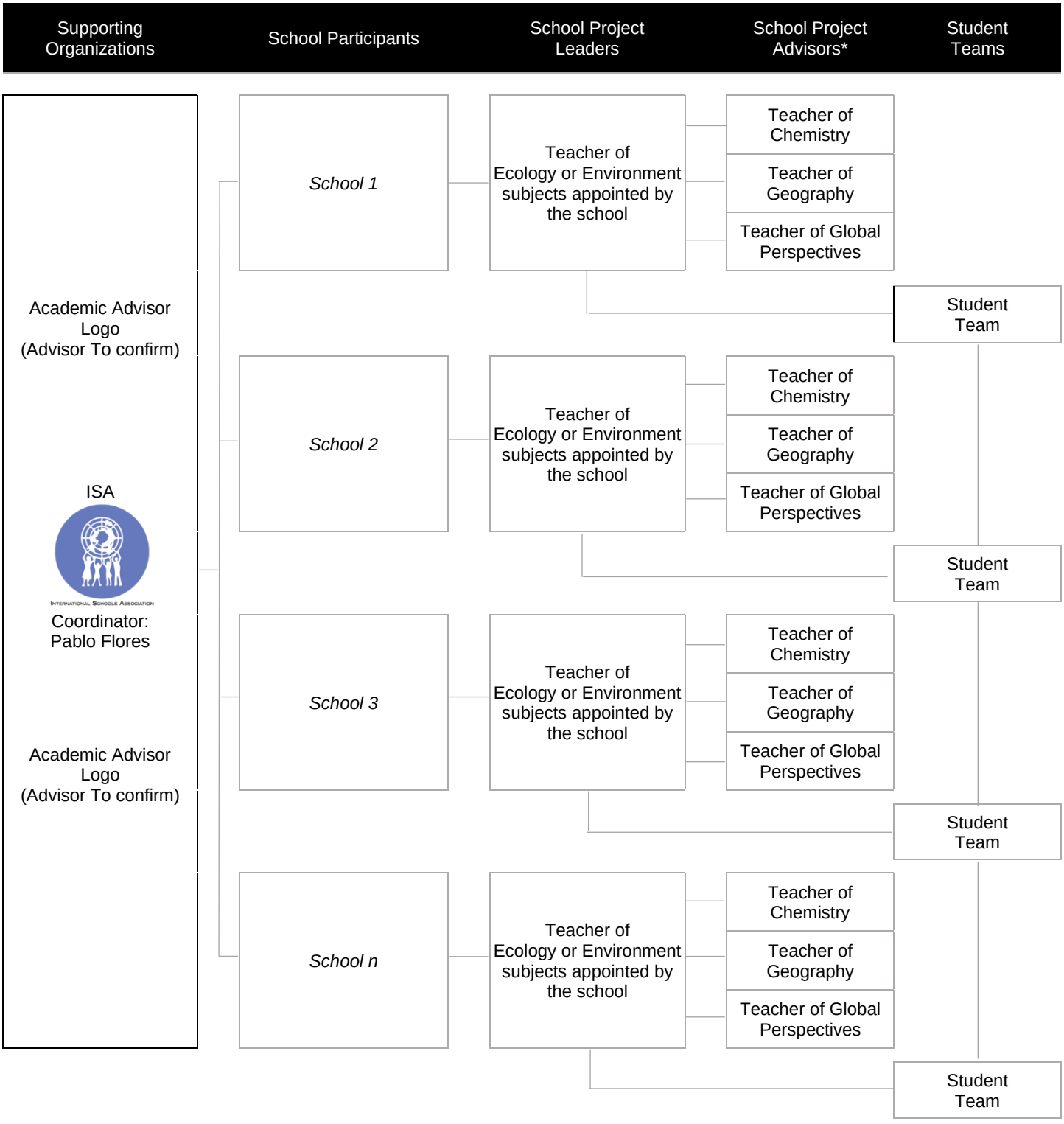
At the end of the project, the schools will present their work and findings to a panel of experts from the supporting organizations, which can be both in-person and online.

This project is student-driven, with teachers acting solely as supervisors of their teams. Students will engage in independent learning through various activities, project stages, and problem-solving tasks. Additionally, these activities will help young learners develop and strengthen both their cognitive skills, such as problem-solving, and non-cognitive skills, such as motivation to learn, environmental stewardship, multicultural communication, and teamwork.

Learning Objectives

- *Develop Environmental Awareness*. Understand the impact of human activities on local ecosystems and how to monitor environmental health.
- *Build Technical Skills.* Gain experience in using environmental sensors, data analysis, and digital collaboration tools.
- *Foster Collaboration.* Work in teams and engage with students from different regions to compare and contrast environmental data.
- *Enhance Communication.* Improve presentation skills by summarizing and presenting findings.

