**ECOCOLUMN DATA COLLECTION**

**There are three tasks you must complete as a group**

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##

## TASK 1: Quantitative Data Collection Jigsaw

**Today we collected several quantitative (numerical) data points from our Ecocolumn. But what do these numbers mean? Why do we collect this data?**

1. Divide the follow short readings about these variables among your group in the following way.

Reader 1: Nitrates

Reader 2: Dissolved Oxygen

Reader 3: pH and Temperature

Reader 4: CO2 gas and O2 gas

1. As you read, fill out this chart to make a “cheat sheet” for your group about the different data we are collecting.
2. Lastly, your group will do a quick verbal share out of the variable(s) you each read so that everyone understands the data you are collecting.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Why do we test for this?** | **Units** | **Additional Notes:** |
| **Nitrates** |  |  |  |
| **Dissolved Oxygen** |  |  |  |
| **pH** |  |  |  |
| **Temperature** |  |  |  |
| **CO2 gas** |  |  |  |
| **O2 gas** |  |  |  |

#### NITRATES: What are nitrates and why are they important?

Nitrates are a form of nitrogen. Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems. Nitrates in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L); in the discharge from wastewater treatment plants, it can range up to 30 mg/L.

Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors.

#### DISSOLVED OXYGEN - What is dissolved oxygen and why does it matter?

The stream system both produces and consumes oxygen. It gains oxygen from the atmosphere and from plants as a result of photosynthesis. Running water, because of its churning, dissolves more oxygen than still water, such as that in a reservoir behind a dam. Respiration by aquatic animals, decomposition, and various chemical reactions consume oxygen.

Wastewater from sewage treatment plants often contains organic materials that are decomposed by microorganisms, which use oxygen in the process. Other sources of oxygen-consuming waste include runoff from farmland or urban streets, feedlots, and failing septic systems.

Oxygen is measured in its dissolved form as dissolved oxygen (DO). If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken, or die.

DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water and water holds less oxygen at higher altitudes.

#### pH: What is pH and why is it important?

pH is a term used to indicate the alkalinity or acidity of a substance as ranked on a scale from 1.0 to 14.0. Acidity increases as the pH gets lower. pH affects many chemical and biological processes in the water. For example, different organisms flourish within different ranges of pH. The largest variety of aquatic animals prefer a range of 6.5-8.0. pH outside this range reduces the diversity in the stream because it stresses the physiological systems of most organisms and can reduce reproduction. Changes in acidity can be caused by atmospheric deposition (acid rain), surrounding rock, and certain wastewater discharges.

#### WATER, SOIL, OR AIR TEMPERATURE - Why measure temperature?

Temperature is a critical factor influencing several aspects of an ecosystem. It influences biological activity and many chemical variables in the ecosystem.

Temperature plays many roles in the ecosystem. As water temperature increases, for example, the capacity of water to hold dissolved oxygen becomes lower. Water temperature also influences the rate of plant photosynthesis, the metabolic rates of aquatic organisms, and the sensitivity of organisms to toxic wastes, parasites, and diseases.

Optimal temperatures (which vary with the species and their life stage) allow organisms to function at maximum efficiency. The slow change of temperature that comes with the seasons permits organisms to acclimate, whereas rapid shifts may adversely affect plants and animals. Temperature shifts of more than 1°-2°C can cause thermal stress and shock.

#### CO2 gas - Why measure CO2?

Carbon dioxide regulation is based on the balance of the exchange of oxygen and carbon dioxide by producers in an ecosystem. These producers photosynthesize and depending on the time of day or the amount of light energy present, the levels of carbon dioxide and oxygen change. In nature, aquatic ecosystems have lower levels of dissolved oxygen and higher levels of carbon dioxide in the morning and at night. A lack of sunlight does not allow for photosynthesis to occur, limiting the levels of dissolved oxygen. When the sun rises higher in the sky, producers can photosynthesize more and the creation of more oxygen, lowers the level of carbon dioxide.

#### O2 gas - Why measure O2?

All organisms - plants, animals, fungi, microorganisms - use oxygen during respiration. Autotrophs (like plants) alone release O2 during photosynthesis. Available oxygen can be a limiting factor in ecosystems, and changes in O2 levels may indicate an increase in respiration or a lack of photosynthetic activity.

## TASK 2. Qualitative Data

**Instructions: In your group, read through the descriptions of different qualitative (non-numerical) data you should collect over your project.**

**Photograph:** Take a picture of your Ecocolumn’s Aquatic and Terrestrial chamber each time you collect data. This will help you notice visual changes to your system over time.

**Aquatic Turbidity:** Turbidity is a measurement of how clear or cloudy the water is in an aquatic environment. There are quantitative ways to measure turbidity that we will use later in the year. However, for our Ecocolumn, we will rely on qualitative descriptions of clarity or cloudiness.

The turbidity in your Ecocolumn may range from:

Crystal Clear

Slightly Cloudy

Moderately Cloudy

Very Cloudy

Blackish/Brownish

**Odor:** Odor can indicate low dissolved oxygen in water or hypoxic (low oxygen) decay on land. This is why some swamps release methane or smell like rotten eggs. If you notice a change in odor in your Ecocolumn chambers, make note of it.

The odor in your Ecocolumn may range from:

No odor

Slight odor

Smelly

Very smell

Devastating

**Organisms # and Health:** You should have recorded the type and number of the organisms you added to your Ecocolumn in your Adding Organisms document. During this project, you should make observations about any visible changes to how your organisms look or behave.

**Other changes you notice:** If you notice any other changes in your Ecocolumn, make sure to record that in your observations.

As a group, record your first qualitative data below:

|  |  |
| --- | --- |
| **Date** |  |
| **Picture** |  **(paste picture in box here)** |
| **Turbidity** |  |
| **Odor** |  |
| **# and health of organisms** |  |
| **Other Observations:** |  |

## TASK 3: Preparing for Ecological Monitoring

Over the next several weeks, your group will be monitoring several variables you are curious about in your Ecocolumn. Your experimental question:

How does \_\_\_\_\_\_\_\_ change over time in our Ecocolumn?

Discuss in your group which quantifiable data you want to monitor in your Ecocolumn. Consider:

* Any data you collected yesterday that you are curious about
* The relationship between different variables
* Your expectations for how your Ecocolumn may change over time

Your group will monitor **at least 3 variables.** You will have approximately 15 minutes to collect data in class each time we take measurements; however, you can collect additional data if you arrange to do so outside of class.

Our group plans to monitor:

1.

2.

3.

We expect these variables to change in the following ways. (Remember to include a reasons for your prediction.)

Hypothesis for variable 1:

Hypothesis for variable 2:

Hypothesis for variable 3: