**Subject area/course**: Science/Environmental Science

**Grade level/band**: 9-12

**Task source**: Summit Public Schools

**Ecocolumn**

**STUDENT INSTRUCTIONS**

1. **Task context**:

How connected do you feel to the ecosystem you live in? When you take a breath, do you ever wonder where those molecules in the air have traveled from? Matter is constantly being recycled around us, changing form and location in the ecosystem. If we look at our Earth as an ecosystem, it is easy to lose our sense of place. But what about a smaller ecosystem? Ecosystems are complex: they encompass changing forms of matter, flow of energy, many living and non-living components, and the relationships between them. If you wanted to design a self-sustaining ecosystem, could you do that?

This is a question asked by the researchers who designed Biosphere 2, the largest closed ecosystem ever created by humans. In the 1990s, these researchers attempted to design a self-sustaining ecosystem capable of supporting human life inside of a sealed facility in Arizona. Their goals were to understand how natural ecosystems function, as well as to explore the possibility for humans to create new ecosystems on other planets. Several participants in the study were locked inside Biosphere 2 for over two years, trying to meet their needs for food, water, and air using only what the closed ecosystem was able to provide them. Today, the Biosphere 2 facility belongs to the University of Arizona, where researchers study questions about how living ecosystems on Earth function.

Environmental scientists often study changes in ecosystems through what is called "ecological monitoring". Ecological monitoring involves collecting data about the air, water, soil, and organisms in an ecosystem, both to describe the ecosystem and to track changes over time. Additionally, scientists often use models to describe patterns and relationships in the natural world. Lastly, scientists look at data to inform new questions to research and study.

1. **Final product**:

For this project, you will be designing a semi-closed ecosystem, called an Ecocolumn. You will get to choose how to set up your Ecocolumn and what organisms to include inside of it. Your ecosystem will contain abiotic (nonliving) and biotic (living) components, and your goal is to assemble the ecosystem so that your living organisms will be able to survive sustainably on the resources inside the Ecocolumn. Energy will enter your ecosystem from sunlight, but all the matter in your ecosystem will be "locked in" for the duration of the project. You can expect both the living and nonliving components of your ecosystem to show changes over the course of this project.

You will take detailed observations of your ecosystem for qualitative data. Additionally, you will learn how to use equipment that will allow you to collect quantitative data about your Ecocolumn over several weeks of the project. For this project, you will create diagrams to model patterns and relationships between components of your Ecocolumn. You will represent and interpret data from your ecological monitoring. From these data, you will generate a testable question, hypotheses, and a proposed study design. Your proposed study will be an experiment that could be done by future scientists to explore a pattern or observation you noticed in your Ecocolumn.

As in many disciplines, if you want to make something happen, you need to convince others to fund you! One of the final two products will be a "pitch" describing the results from your Ecocolumn monitoring and your proposed follow-up study. With feedback from your peers, you will create a convincing argument that your project deserves further funding from the National Science Foundation. Your high-quality pitch will be modeled after the kinds of grant proposals that scientists submit when they want to get monetary support for new research.

Furthermore, you will individually demonstrate skill at study design and ecology content knowledge through a graded AP Environmental Science exam-style free-response question. Your high-quality response will model that of college-level exam responses, thoroughly addressing the prompt with specific examples and details from your content knowledge.

**Additional Information**

1. **Knowledge and skills you will need to demonstrate on this task:**

* Develop a testable question and design a study
* Collect, organize, and interpret data about how the ecosystem changes over time

1. **Materials needed:**

Your teacher will provide the materials needed to create an Ecocolumn. He/she may also ask you to bring in additional items to include in your Ecocolumn, as you’re able.

You will need the following documents:

* Item A. Building an Ecocolumn Student Instructions
* Item B. Adding Organisms
* Item C. Terrestrial Animals List
* Item D. Data Collection Setup
* Item E. Nitrogen Cycle Task Card
* Item F. Natural Biogeochemical Cycle Model Feedback
* Item G. Asking a Testable Question
* Item H. Examples of Testable Questions
* Item I. Hypothesis and Experiment Design
* Item J. Ecocolumn Report and Proposal
* Item K. Breaking Down an FRQ Prompt (optional)

1. **Time requirements:**

This task will take approximately 2-3 weeks to complete. Your teacher will provide additional details regarding deadlines and due dates.

1. **Scoring:**

Your work will be scored using the Summit Public Schools Ecocolumn rubric. You should make sure you are familiar with the language that describes the expectations for proficient performance.