Organizational Work



** Besides helping to advise teacher leaders, Advisors can develop their own subprojects. For instance:*
Chemistry - Students can explore how chemical balances in water affect ecosystem health and water usability for plants and animals, and it could lead to insights on pollution and water treatment solutions.
Geography - Students could study the types of land use in and around the school area (urbanization, agriculture, green spaces) and assess the human impact on natural ecosystems.
Global Perspectives - this project could focus on studying global conservation efforts and their ethical implications, such as balancing economic growth with environmental protection.

The organizations acting as academic advisors will provide knowledge support to the students and teacher leaders. For this purpose, several lectures will be organized, which can be offered for free or for a small fee during the project's development. These lectures are intended to support school teams with the necessary knowledge and help solve any challenges that arise.

Each school will have one teacher as the project leader. While each school is limited to participating with one team, there are no limitations on the number of students that can be part of the school team. The school administration can choose the teacher leader they consider most appropriate to lead the team; however, teachers of ecology or environmental sciences are recommended for that role. Project leaders must gain the support of their colleagues in related subjects such as Chemistry, Physics, and Sciences in order to solve questions that may arise during the process.

Project leaders must encourage their students to interact frequently with students from other schools by exchanging experiences, ideas, and data, thereby strengthening their intercultural communication skills. Teacher leaders from different schools are also encouraged to share experiences and information with each other.

To facilitate these interactions, a common platform will be needed for each subject involved in the project. Teachers can choose the most suitable platform, like WhatsApp. For students and teachers, several platforms are available, such as Discord, Padlet, Google Workspace, MS Teams, or Slack.

Each school forms **a team of students** under the guidance of **a teacher**	→ Each team propose **parameters to monitor**. Then, the parameters are collectively agreed with other schools	→ Teams research their parameters, **sharing findings** via a collaborative platform.	→ Teams help each other to **showcase their work** as a single presentation.	→ All teams jointly **present the project results** to a panel of expert. Awarding of certificates.

Project Implementation Steps

Estimated Schedule

Time Frame	Work	Operational Characteristics
September - October 2024	Project design	- Teacher Leaders Group Formation: Each school appoints a teacher leader to join the interschool coordination group. - Student Teams Formation: Schools create student teams and establish communication platforms for collaboration (e.g., Zoom, Google Meet). - Kick-off Virtual Meeting: Initial virtual meeting to introduce teams and discuss further project developments.
November 2024 - March 2025	Ecosystem monitoring and analysis	- Research Phase: Students begin obtaining and analysing data. - Collaborative Platform Engagement: Regular updates, discussions, and sharing of research progress on the collaborative platform. - Virtual Meetings: Ongoing virtual meetings between student teams to exchange insights and address challenges. - Ecosystems Lectures: A series of lectures provided by a academic advisors, tailored to the project needs. - Final Work: Each school team produces a final work (e.g., report), which will later be synthesized into a unified presentation.
April 2025	End of the project	- Presentation of the works before a panel of experts. - Closing ceremony. - Award of certificates.

Technical Characteristics

There are no specific technical characteristics for the devices or methods that each school may implement. Therefore, each school can proceed to obtain data and analyse it using their own resources.

However, schools are encouraged to monitor and measure the same parameters in order to exchange information and make comparisons that can allow to come to comparative conclusions.

Additionally, schools are recommended to use open-source Internet of Things (IoT) platform. For example, ThingSpeak is a free platform that allows to collect, store, and analyse data from sensors in real-time. It provides a user-friendly interface for users to manage and visualize their sensor data, making it easy to track changes in environmental conditions and make informed decisions. The data can be accessed from any device with a password.

Recommended parameters for monitoring and analysis

Air	level of O2	level of Co2	level of other gases
	temperature	humidity	winds / acoustic pollution
Soil	main composition	temperature	humidity
Fauna	type & quantity of birds	type & quantity of other animals	type & quantity of insects
Flora	type & quantity of trees	type & quantity of plants	type & quantity of others (grasses, mosses, etc.)

Documentation of the Activities

Team "……..." School Activity Diary	Teacher Supervisor_____ Team coordinator_____ Team members_____ _____ _____ School Logo

Lesson #	Activity	Working reflections	Difficulties found	Suggestions

Example of diary of activities

Each team, in each school, should have a “Development report diary” to register details like stages, problems found, things to improve, etc. Project leaders may appoint a student that should be responsible for keeping that diary, take pictures and make short videos on the activities of his team.

It is very important to keep properly the activity diary, since this diary will be the main source of information for the final writing of the research papers, and for the future continuation of similar projects with new students.

Blogging

• Blogging in the classroom, especially throughout project work, is a great way for students to document their work and experiments.
• The blog serves as a platform upon which to post written editorials, videos, photos, how-to instructions, and more.
• This would be a great way for students to take initiative, get involved, and share their stories with others.
• This type of documentation is recommended in the greenhouse classroom along with the Diary of Activities.

Safety Considerations

The safety of students and teachers is paramount in all activities related to the Ecosphere Project. In case of an emergency during field activities (e.g., adverse weather conditions or accidents), there should be a clear plan in place, including emergency contact numbers and access to first aid. To ensure a safe learning environment throughout the project, the following measures must be implemented:

- All fieldwork (such as gathering soil or water samples) must be supervised by a teacher or an authorized adult.
- Students should wear appropriate clothing, including gloves, masks, and protective gear, when handling samples or using chemicals.
- First aid kits must be readily available during all field activities.

- For experiments involving chemical analysis (e.g., water or soil testing), students must follow proper chemical safety protocols.
- Teachers must provide clear instructions on the correct use of chemicals and equipment, including safe disposal of chemical waste.
- Any student working with hazardous materials must be supervised at all times.
- Before conducting field research, students must be briefed on potential hazards, such as uneven terrain, insects, and plants that may cause allergic reactions.
- Students must work in groups and be accompanied by a teacher or responsible adult while conducting outdoor observations.
- Ensure that all students are familiar with the environment where they will be collecting data and are equipped with basic safety knowledge (e.g., avoiding unsafe areas, recognizing poisonous plants).
- For all online collaboration, schools must ensure that students use secure platforms, following the school's internet safety policies.
- Teachers must monitor online interactions and ensure that appropriate behaviour is maintained on all collaborative platforms.
- Any scientific equipment used in the project (e.g., sensors, thermometers, or weather stations) should be handled according to the manufacturer's instructions, with proper training provided by teachers.
- Students should be made aware of electrical and equipment safety when using devices that require power.

Estimated Budget per School

As mentioned earlier, there are no mandatory tools required, and each school can measure, monitor, and analyze its ecosystem based on available resources. However, it is recommended that all participating schools agree on certain common parameters to ensure data can be exchanged and compared.

Thus, there are several educational kits available on the market that include various sensors. These kits can easily be assembled and connected to a shared IoT platform. For example, the Green Living Innovations kit from STEM Education (https://www.why.gr/en/shop/educational-kits/stem-en/stem-secondary-education/green-living-innovations-kit/)

costs €230.00 and includes an IoT (Internet WIFI Extension Board for micro) and several Octopus sensors, such as a temperature and humidity sensor, waterproof temperature sensor, water level sensor, analogue UV sensor, pressure sensor, light sensor, and soil moisture sensor.

Additional sensors can be purchased separately based on each team's specific needs. Lectures from academic advisors are available for free or at a fee of €125 per 50-minute session. If the project includes four lectures, the total cost will be €500, which will be divided among participating schools.

In summary, the estimated total cost for each school, including acquiring some technology and attending lectures, should not exceed €300-€400.

APPENDIX

Complementary Information and Supporting Material for the Activities

I. Useful Information

STEM Education

- Website: https://www.why.gr/en/
- Provides educational kits and resources for schools, such as the Green Living Innovations kit.

ThingSpeak (IoT Platform)

- Website: https://thingspeak.com/
- Open-source IoT platform used to collect and analyze environmental data.

Foundation for Environmental Education (FEE)

- Website: https://www.fee.global
- One of the world's largest environmental education organisations.

The Think Earth Environmental Education Foundation

- Website: https://thinkearth.org
- Nonprofit public-private partnership, is committed to environmental education..

UNESCO – Education for Sustainable Development

- Website: https://en.unesco.org/themes/education-sustainable-development
- Offers resources and frameworks for integrating sustainability into education.

II. Tips Integrating Science Principles and STEM Concepts

Use Real-World Problems

Integrate environmental science with technology by addressing real-world problems like air pollution or biodiversity loss. For example, students can use sensors to collect data and interpret it using basic coding and digital tools.

Hands-on Learning

Encourage students to actively participate in gathering environmental data around their school. Using technology like IoT sensors or apps, students can visually analyze trends in pollution or temperature over time.

Collaborative Projects

Pair students from different schools or classes to work on the same environmental issue, promoting teamwork and global learning through shared platforms like Discord or Slack.

Creative Integration

Art can play a role in the project through data visualization. Students can use tools like Canva or Google Data Studio to create visual representations of their findings, making the scientific data more accessible and engaging.

III. Examples of Classroom Activities

Activity: Air Quality Monitoring

Objective: Measure air quality around the school using basic sensors (CO2, temperature, humidity).

Instructions: Set up air quality sensors in different locations around the school and compare data collected over a week. Analyse the impact of weather and traffic on air pollution.

Activity: Biodiversity Survey

Objective: Conduct a biodiversity survey by classifying local insects, plants, and birds.

Instructions: Have students observe and record the species they find on school grounds, identify them using field guides or apps, and create a biodiversity index.

Activity: Water Quality Testing

Objective: Measure water quality from nearby ponds or water bodies using simple chemical tests.

Instructions: Collect water samples and test for pH, temperature, and pollutants. Discuss how water quality affects local flora and fauna.

Activity: Sustainable Solutions Design

Objective: Develop a sustainable solution for an environmental issue identified during data collection.

Instructions: Students work in teams to brainstorm ideas (e.g., green spaces, pollution control) and create a prototype or action plan, presenting it to the class or other schools.

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